A STUDY OF CROP DAMAGE BY WILD BIRDS AND MAMMALS IN THE SOUTHERN PENINSULA OF MICHIGAN

THESIS FOR THE DEGREE OF M. S.

David Damon

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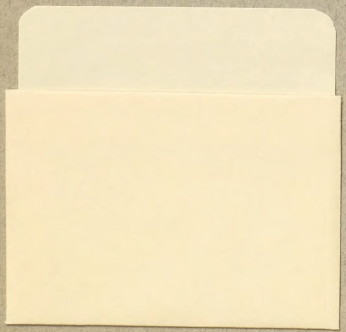

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With Observations On The Effect Of Repellents On The Germination Of Corn

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With Observations On The Effect Of Repellents On The Germination Of Corn

Thesis

Submitted To The Faculty Of The Michigan State College
In Partial Fulfillment Of The Requirements For The
Degree Of Master Of Science

By

David Damon

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INTRODUCTION

There appears to be a growing tendency for farmers in southern Michigan to consider the game birds on their farms as a crop like their beans and wheat. In most cases, however, the farmer does not sell his pheasants outright by charging the hunter a set price for each bird taken, but instead hunting rights are leased - each hunter paying so much per day of hunting.

The universal depression that surrounds us has been a stimulus which has caused many farmers in all parts of this country to consider game as a crop. Other stimuli have come from the various progressive conservation groups, and in Michigan the most prominent organization in this work is the Michigan Division of the Izaak Walton League of America. This group has taken a broad view of the subject and while urging the farmer to do his share in propagating game by furnishing a little food and cover, it has at the same time listened to the farmer who claimed that the damage done by a bird was far in excess of the returns on hunting rights and leases, and in excess of the good done by the bird in eating insects and weed seeds.

If the Izaak Walton League wished to propagate and release game birds on farms it had, therefore, to choose one of two roads of approach to the subject. The League could either

go ahead and release propagated birds without giving the farmer an ear, but assuming that he would profit by this act in every case, or it could listen to the farmer and cooperate with him by first investigating the matter and learning to what extent each party was correct. The League chose the latter road of approach.

PURPOSE OF THE STUDIES

The chief object of these studies was, as has already been hinted, to determine the status of the ring-necked pheasant, Phasianus colchicus torquatus, on Michigan farms. The Izaak Walton League wanted to learn the correct answer to this question. The Zoology Department of the Michigan State College agreed to cooperate with the League in this work and added that it wished the studies to be made on other forms of wild-life found on Michigan farms, especially those affecting farm crops. Control or preventive measures were to be taken into account in cases of serious crop destruction.

The species of birds found to do more or less damage to crops and included in these studies are as follows: pheasant; Eastern crow, Corvus brachyrhychos brachyrhychos; bronzed grackle, Quiscalus quiscula aeneus; Eastern red-winged blackbird, Agelaius phoeniceus phoeniceus; European starling, Sturnus vulgaris vulgaris; red-headed woodpecker, Melanerpes erythrocephalus; killdeer, Oxyechus vociferus vociferus;

Eastern robin, Turdus migratorius migratorius; and Northern bluejay, Cyanocitta cristata cristata. The mammals included the fox squirrel, Sciurus niger rufiventer; varying hare, Lepus americanus americanus; cottontail rabbit, Sylvilagus floridanus mearnsii; raccoon, Procyon lotor lotor; and muskrat, Ondatra zibethica zibethica.

As all field men know from experience, it is not an easy matter to observe all animals going about their routine life. It is often a stroke of good luck that permits one to observe the more wary animals or those which have nocturnal habits. As a result, attempts to see all species in the act of feeding have not been rewarded. Sufficient evidence has been accumulated in all but two or three instances to recognize the species involved. In every case unless otherwise stated personal field examinations were made.

Numerous photographs were taken in the field and serve as a permanent record. Several are included in this paper.

PROJECTS AND METHODS

1. Preliminary survey - Since it was planned that intensive studies would be conducted in Williamston township, Ingham county, it was thought advisable at the outset (July 1931) to learn what crop injuries or benefits, if any, the farmers of this township thought they had experienced from the wild-life population of their farms. This was done by personal interviews with farmers or farmers' wives. The following year a check up was made on several of the same farms by actual field inspection in an attempt to learn the value of such interviews.

2. Field studies of crop damage - Throughout the summer and to a lesser extent during spring and fall, field studies were made in an effort to determine the extent and kinds of damage that the various species of wild-life were doing to the farmer's crops. Cooperation of the Conservation Department made possible field studies of wild-life damage throughout southern Michigan to supplement the Williamston township studies. Thus it was possible to gain a better idea of the extent of damages as well as to have access to a greater variety of damage types than could be had in one township. Field studies were confined almost entirely to the farming land in southern Michigan (south of Town Line 16), although wild-life blanks and form letters were sent to

the Conservation Officers and County Agricultural Agents throughout the southern peninsula.

3. Studies of damage prevention - In discussing a particular crop damage with a farmer he was asked what, if any, measures he had taken to prevent the damage. He was also asked what results he had obtained. In addition to this accumulation of "home preventive measures", experiments were conducted on the effect of various repellents on seed corn germination. The repellents least harmful to germination were then used to determine their value in preventing corn pulling by pheasants. For this work captive pheasants were used at the college and at the Kellogg Bird Sanctuary. To supplement these experiments under actual field conditions, trial plots of treated corn were planted on various farms scattered over Williamston township.

PRESENTATION OF DATA

Preliminary Survey of Williamston Township

As it was desirable to know what the farmers' attitudes were towards the various species of wild-life, the first problem attacked was that of making a crop-damage complaint survey for Williamston township. Seventy-six farmers were interviewed. The entire township was well represented in this survey save for the three experimental areas upon

which Messers Wight, Dalke, and English were doing intensive research work.

It was found that a number of farmers who were renters had lived on the farm one year or less so that in order to have comparable results only damages which had occurred within the last year could be used. Damage which was reported as occurring in previous years, but not within the past year, was not included in the final results. Care was taken not to place emphasis on any one bird or mammal, but to allow the farmer to place each animal in the niche where he believed it belonged.

A spot map was made showing the location of complaints for the various species. (See sheet #1.)

Among the seventy-six farmers interviewed the following complaints of damage were made for the year 1930-31: to field crops, thirty-six cases; to poultry, four; to both poultry and field crops, one, while thirty-five filed no complaint of any kind.

The species involved and the number of farmers making complaints on each are as follows:[1]

Pheasant	- 24	Raccoon	-1
Crow	- 24	Pigeon	-1
Skunk	- 5	Killdeer	-1
Hawk	- 3	Muskrat	-1
Grackle or "Blackbird"	- 2	Squirrel	-1

1. Some farmers had complaints on more than one species.

Nature of Complaints:-

Pheasant - Approximately one half of all pheasant complaints concerned corn pulling. The next most numerous complaint was that of pheasants eating, standing and shocked wheat. Two reported garden damage (mostly to seedling peas and ripe tomatoes), two said ear corn was damaged, one reported the pulling of field beans. One farmer disliked pheasants, because he had seen them kill quail and rabbits, and one farmer had an indirect complaint about pheasants in that hunters damage his fences when they swarm over his farm during the hunting season without permission. The southeast part of the county has much good cover and many pheasants. One half of the total complaints on this species came from six sections in this part of the township.

Crow - Over one half of the crow complaints resulted from corn pulling. Five farmers complained of crows killing young chickens and four reported damage to ear corn. Crow complaints are well distributed over the area surveyed.

Hawk and Skunk - The three hawk and five skunk damage reports were of chicken-killing.

Grackle - One of the grackle complaints was of damage to ear corn, the other was of injury to wheat. Red-winged blackbirds may have been the violaters as well as grackle, because in most cases the farmers call red-winged blackbirds, bronzed grackles, and cowbirds, "blackbirds".

Squirrel - The feeding on ear corn near a woods was the occasion for this single squirrel complaint.

Pigeon - A case of barn pigeons pulling corn seedlings was reported.

Killdeer - This bird was said to have been seen digging out newly planted cucumber seed, shelling them, and eating the "meat". The farmer said he then shot the bird and found the "meats" in its stomach.

Raccoon - In the single case of raccoon damage, this mammal was reported to have eaten green sweet corn ears. It was said that fifty ears were ruined in one night.

Muskrat - Although there was but one case of muskrat damage recorded as occurring within the previous year, there were two other reports in the same vicinity of similar damage occurring the year before. The muskrats also attacked corn, but in a different way from the animals mentioned above. This mammal was said to cut down the entire corn stalk. This damaged corn was found only along small streams or ditches.

Determination of the Accuracy of the Damage Reports

In 1932 (the year following the survey) it was decided to study the same area in an effort to learn the accuracy of the damage reports when collected by the house to house canvasing method.

Thirty-three farms were revisited and signs of crop damage by wild-life were looked for by personal field exam-

inations. The results of the check up are as follows:

12 (36.3%) made complaints in 1931, but no damage seen in 1932.

6 (18.1%) made no complaints in 1931, but damage was seen in 1932.

Total

18 (54.5%) of the observations differed from the original survey.

6 (18.1%) made complaints in 1931 and damage was seen in 1932.

9 (27.2%) made no complaint in 1931 and no damage was seen in 1932.

Total

15 (45.4%) of the observations differed from the original.

It will be noted that damage was found on twelve farms. On some farms the crops were damaged by two species. Squirrel damage alone was found on two farms; squirrel and crow, one farm; crow alone, four farms; pheasant and crow, three farms; pheasant alone, one farm; squirrel and blue jay, one farm.

In the observations a farm was considered as having damage if any injury was noted on any crop whether or not it was perpetuated by the same animal as in that complaint of the previous year. Too much importance must not be attached to the results of this check up. The methods used put the farmer at a disadvantage by suggesting that he tends

to over-estimate his crop losses. There are several factors which contribute to this tendency. First, crop rotation will affect the amount of damage in any one field from year to year. Second, all the farms could not be visited frequently enough to catch sight of all the damage likely to occur at the critical stages of the plant throughout its development. Third, the amount of damage may vary from year to year in the same field having the same crop. There are various reasons for this, such as, for instance, a reduction in the number of the animal species or the finding of other feeding grounds.

Comparing this survey for Williamston township in which farmers were interrogated with voluntary reports from farmers throughout the state, it has been found that in most cases the complaint more nearly approaches the amount of damage in the case of voluntary reports. The reason is that the average farmer will not take the trouble to report his crop damage unless it is of some importance in the first place.

FIELD STUDIES OF CROP DAMAGE

These studies consisted of observations made in Williamston township and on farms scattered over southern Michigan. In the latter case, specific damages, as reported by farmers either directly to the Zoology Department or indirectly through the medium of Conservation Officers or County Agricultural

Agents were studied.

Pheasant

Types and Extent of Damage

Field Corn - The majority of the reports of crop damage dealt at least in part with pheasants. Complaints of damage to corn and truck crops were about equal in numbers. An occasional report of corn damage was of feeding on ears, but the remainder concerned corn pulling.

The corn pulling habit of some pheasants has given rise to the greatest number of complaints on this bird as it affects corn. Maxson (1921) and Burnett (1921) report corn pulling by pheasants in Colorado. Cottam (1929) in Utah, Swenk (1930) in Nebraska and Pirnie (1927) in New York report the same to occur in those states.

The removal of young corn seedlings by pheasants is usually spoken of as "corn pulling", but it would be more accurate to say "corn digging". In the method used by the pheasant there is very little actual pulling. The fourteen birds observed by the writer used their beaks like a miniature pick-ax in digging. The crater shaped hole about one and one half inches across is dug beside the stalks until the kernel is reached. (Fig. 1) A small mound of soil is piled at the bird's feet on one side of the hole. Sometimes the stalk is snapped off with the beak and left lying; it is seldom eaten. The germinated kernel and sometimes the succu-

lent roots are consumed. It is the writer's belief that there may at times be a preference for the roots because a kernel (untreated with a repellent) will occasionally be found which has been dug out and left, whereas the holes are quite free of roots. One farmer reported examining a pheasant's crop which was packed full of succulent corn roots, but had only two or three kernels.

Edges of fields adjacent to good cover (Fig. 2), furrows and other depressions which aid in concealing the pheasant are especially subject to attack. Each hill in a row for some distance will frequently be dug up (Fig. 3).

Over a score of sweet corn patches were studied and it was found that this crop is frequently attacked by pheasants. The damage done to the seedling is exactly the same as described under field corn. The loss here, however, is considerably higher than in the field corn since as a result of low ears the pheasants have easy access to them. One farmer was able to get but two messes of corn which were not damaged. This was from a patch of eight rows, each about twenty rods long (Report 7). Another farmer estimates 20% of his corn taken by pheasants while it was green (Report 6, Part II). A third farmer has had to stop trying to grow sweet corn in fields some distance from the house (Report 9). His was a case of corn digging by the pheasants and one year he had to replant a whole field (4 acres) three times and

then got a poor stand, allegedly from pheasant damage.

Reports that pheasants feed on green ears of corn has not been verified by these studies. Such cases are believed to be rare and the damaging species may be "blackbirds" and the crow (Report 2) who with his constant sentinel manages to escape the farmer's eye. One farmer reported that the young pheasants were the individuals doing the damage since the ear would support their light weight while they stood on it and fed. Another farmer claimed that he watched the birds (of any size) "hold on to the side of the ear and eat the corn like a woodpecker".

On five occasions the writer has observed pheasants picking a few kernels from a mature ear where it hangs within reach and especially if the tip is exposed (Fig. 4). Such losses are not great and are usually unnoticed.

Now and then a farmer complains that the pheasant eats considerable corn from his shocks which he leaves out over winter. It is true that some corn can be taken in the course of a winter (Fig. 5), but a farmer who neglects to haul in his corn must expect such feeding if he has pheasants on his farm. Out of eighty corn fields observed on January 8, 1932 in Williamston township, the corn had been hauled from forty-two. On the remaining thirty fields there was corn still in the shock. In this township, at least, a little over

half of the farmers had hauled their corn to cover by New Years. It is not known what per cent of those remaining were husked.

Some farmers purposely leave a few shocks of corn to help the birds through the winter and sometimes a farmer is found who will invite the pheasants to feed with his chickens. Calamity has been known to accompany the latter practice because valuable roosters may be killed in the spring by the cock pheasants who are of a fighting disposition at that time. Matings of cock pheasants with the domestic hens giving rise to hybrid fowls have been reported, but these hybrids have not been seen by the writer. The most serious drawback in feeding pheasants with chickens is the danger of destruction of gardens in the spring. The pheasants become less afraid of humans and may make frequent raids on the garden even though near to the house.

It is recommended that winter feeding stations be placed in the field in the vicinity of the birds' winter quarters. Pirnie (1930) advises that feeding stations should be established early in the season so that the birds will learn where to find food when really needed. This will also reduce the tendency for pheasants to look for food around the farmyard. It is not to be understood that pheasants will not visit the garden if they are fed in the field, and garden patches far removed from the house are especially subject to

injury.

Market Gardens - The market gardener often experiences considerable money losses as a result of pheasants feeding on his vegetables. This type of damage is found mostly at the outskirts of cities, not only because the most truck gardens are here, but also because city hunting restrictions prevent hunting at any time. Frequently there are many acres of subdivisions not yet built up (Fig. 6). These are allowed to grow to weeds which furnish the pheasants with excellent cover.

Tomatoes - Of seventeen market gardens observed near Detroit and Lansing the largest losses occuring on any one crop are those with tomatoes. Depending upon local circumstances the loss will vary from a few dollars to several hundred. In some places the farmer is fortunate to receive enough to pay expenses at the end of the year. One farmer estimated his loss on non-salable tomatoes to be between $150 and $200 (Report 15). Another placed his loss between $500 and $600 on tomatoes alone (Report 6). These figures are computed by multiplying the current market price by the number of bushels of ruined tomatoes gathered.

The bulk of the loss comes at the very first of the tomato season when this vegetable is sold at a very good price.

At this time each ripe tomato is valuable, but just as the first ones begin to redden on one side, the pheasant arrives and takes two or three mouthfuls out and looks for another tomato (Fig. 7). Later when the tomatoes are numerous and of little value, the loss is lessened. A pheasant seldom eats much of any one tomato, but he seems to sample many. Often one peck in a fruit is all he cares for, but that peck has ruined the tomato for selling.

Melons - Both watermelons and muskmelons are relished by pheasants, but there may be a slight preference for the latter (Report 6, Part I). No case of pheasants attacking green, immature watermelons was found, but such may exist, because one case of a light attack of this kind on green muskmelons was found (Report 16). However, melons are readily eaten when they ripen. Observations on injured melons in which the rind was penetrated seem to indicate that the bird is after the seed of muskmelon and the sweet water of the watermelon. Some of the injured melons have little left but the rind while others have only shallow beak marks on the surface (Fig. 8). If the rind is penetrated at all the melon soon rots and is a total loss. Melons with but a tiny hole are suitable for home consumption and should be eaten before the sound ones.

Small melon patches of less than an acre and adjacent

to suitable pheasant cover on one or more sides (Fig. 9) suffer more loss in proportion to their size than more extensive areas. Apparently, the pheasant will feed on a melon for a long time and may get a whole meal from it. Although no case was found in which crows were known to be responsible for the types of damage described above, it is not unlikely that they may be the cause of some melon injuries which are blamed on the pheasants.

Strawberries - Reports have been received of pheasant injury to strawberries. Some farmers report heavy losses but most are relatively mild. The larger losses are sustained by farmers who grow large beds of strawberries for market. A farmer's wife reported that she was able to obtain but thirty-eight quarts of berries from her patch in 1931 where she used to get a crate (24 qts.) every other day. However, since all the berries were undersized, there is some question as to how much of the reduced crop can be laid to the pheasants and how much to the extremely dry weather of that year (Report 7). It is interesting to note that in this particular garden there were two rows of ripe tomatoes adjacent to the damaged strawberries, but not a single injured tomato could be found. This might indicate that the pheasants preferred strawberries to tomatoes at times.

Another farmer, who had two rows of strawberries for

home use, reported considerable damage on them (Report 10). A few injured berries were found, but not nearly as many as was expected from his complaint. Later in the day two robins were seen feeding on the berries and there is a possibility that this species is as much to blame as the pheasant (if not more so) for the strawberry damage in this particular field.

The strawberries are attacked when they ripen. One or two pecks are made in a berry and the remainder left so that here as in the tomato much can be spoiled, although but little is actually eaten. Sometimes the berries are severed from the vine and scattered over the ground without being pecked into. These berries soon shrivel up and are a complete loss.

Pheasant damage to other garden crops are of less importance over southern Michigan as a whole, although considerable injury may occur locally to particular crops.

Other crops upon which pheasant damage has been recorded for Michigan in these studies are as follow. Popcorn may be dug out as a seedling; garden peas may also be dug out or taken from the pods on the vine; cucumbers have been pecked into (Fig. 10); and likewise potatoes which were partly exposed at the surface of the soil were attacked.

Control of Pheasant Damage

Value of Repellents on Seed Corn

Experiments were conducted both in the laboratory and in the field to determine the value of various repellents on seed corn in preventing corn "pulling" or digging. The laboratory tests were for the purpose of determining the effect of a repellent on the corn consumption by the pheasants, and the materials finally used were those chosen from some thirty-three after determining the effect of each substance on the germination of the corn. The results of the germination tests are found under another heading (p. 30). The field tests were for the purpose of determining the effect of a repellent on the corn consumption by the pheasants when the corn was actually planted (p. 25). All the treatments used in the field were those which had permitted a germination of 90% or more in at least one doll[1] on both varieties of field corn used (Polar Dent and M. A. C.) Two laboratory tests were made in which treated seeds were exposed in containers to pheasants. These tests included more treatments than the field tests, the former having a number of powdered compounds, the best of which were not used in the field because of the lack of a suitable substance (at that time) for making the powder adhere to the

1. The rag doll method was used in making the germination tests. See page .

kernels. Only one commercial repellent[1] was used because the Farm Crops Department had reported poor germination of seed corn when treated with this. The following repellents were used:

1. Lysol (1 hr. soaking)
2. Bunny Bane
3. Gypsum
4. Hammond's Copper Solution
5. Lime
6. Salt Petre
7. Lysol (5 min. soaking)
8. Copperas
9. Zenoleum
10. Semesan
11. Chloride of Lime
12. Copper Carbonate
13. Cro-shoo
14. Red Lead

The solid repellents were dissolved or suspended in water because it was felt that the effects would be more lasting if the chemicals were allowed to penetrate the kernel than if dusted on the surface. Later on crank case oil was found

1. "Cro-shoo"

to be excellent as a "sticker" or substance causing the powdered compounds to adhere to the kernel and no doubt would have been ideal for these treatments. Lysol was diluted in water 1:400 and Zenoleum was diluted 1:100. Cro-shoo was used full strength as its makers direct.

In all treatments the corn was soaked for five minutes except in one lysol treatment when it was soaked one hour. The latter treatment was reported by a farmer's wife to be successful in preventing corn pulling. Five untreated controls consisted of seed which was soaked five minutes in clear water.

Each treatment was applied to fifty grams of field corn which was then placed in an uncovered, large-mouthed, pint fruit jar. The jars of treated corn were set inside a pen with six captive pheasants, with the controls well distributed along the row of jars. A cleat held the jars upright along the side of the pen and prevented spilling. The pheasants received no other grain during the tests.

This experiment was designed merely to give the relative value of one repellent compared to the others on the assumption that the grains would be eaten in order from the least distasteful to the most distasteful. Irregular visits were made during the day to determine the order of eating. The two tests varied considerably as to the order, yet there

were a few consistencies worth noting. In both tests all lysol treated seeds were eaten before the last jar of control (untreated) seed. In one of the tests the seed treated for one hour in lysol was the very first jar to be emptied. The gypsum treated seed was also eaten in both tests before the last jar of control seed.

After ninety-six hours of exposure to the pheasants, the remaining seeds were those treated with red lead, semesan, cro-shoo, chloride of lime, copper carbonate, and zenoleum. Of these red lead and cro-shoo treated jars showed the least loss, indicating that they were the most valuable repellents.

Field Tests on Captive Pheasants

In an effort to find some effective seed treatment which the college could recommend to farmers, outdoor experiments were run with captive ring-necked pheasants at the W. K. Kellogg Bird Sanctuary near Battle Creek. Pine, gas, and coal tars were used. The plan was to find which tar was most valuable as a repellent. At the same time it was planned to find out whether or not all stages of the corn up to a height of three inches are equally subject to damage.

The pheasant pens at the Kellogg Bird Sanctuary are 6 x 70 feet. Three of these pens were chosen and all but 10

feet of their length was spaded and planted with three rows of untreated corn alternating with three rows of treated corn running the entire 60 feet. Thus the first pen alternated coal tar treated corn with the untreated corn, the second pen was handled likewise, but the seed treatment was gas tar and the third pen had seeds treated with pine tar.

A wire partition was put across the pen in such a position as to allow the pheasants access to only the first 10 feet of the 60 feet strip of corn the idea being that as the corn grew, the birds would be allowed on another portion of the stand by moving the partition, the corn being of an older age each time. It was planned that six ages of corn would be used, each time exposing 10 more linear feet. The first area was exposed to the pheasants immediately after planting, the second after germination, the third when the first shoots appeared above ground, the fourth when one inch high, the fifth when two inches high, and the sixth when three inches high.

Two hens and one cock pheasant were put in each pen and each group was transferred to a different pen when a new exposure was made so that no group remained in the same pen during two successive exposures. This was done to reduce any tendency for the birds to become accustomed to the taste of

one repellent.

The birds were not fed for a day after being put on a new area so that they were somewhat forced to feed on the planted corn. The purpose was to find if the pheasants would eat the untreated corn in preference to the treated, and also in what stage the corn was first eaten.

The three pheasant groups were lettered A, B, and C. The first corn eaten by group A was on section 2 (germinated corn); group B first fed on section 3 (corn first appearing above ground); group C first fed on section 4(one inch corn). It was after the first corn was dug out by a group that all succeeding sections were attacked by that group, frequently leaving nothing but holes and wilted stalks where the corn once grew (Fig. 11). Since these birds were all pen raised, the above observation indicates that pheasants acquire the corn digging habits either accidentally in digging for worms or for food other than corn, or they may learn from other birds already familiar with the art of corn pulling. An observation on group A bears out the latter statement of the ability of pheasants to learn from their associates. None of the birds of this group had dug any corn up to the time they were put on section 2. Soon after this section was exposed to them one of the hens while digging here and there in the soil came across a hill of corn. When the other hen saw the

first hen had something to eat she rushed over and proceeded to help dig and soon she uncovered a seed. By this time the cock who had taken notice came over and both hens left and began to dig vigorously elsewhere for themselves. None of the groups found very many of the hills before the corn appeared above ground, but after the corn's appearance practically all of it was dug out.

The tar coats on the corn did not prevent the pheasants from eating it, nor did it even reduce the damage. Since the treated and untreated rows alternated, the birds were apparently unable to distinguish one row from another and it was just a matter of chance which hill was dug. Regardless of which hill was dug, the kernels were eaten. The conclusions from this experiment are: 1. Pheasants learn to dig corn in at least two ways, (a) by accidental discovery of the corn and (b) by imitating others familiar with corn digging. 2. Treating corn with coal, gas or pine tar will not insure it against pheasant injury.

Field Tests Under Natural Conditions

Thirteen plots of treated corn with untreated controls were planted on various parts of Williamston township. Three of them were destroyed by farm operations thus leaving but ten upon which final results could be obtained. These

were not plots in the ordinary sense of the word. The term "row" would be more fitting since each plot was a single row planted along the edge of the cultivated field and in those places one would expect pheasants to visit. Each row consisted of one hundred and fifty hills of 3 kernels each. Three controls were run with twelve repellents in a plot. Each ten hills were treated in the following order: Control #1, coal tar, gas tar, pine tar, crank case oil, Carbolineum, Zenoleum; Control #2, Stanley's Crow repellent, Crowtox, Bye Bye Blackbird, Cro-shoo, Corbin, dilute lysol (soaked one hour), and Control #3.

The various repellents which were in solid form such as lime, red lead, gypsum, etc. were not tried in the field because it was thought that contact with soil and rain would soon dissipate the repelling power of these compounds. Later it was discovered that oil made a good "sticker" for such powders and would withstand considerable weathering.

Observations were made from time to time and it was found that the corn which had been dug out was done by pheasants in all recognizable cases. Where rain had fallen before an observation was made it was difficult to tell what animal had done the damage which occurred since the last observation.

No distinction was made between stalks missing in the final tally as a result of pheasant digging and those missing because they failed to germinate. The percentage of stalks missing for the three controls combined is 32.5%. The percentages for the coal tar and the carbolineum treatments both exceed 32.5% while the remaining treatments have smaller losses. One plot of coal tar treated seed accidentally received an overdose of this very heavy repellent which prevented water from reaching the seeds and none of them grew. This fact contributed to the large percentage of missing stalks in the coal tar treatment.

From Table I (p.98) it will be noted that "Bye Bye Blackbird" shows the lowest percentage of missing stalks, but is followed closely be Zenoleum.

Assuming that the effect of a repellent on corn germination is the same in the field as in the laboratory, a correction was made by using the results obtained on the germination tests of the same corn (Polar Dent) as given in Table II (p.99). A new percentage was thus obtained which represents the loss of corn due to factors (chiefly pheasant digging) other than the effect of the repellent.

It is difficult and often impossible to determine the significance of these results by simply comparing the percentages with the control, but by using the Probable Error (P.E.)

of the percentages to the Probable Error of the difference can be obtained. If the latter figure is 3 more the difference is considered significant. These ratios are given in the last column of Table I and were obtained after combining all the three controls.

It will be noted that gas tar and Carbolineum are not significant. Coal tar appears to be highly significant, but when one takes into account the relative percentages of loss of coal tar and control, it is seen that the significance is in the opposite direction. That is, the results indicate that corn treated with this material is most likely to succumb.

It is interesting to compare the field and laboratory tests on lysol treated seed. It will be remembered that in the laboratory the tests showed that the pheasants ate this seed as readily as they ate the untreated controls, which would indicate that lysol was a poor repellent. When the lysol treated seed was placed in the field about 5% was lost due to factors other than the repellents. The ratio of the differ ence of the percentage to the P. E. of the difference is 18.5, a number highly significant.

These results cannot be taken as conclusive since a maximum of only 300 seeds was used, but they do indicate the value of further research along this line.

Coal tar, gas tar, pine tar, engine oil, and lysol

are familiar to everyone. All were used full strength except the lysol which was diluted approximately 1 : 400. Stanley's Crow Repellent, Crowtox, Bye Bye Blackbird, Cro-shoo, and Corbin are commercial repellents having tar basses. These were used in the strengths recommended by the manufacturers. Carbolineum is a wood preservative which apparently has a creosote base. This was used full strength. Zenoleum is a liquid used to eradicate lice and mites in poultry houses. This was diluted approximately 1 : 100.

Since the pheasants may find enough food value in the roots of corn seedlings to make the digging of corn worthwhile without always eating the kernel, as stated elsewhere in this paper, the repellents used in this experiment are of doubtful value. The discovery of oil as a "sticker" for such apparently effective repellents as copper carbonate, red lead and chloride of lime may be the solution to seed treatment against pheasant pulling since these chemicals gave good results in the two laboratory tests. Although these chemicals are considered poisonous in large quantities, no pheasant used in these experiments has been induced, even by starvation, to eat enough corn treated with these chemicals to produce any ill effects.

Observations on the Effect of Repellents on Corn Germination

It was desirable to know the effect of repellents on the germination of the corn before making tests on their repelling powers. Obviously any chemical which greatly retarded or reduced germination would be discarded on the start.

After consulting the Farm Crops Department as to the popular varieties of field corn, M. A. C. and Polar Dent were decided upon. It was also decided to include pop corn in the tests since several farmers were found to raise large quantities of it for market. The fields were larger than market sweet corn fields. The Australian Hulless variety of pop corn was chosen.

Thirty-six different treatments were used on these three kinds of corn, but all treatments were not tried on each kind of corn. The M. A. C. variety of field corn was used the least, because it was the last received and tests of a number of chemicals had already been made on Polar Dent. Those which were decidedly detrimental to germination were not duplicated on the M. A. C.

As will be seen from Table II, (p.99), most of the substances used as probable repellents are more or less common compounds, many of which can be found on the average farm.

Five commercial repellents having trade names were used. More such substances are manufactured, but were not obtainable at the time. The other substances having a trade name are designed for purposes other than a deterrent, but were tested because it was believed they would impart a disagreeable taste or odor to the corn.

The list of substances used was obtained from three sources: first, "home remedies" or methods used by some of the local farmers; second, information received from the Bureau of Biological Survey; third, products advertised in farm and garden magazines.

The "repellents" can be grouped as follows:

Commercial Crow Repellents -

Crowtox
Cro-shoo
Corbin
Stanley's Crow Repellent
Bye Bye Blackbird

Commercial Products Other Than Crow Repellents -

Semesan)
Ceresan) Fungicides
Hammond's Copper Sol'n)
Weedex - weed killer
Wilson Weed Killer
Hammond's Weed Killer
Carbolineum - wood preservative
Pyrox - insecticide and fungicide
Bunny Bane - rabbit repellent for fruit trees
Zenoleum - insecticide for poultry houses

General Compounds -

Oil	Salt petre
Red lead	Chloride of lime
Kerosene	Copper carbonate
Lime	Copperas
Turpentine	Gypsum
Coal tar	Nicotrol
Pine tar	Lysol
Gas tar	Arsenate of lead

"Rag dolls" were used in all tests. (Figs. 38 and 39). Each doll was made of a piece of unbleached muslin 1 x 3 ft. The kernels were spread out on the cloth and rolled into it. The complete doll was then kept moist during the test. Four hundred kernels were put in each doll, except one small group (dolls 149 - 151 inc.), and all germinated kernels were counted after 48, 72 and 96 hours, except dolls 85 - 104 inc. which were also examined after 120 hours, because it was believed that the accidental drying which occurred in this set might have retarded normal germination. However, it will be noted that there was very little additional germination during the last 24 hours. Observations were discontinued after 72 hours on those dolls which had a germination percentage of 97 or more, providing the remaining seeds were all discolored and showed no indication of sprouting. The other dolls were germinated for 96 hours with the exception noted above on dolls 85 - 104 inc. which were carried an extra 24 hours.

It will be noted in Table II (p.99) that where the same treatment was applied to more than one doll of one kind of corn (separate sets) the results sometimes varied widely. It is believed that the fluctuation in room temperature was the cause of these cases of wide divergence since each set of tests was begun on different days. To get a better picture of the "repellents" effect on germination more dolls should be tested. Fewer kernels might then be used in a doll.

Table III (p.109) is a summary of Table II (p.99) and gives the comparative effect of each treatment on the three kinds of corn. Where more than one test was made on a "repellent", the average for all tests was used. It was then seen that in a few cases there was a marked difference between the field corn and the pop corn. Eight of these "repellents"[1] were tested on pop corn and field corn (Polar Dent) at the same time under identical conditions. The results are given in Table III (p.109). In all but two cases (control and chloride of lime) the figures for the two corns were brought closer together than before and in four cases (control, chloride of lime, Cro-shoo, and Bye Bye Blackbird) the relative percentage of germination was reversed. Table IV (p.111) suggests that too much importance should not be put on the marked difference between field corn and pop corn as to their reaction to some repellents as shown in Table III (p.109).

1.

Bye Bye Blackbird	Carbolineum	Copperas
Corbin	Chloride of lime	Lysol (soak 1 hr.)
Cro-shoo	Salt petre	

All of the commercial repellents which were tested gave satisfactory germination results. In addition to these, the following can be used on corn without serious reduction in germination:

Coal tar	Carbolineum (conc.)
Gas tar	Hammond's copper sol'n (Dilute 1:50 soak 5 min.)
Pine tar	
Lime	Arsenate of lead
Chloride of lime	Bunny Bane
Copper carbonate	Ceresan
Gypsum	Lysol (Dilute 1:400, soak 1/2 to 1 hour)
Semesan	
Red lead	Zenoleum (Dilute 1:100, soak 5 min.)

The compounds in powdered form are applied to corn previously treated with a thin coat of used crank case oil or glue size. Red lead is the most highly recommended of the powders. If Carbolineum or any of the three tars is used, extreme care must be taken not to apply too much. Two tablespoonfuls to the bushel is sufficient and is most easily applied to corn previously heated with warm water and drained. If the seed is too heavily coated there is danger of preventing germination by sealing out the water.

Other Methods of Control

A few methods have been tried out in an attempt to reduce pheasant depredations. The most common and simple yet tedious method is pheasant chasing. The benefits, however, are few unless a constant watch is maintained because the effect of chasing is temporary and the birds often return as soon as the chaser has gone to another part of the field. Some farmers keep a dog trained to chase the pheasants from their corn field or tomato patch. One farmer reported that he had tried this method in his tomato field, but had to discontinue the practice because the dog did more damage to the vines than the pheasants did to the fruit. Even where a dog can be used successfully, as in "milk stage" corn, usually someone has to be on hand to see that the dog does his work.

Each year the Conservation Department gives a number of permits to farmers allowing them to shoot to scare pheasants. The report of a shotgun in most cases gives but temporary relief and must be followed up at frequent intervals. A Williamston farmer discovered a unique way of frightening pheasants from his tomato patch which was next to his house. He went out the front door with his shotgun and scared the birds away a couple of times. From then on he said that all he had to do was to squeak the front door hinges.

A farmer west of Lansing was troubled with a cock pheasant who made regular visits to his garden. This man emptied the lead out of a shotgun shell, replaced it with little pieces of wadded paper and waited for the pheasant's return. While the bird was busily eating in the garden the farmer came up behind it and fired. He reports that the cock was so surprised at the sudden explosion followed by a snowstorm of paper wads that he ran down the hill squawking at the top of his voice and never returned.

Sometimes the farmers will put up various types of scarecrows to frighten pheasants. Human effigies, shiny metals, clattering tins and these have not brought reports of satisfaction from all the users.

Plans were made in the fall of 1931 to try live trapping of pheasants on the college farms in the winter, when food was scarce and carrying them off the farms as a means of control in those places where pheasants do considerable damage and where no open hunting season is allowed as, for instance, on sub-divisions within city limits. A fall pheasant census was to be made first and this followed by live trapping and removing of the birds. In the spring another census was to be made to determine the relative abundance of pheasants then as compared to the fall abundance.

The fall census was made and the first blanket of

snow was anxiously awaited. When it finally came it immediately melted and throughout the winter the snow was so scanty and temporary that it was felt that live trapping in the midst of an abundance of food would be useless. It is thought that this method may be of value in a few instances, but unless a combination of favorable conditions is to be had, time-consuming live trapping should not be tried.

Two methods of taking a pheasant census have been employed on the College farms. The first one (mentioned above) was made by the writer with the aid of a bird dog and every field was covered thoroughly. The entire census was made over a period of about three weeks in October and November 1931 (during spare hours). No field was covered more than once and each flushing of a pheasant was recorded. Approximately 1700 acres were covered in this census with a total of 66 flushings. When a pheasant was flushed it was followed with the eye and if a bird of the same sex was flushed at the approximate place of alighting a few minutes later it was considered as a reflush. Allowing for a few of these flushings which were, no doubt, reflushings of birds seen a few minutes earlier, it was estimated that the total of 60 pheasants were seen on the entire area, or 28.3 acres per bird. This represents 22.6 pheasants per section.

In February 1932 the class in Forest Zoology made another pheasant census, but this time only college property

was covered, reducing the area to approximately 1250 acres. The entire class (16) went into the field at once and in two laboratory periods (total of four hours) the work was completed. The class worked in pairs and on a map of their area each pair recorded all flushings including the sex of the bird, time flushed and direction of flight. The data were then compiled and a composite map made. From this map it was found that a total of 71 flushings were made, but due to the nature of the method used, there was much more reflushings. It was estimated that 46 different birds were seen during this census or 27.6 acres per bird. This represents nearly 23.2 pheasants per section.

Pheasant damage has been reduced, particularly spring damage, by reducing the amount of cover in which these birds gather in the winter. In some cases this means putting more land under cultivation or in case of lowlands which are expensive to drain, burning during spring and fall. If it is impossible or undesirable to burn the area, mowing the vegetation with a scythe is sometimes resorted to.

Destroying pheasant cover gives only local control by affecting the local distribution of pheasants. A drawback to this method as a means of control on any one farm is that the adjacent farm may furnish sufficient cover, so that crops near the line fence may continue to suffer. This is noticed

especially in small truck farms in city sub-divisions. Over a dozen such farms were observed by the writer to be surrounded by a rank growth of weeds which gave splendid cover while the truck crops supplied the food. It has been noted that the most damage is done to those crops which have been planted next to alfalfa or an uncropped area covered by weeds. The least damage is found on fields separated from the weedy area by another field of several rods width. This fact suggests a method of reducing damage by planting those crops such as tomatoes, peas, etc. which are very subject to damage, as far from the uncultivated area as is possible.

On the average farm in southern Michigan the annual open season on pheasants is sufficient to keep this species in check, but there are many localities in which this bird has found conditions very favorable for its increase. On market gardens within city limits this has been largely a result of hunting restrictions which permit no open season. There are times, however, in which even an open season is not effective in reducing pheasants. An example is that of a market gardener living just outside the city limits of Detroit. Pheasants were very plentiful on his farm and each year the vicinity was artificially stocked with pheasants by a group of city sportsmen. This farmer allowed any one to hunt on his place hoping that this would reduce the number of pheas-

nts. Theoretically his idea was good, but he had forgotten hat birds would not remain on his farm to be shot. Instead hey escaped destruction by crossing the line fence on to the djacent farm which was owned by a man who lived in town and ho permitted no hunting. The latter farm was not cropped, ut allowed to grow up into excellent pheasant cover and as result a very few birds were shot on the market gardener's arm.

Most farmers enjoy seeing a few pheasants on their arms, but when this bird reaches such numbers as to become estructive to the crops it is no wonder that the farmers' ttitude towards the pheasant is changed. The average farmer s not a sportsman and when he asks the state to allow him o shoot a troublesome bird it is because he wants to pro-ect his tomatoes, corn, peas or other crops. To whom per-nits to shoot pheasants out of season should be given could e determined by a trained field man who would personally isit the fields damaged. In order that such a method be effective inside city limits it would be necessary for the ity to cooperate with the state in giving the farmer hunt-ng privileges. The cost of maintaining an effective force f field men might prohibit such a plan while there are so ew complaints.

A more general plan by which the state could help the armer would be to increase the bag limit or the length of

unting season in those counties having the greater crop damge by pheasants. Which counties these are could be determined y a survey. It would thus be incumbent upon the individual 'armer to control the amount of hunting on his farm during the eason. Needless to say, the human element would enter here ince some farmers find the control of hunters more difficult han the control of pheasants and for this reason dislike the heasants.

Hunting organizations could also help the farmers livng near the hunting grounds by improving and increasing food on these grounds so that the birds would not have to call upon the farmers for so much of their food.

State permits to reduce the pheasant population on a farm by shooting if given after a careful investigation, to farmers who suffer severe crop losses by pheasants the writer feels to be a wise policy. The town or city should cooperate and aid those who have farms within its limits.

Status of the Pheasant

These studies show that the answer to the question conerning the status of the pheasant is a purely local matter and must be worked out separately for each area. Since it is often impracticable to reconcile perfectly the rival interests of hunter and farmer, it is desirable to favor the farmer inasmuch as measures should be taken to keep the pheas-

nt population to such numbers that serious crop damage will
ot result. Both the city sportsman and farmer must be taught
o see the other's viewpoint before a favorable spirit of
ooperation can exist between them. Certain hunters are to
lame for the hostile attitude which exists between both par-
ies in many places and until he learns to respect the farmer
s he does his partner in other lines of business or sports
ne cannot expect the farmer to listen to suggestions for
ncouraging wild-life on his farm just for the sportsman's
easure. Instead of overstocking the land already well stock-
l the sportsmen might better spend their money in discovering
ay introduced stock fails in apparently good pheasant land.
f the range of the pheasant could be increased this would
nd to relieve the over-crowded hunting conditions which now
ist and might help reduce overstocking in the present range.

Lack of pheasant damage to the crops on the college
rm in 1931 - 32 indicates that a concentration of 20 to 25
easants spread over a section of land as determined by two
nsuses (p.37) is not likely to be serious in general farming
nd upon which such crops as corn, small grains, beans, and
y are grown. No doubt areas under this type of farming can
l do support twice as many pheasants without serious crop
mage. It must be remembered that 20 pheasants per section
the fall and winter may mean many more in the following

ummer. There is always danger of local damage to garden egetables and as to the truck garden districts, it would be est to have no pheasants, even though some farmers may desire few, because one or two birds can ruin considerable produce ver an area of considerable size, and in the case of the arliest tomatoes the pheasants peck into all the ripening ruits as fast as they appear. The above figures are necessrily inconclusive since no great area was studied and since ne area will differ from another and several areas should be nvestigated before coming to any definite conclusion as to ne best pheasant policy.

James Ritchie (1931), a Scottish writer, considers ne pheasant in Scotland as one of the "casual bird marauders" n grain crops and says, "On the whole, and where the condiions approach those natural to the species, the pheasant is elpful rather than injurious to the farmer, but where excessve rearing of pheasants for sport takes place, the conditions re apt to be reversed and Mr. Hugh S. Gladstone is of the pinion that in numbers of more than one bird per acre, it is iable to become harmful".

Crow

Kalmbach (1920) states that the common crow, Corvus achyrhynchos brachyrhynchos, is the most abundant and wide- distributed of our American crows. This bird is well known practically all parts of this country east of the Rocky untains. Its bad habits are generally recognized; in fact, ch better known than the good habits. The result is that is species has received criticism throughout most of its nge.

Since the crow is an omnivorous feeder, its destruc- ve habits from the farmers' viewpoint fall into two broad oups. First, there is the destruction of crops, and second, e destruction of poultry and eggs.

Types and Extent of Damages

Corn - Crows attack corn more than any other single rm crop. The damage to corn has been found to occur in at ast four different stages of its life history. The greatest sses occur at the time of sprouting. Observations were made eight crows who were seen to pull a total of fourteen hills seedling corn in five fields. Hundreds of similarly damaged lls have been seen. The crow removes the germinating kernel d if the little stalk is not entirely pulled out of the ound, the roots are so exposed that the seedling soon dies. e type of injury can usually be distinguished from that of easants. First, it must be kept in mind that the crow has

a tendency to do more actual pulling of the stalk, whereas the pheasant does more digging to reach the kernel. The crow also digs, but the hole is usually small at the top with all sides vertical or nearly so and the conspicuous little mound of dirt at one side of a hole made by a pheasant is lacking where the crow digs. The stalk often shows two transverse depressions at about its middle where the two sides of the beak have grasped it in the act of pulling. The pheasant usually snaps the stalk in two if he touches it at all. If the soil is in just the right condition, footprints may be found that will indicate which species was responsible for the damage. The hind toe of the crow is long and leaves an imprint on the ground, whereas that of the pheasant is very short and usually leaves no mark unless it be a small hole behind the imprint of the other three toes.

Corn pulling by crows is likely to occur in any part of southern Michigan where corn is grown. Fields well removed or hidden from the house have been noted to suffer the greatest losses. In hilly or rolling fields the portions which are hidden from the house by the hills are damaged more than the other parts. One farmer reported that his heaviest losses were on the light sandy soils rather than on the clays, presumably because of the greater ease with which the stalks can be removed from the sandy soils.

Another type of corn injury has been found and believed

o be the work of crows, although no animal has been observed
n this act. This injury occurs to the corn from the time it
s four feet tall until it has reached the tassel stage. The
njury at this time is found at the base of the stalk into
hich a hole is pecked. The hole is ragged looking, from one
o four inches long, and usually between the first and second
odes, (Figs. 12 and 13). It is not known why crows should
ttack the corn in this manner unless it is for the sweet
uices found in the succulent stalk at this time. It was
hought that the crow was digging out borers so approximately
hree dozen stalks both injured and uninjured were carefully
xamined, but no trace of borers was found in any.

After being attacked the stalks are, of course, very
ich weakened and usually topple over with the first gust of
ind and the whole plant is then a total loss (Fig. 14).

This injury to corn stalks appears to be quite common
.nce only four cases have been noted in the course of these
udies, two in Ingham county, one in Calhoun county and one
i Kent county. The past two summers have been unusually dry,
id it would be interesting to note if this type of damage
uctuated with the amount of summer precipitation over a
riod of several years.

The greatest damage was seen in a field at Union City.
e injured portion of the field (around a large elm tree
owing in the fence row) was an area twelve rows by twenty

ows on which 26% of the stalks were injured to such an ex-
ent that the entire plant was a total loss or would be
tunted later (Report 1).

A local high school biology teacher reports that he
as observed pheasants feeding on the stalks of corn, but he
ays that this injury is more in the form of a round hole than
greatly elongated hole.

Corn is commonly injured by crows when the ear is in
he "milk stage". The writer has observed over a dozen crows
eeding on corn, and in every case the ear attacked was im-
ediately examined. In addition several hundred crow damaged
ars have been seen. In the average field of corn where the
ars are two feet or more above the ground the kernels are
aten after the husk has been torn away from the ear. This
s accomplished while the bird stands on the top of the ear
that the typical injured ear has the husks on the top un-
isturbed, except perhaps at the tip while one or both sides
ave the husks torn to shreds and the kernels broken. The
sks on the underside usually remain intact (Fig. 15). There
e a number of variations from the typical damage, but as a
le several ears as described above will be found. The
jured ears are always horizontal or very nearly so and al-
ys at the edge of the field or around a tree or other good
ookout" post within the field. A fence row serves as a

;ood "lookout" for the crow on guard and consequently the .djacent corn is likely to be damaged (Fig. 16). It is not :o much the amount of corn eaten as it is the subsequent njury resulting from water entering the ears that makes uch attacks more serious than they appear to be on first ight.

Sweet corn and field corn which is unusually short :o that the ears are close to the ground may be greatly dam- ged. In such cases the damage will occur in any or all arts of the field and the ears are badly mutilated (Fig. 7). Damage of this kind is difficult to distinguish from imilar damage by other forms of wild-life. Unless one ctually sees the animal feeding on the corn, the wrong pecies may be condemned.

The feeding by crows on roasting ears is widespread n the lower peninsula, but the amount of damage is seldom reat, especially in southern Michigan where the corn is all enough to prevent the crow's feeding from the ground. ometimes serious damage results in shorter corn where ground eeding is possible. A ten acre field of short corn (one- alf mile from the house) near West Branch (Ogemaw county) as observed in which between one-third and one-fourth of he ears were damaged (Report 5).

The loss of each ear of corn means more to the Michi-

n farmers than it does to the farmers in the corn-belt
ates, and for this reason more crow complaints are heard
om Michigan and similar states, although the total amount
damage may be less than in the corn-belt states. The
eat number of woodlots in Michigan furnish numerous crow
osts and nesting areas in close proximity to the relative-
small corn fields. In spite of this condition, it is
rprising that there are not more complaints made against
ows on these grounds. This is due, first, to the feeling
at such damage is not serious enough to lodge a complaint
d, second, the damage is frequently undiscovered and if it
discovered the farmer may believe it a result of feeding
some other species.

Kalmbach (1918) states that crows may injure corn
fter it has been shocked, but he adds that this form of
njury appears to be the least serious of all the crow's
ttacks on corn. This type of damage has not been observed
n the course of these studies nor has a single complaint of
is nature been received.

Muskmelons - Aside from a case of muskmelon injury
ear Detroit (Report 17), no other garden crop (except possibly
ucumbers) has been observed to be damaged by crows. All of
he injured melons on this six-acre field were small green
es; the larger ones being untouched, perhaps because of the

arder rind. The most severely injured melons were com-
letely hollowed out, leaving only the rind (Figs. 18 and
9). It was estimated that one melon out of ten or fifteen
as injured over most of the six acres.

On a farm adjacent to the college farm several in-
ured cucumbers (Fig. 20) were found along with some injured
op corn, but it was not known what species caused the dam-
ge. Both pheasants and crows were common in the vicinity,
nd a number of ears of field corn nearby were damaged by
rows.

Apples - One orchard was observed in which several
ushels of apples were injured while on the tree by having
ortions of each apple eaten by crows.

Live-stock and Poultry Destruction - In the course
f this study no reports of crows attacking live-stock in
ichigan were received, but Kalmbach (1918) says, "The crow
s accused of molesting and in some instances actually kill-
ng live-stock, as young lambs and swine, and no doubt in
ome cases he is guilty". However, he finds stomach exam-
nations have shed no light on this habit. Kalmbach also
ecords a report of crows "killing young merino lambs by
ecking into the brains, which with the eyes, were eaten".

In the complaint survey of Williamston township,
everal farmers reported that crows had given them some

uble with the poultry. Eight or ten farmers in widely parated counties of southern Michigan have stated that they i losses of this type at one time or another. From this e may well conclude that the damage is widespread, and the verity of the damage is dependent upon local conditions. fact, it seems to be due to the habits of individual crows cause complete relief has been obtained by the killing of single crow caught stealing a chicken. Kalmbach's (1918) udies of crow stomachs show that nearly 5% of 1340 adult ows contained remains of chickens or chicken eggs. He und that such food was most important to the crow in May d June, the same months that most of the depredations on ultry are committed. He found that 12 of the 127 stomachs llected in January contained poultry or their eggs and be-eves that a "portion, at least, of such food should be assed as carrion".

Since no personal studies were made on poultry de-edations, it is not possible to give any data on the loss- to poultry raisers resulting from crow raids in Michigan.

Control of Crow Damage

Various kinds of frightening devices have been used the farmers in their fields. A method which gives satis-ctory results on one farm may be useless on another farm. us the method of control appears to be just as much a

cal matter as is the type and extent of damage.

The old-fashioned human effigy is seldom employed except in gardens or small acreages of vegetable crops. The maged six acre field of muskmelons mentioned above contain- six of these scare crows well distributed and this was e largest area noted upon which human effigies were employ-. Their value was little since damaged melons were found close as twenty yards from them.

Shining tins hung so that they rattle in the breeze, ite boxes set in the field, shiny wire laid on the ground, d newspapers spread on the ground have been found success- l in some instances. Dead crows hung on a pole in the field believed by many farmers to be an effective method of con- ol. Farmers living in the vicinity of West Branch (Ogemaw unty) where crow damage to corn was very great found that en temporary relief could not be had until they had shot and ng up a crow. A crow killed with a gun and hung up was und by one farmer near West Branch to be more effective than ght crows which were poisoned and hung up earlier in the ason. Perhaps a terrific explosion coupled with the death one of their kind throws more terror into the crows than quiet death by poisoning. A farmer living in Williamston wnship finds that a black cloth tied to a pole and stuck t in the field is a suitable substitute for a dead crow.

Some farmers find that their sprouting corn can be

easily protected by scattering a quantity of grain on the field, the result being that the crows will eat this exposed grain rather than take the trouble to dig out planted corn. Better results are obtained if the grain is previously softened in water.

There are a number of commercial crow deterrents on the market for treating seed corn to reduce damage to germinating seed. Most of these deterrents have a tar base of one kind or another. Coal, gas, and pine tars have proven successful as crow repellents. In using any tar care must be taken not to give the seeds an over-dose which would make them waterproof and thus prevent germination. Two tablespoonfuls of tar to a bushel of seed is the usual quantity applied. The corn is more easily and evenly coated if it has been previously heated with warm water and drained. The corn is stirred until all the kernels become uniformly coated, then spread out and thoroughly dried before using in the planter.

Kalmbach (1920) mentions that a coating of red lead on corn has proven quite successful in Europe and it will be recalled that this compound was one of the more successful pheasant repellents. To date no experiment has been conducted to determine the value of red lead as a crow repellent. Kalmbach (1920) says that a thin coat of glue size is

used as a "sticker" for the red lead dust. The writer has found used engine oil to be a very good "sticker" for red lead.

Whatever deterrent is used on the seed, it must possess three properties to be of value. First, it must not inhibit or retard seed germination too greatly. Second, it must remain on the seed during the period when the sprouting seed is subject to damage. Third, it must be obnoxious to the species which is to be controlled. However, if the animal is satisfied with eating just the tender roots, as seems to be the case with some pheasants, it is not surprising if damage continues to occur after application of a good deterrent.

Kalmbach (1920) reports that poultry yards can be easily protected from ravages of crows by strands of cord stretched across at intervals and at a height of 6 or 8 feet above the ground.

The killing or eradication of crows is sometimes necessary. Wholesale slaughter of this bird by poisoning or organized shooting campaigns is advisable only in special cases, because crows have been found to be about neutral with regard to "good and bad" feeding habits; that is, one side balances the other and it is in many cases a few individuals which cause the greatest irritation to the farmer. Thus unnecessary expense might be involved in a wholesale slaughter

mpaign. Even in cases of corn pulling of which all crows
y be guilty, a good deterrent may be the best control
asure.

Poisoned eggs in artificial nests or traps hidden in
sts of unpoisoned eggs will usually put an end to egg-
ealing crows.

Kalmbach (1920) suggests the destruction of crows'
sts as an aid in reducing depredations on poultry. "The
ccess of this measure lies in the fact that most of the
ows' raids on the poultry yard are prompted by its desire
secure food for its young." Pirnie reports (verbal) that
has found a dominance of non-breeding crows so feeding
oits are not altogether the result of the need for food
r the young.

Bronzed Grackle

Corn - The most serious injury which this species
flicts on crops is in its attacks on corn in the "milk stage".
e writer has observed scores of grackle feeding on ears.
flock estimated to be over a thousand was seen in a college
rn field. By driving slowly past the field it was possible
see from five to ten birds at a time perched on the tips
ears along the edge of the field. Detailed examinations were
le on a total of over three dozen ears immediately after
ackles left the ears. The injured ears are usually in an

pright position, but may be nearly horizontal. A damaged
ar of field corn has the husks torn back from the tip of it,
nd the exposed kernels punctured and eaten (Fig. 21). When
e bird has eaten as much of the corn as he is able to expose,
will begin on another ear. Sometimes cornfields near grackle
osts have practically every ear opened at the tip as a result
thousands of grackle feeding day after day. A case of this
nd was observed in the college field mentioned above which
s but a short distance from a grackle roost on the Red Cedar
ver. By walking through this field while the birds were
eding one could flush literally hundreds of grackles (Fig.
. Here, as in the case of the crow damage, the loss is not
much the corn actually eaten as it is the subsequent damage
m water entering the ear.

Occasional reports were received of this species pull
up germinating corn in the spring, and one farmer ranks
s bird above the pheasant as to this habit (Report 11).
ther farmer reported that "blackbirds" had dug up some of
sweet corn (Report 8). Most farmers call red-winged
kbirds and bronzed grackle "blackbirds". Both of these
ies were common on this man's farm.

Grackle Roosts

Grackles in association with starlings and cowbirds
often nuisances in towns and cities when they choose those

aces for night roosting. The birds come in various sized
ocks from all directions shortly after sunset and gather in
eat numbers in the tree tops where they keep up a continual
ise until nearly dark. About sun-up the birds leave, at
rst as a few individuals then suddenly the remaining several
ousand all leave at the same instant going in all directions.
this time the sidewalks under the trees are white with
cal material which means sidewalk scrubbing each morning.
is nuisance is confined to a few blocks, usually not over
ree or four, but frequently continues for several years in
e summer time. The small branches in the top of the trees
se their leaves and may be killed.

Grackle Control

Prevention of corn ear damage by grackles has been
nd possible by shooting at the first flocks which arrive in
morning for three or four mornings. The control is local
ce the birds merely move to another field. Over the state
a whole this damage is of little consequence, and it is
y in occasional fields that damage really becomes serious
ugh to need control. A few farmers who have experienced
n pulling by grackles report that a good deterrent will
p this damage.

Two experiments were made on the eradication of grackle
sts. At Rockford, a powerful search light was tried by

he writer as a method of eradication. The light was direct-
into the trees containing the grackles and at first the
rds would fly out and go to other trees, but a little later
the evening, the light had no effect. It was concluded
at this method of eradication is of no value.

A roost of several thousand birds (grackles, star-
ngs and cowbirds at Mason (Ingham county) was successfully
oken up by organized shooting for three evenings. Mason had
d this nuisance for several years with the roost increasing
size each year. Finally, last year (1932) the residents com
ained so strongly that the City Council saw that the whole
tter of relief was a municipal affair since individuals had
en unsuccessful in combating the birds. The first thing
e City did was to purchase a case of 12-gauge shotgun shells
d the night watchman chose a date for the first "shoot" and
vited every adult male who had a 12-gauge gun to take part.
ditional guns were loaned by the Conservation Department.
ortly after the birds had ceased to come in from the fields,
signal was given and everyone began to fire at once. Quite
number of birds fell dead while the thousands which escaped
ath left town very quickly. On the following night the
cond "shoot" was held, but this time the shooting was post-
ned until later in the evening. The result was less satis-
ctory, because many of the sleepy birds refused to leave.
e next evening the third "shoot" took place, but by this

ime so few birds returned that a "shoot" was hardly necessary. fter the third evening of organized warfare, there was no more oost for the rest of the season. This method proved very ffective and relatively inexpensive. Ten or twelve dollars ould cover all expense to the city.

The composition of the roost can be estimated from the ead birds collected by the writer. Of course, these figures o not represent all the birds killed.

Date	Starlings	Cowbirds	Bronzed Grackles	Robins
3/30/32	345	31	29	1
3/31/32*	175	67	9	2
9/ 1/32	20	40	7	1
Totals -	540	138	45	4
% of	74.2-%	18.9-%	6.1-%	0.5-%

Grand Total - 727

Feeding Habits - Stomach contents from a number of these birds were examined to compare the food of the various species at that time of the year. Although an attempt was made to have the insect remains accurately identified by sending them to entomologists, the pieces were so small that identification was nearly impossible. The unknown seeds were sent to seed specialists but here also few definite identifications could be obtained.

Gross examinations were made of the stomachs and no

* These figures include 103 birds which one lady saved from the night before.

mpt was made to obtain accurate proportions of each food, aim being rather to determine whether the diet at this e of year (late August and early September) was chiefly nt or animal and if farm crops were eaten to any extent. ummary of these examinations is as follows:

ronzed grackle - total 27 examined

Milk stage corn found in 25 gizzards

Seeds of green foxtail found in 3 gizzards

Unidentified seeds of wild plants found in 20 gizzards

Insects' remains (mostly Carabidae) found in 23 gizzards

One gizzard completely empty

Corn was far in excess of all other foods together. ound beetles (Carabidae) made up the greatest proportion the insect food.

Starling - total 39 examined

Insects' remains found in 36 gizzards

Unknown seeds of wild plants found in 20 gizzards

Two gizzards completely empty

One gizzard " " except for one seed

Insect food was far in excess of all plant food and any species of insects were eaten. Ground beetles, weevils nd plant bugs were most common. One bird had eaten a great any ants and another had chosen wasps. Grubs, water beetles nd dung beetles were consumed by others. Seeds were of minor

ortance in most gizzards, but one bird which had eaten vast
ntities of plant bugs, wasps, weevils, ground beetles, and
eggs had also eaten 156 seeds of one plant species.

owbirds - total 12 examined

Insect remains found in 4 gizzards

Green foxtail seeds found in 12 gizzards

Black bind-weed seeds found in 5 gizzards

Barnyard grass seeds found in 1 gizzard

Wheat seeds found in 3 gizzards

Lady's thumb seed found in 1 gizzard

Unidentified seeds of wild plants found in 5 gizzards

Very few insects were found. These included ground
tles, wasps and weevils.

Robin - total of 1 examined

Considerable unidentified insect remains

Twenty-four unidentified seeds representing two species

Red-winged Blackbird

Corn - Feeding on the tips of corn ears in the "milk
age" is the only serious offense of which this species has
en found guilty. The injured ear is opened at the top
ig. 23) and resembles an ear fed on by bronzed grackle, but
nce both species feed in large flocks and are quite bold,
is not difficult to see them at work. The grackles seem to
efer feeding on the corn in the early morning and late after-

n while the red-winged blackbirds may feed most of the day.

The most serious case of corn damage by red-winged ckbirds noted was on a farm in Williamston township. In area 10 x 15 rows, there were 62 injured ears out of 173 ch were large enough to be damaged. This represents 35.8% the ears injured. This area was representative of the in- red portion of the field which was about three acres on the gh land. The corn at the foot of the hill was uninjured.

Green foxtail grass - Sometimes the presence of red- nged blackbirds in a cornfield is a distinct benefit to the rmer. A case of this kind was observed by the writer near st Lansing. In this particular field there were about 200 ackbirds, but not a single damaged ear could be found. It s soon discovered that these birds were feasting on the seeds f green foxtail grass, Chaetochloa viridis (Fig. 24).

European Starling

A questionable record of starling in Michigan was re- eived in 1922, but since 1924 its spread in this state has een rapid. Now this bird has become very common in the outhern part of the state. Several reports of starlings have een received from the eastern part of the upper peninsula. his bird has become abundant enough in some localities in outheast Michigan to bring about quite severe crop damage.

Types and Extent of Damage

Market Gardens - Two reports of starling damage were ived and both were concerned with garden crops. One far- near Monroe (Monroe county) reported heavy losses on his t corn, watermelons, and muskmelons (Report 12). He said newly planted seeds were found by the starlings, cracked and eaten. Even after the plants appeared above ground bird used its bill as a probe to reach the seed at the of the stalk. This farmer lost most of his second plant- of a three-acre field of sweet corn and portions of the ld were planted a third and fourth time.

It was claimed that the starlings continued to raid melon field for a period of five weeks and a fourth plant- was necessary to get even a partial stand. Eleven dollars th of melon seeds were used. The only successful method s farmer found for protecting his melons was to cover the ls with boxes, etc. The writer has found that the ordinary deterrents which are applied to corn have been found to be rimental to the germination of watermelons and muskmelons.

The other report of starling damage came from a far- living near Farmington (Oakland county) and although more ecies of vegetables were attacked, the loss was less (Report). One row of lettuce, one row of Chinese cabbage and two ws of beets were destroyed as seedlings. Each row was about ree rods long. The sweet corn suffered little or no injury.

s farmer also loses several pecks of cherries and a number apples each year to birds. Kalmbach (1928) includes these its among those attacked by the starling, and it is possible t this bird was partly responsible for the losses in this e, although the farmer placed the blame on other species.

Starling Roosts

Starlings, like grackles, sometimes choose the shade es of towns for their roosts and are often associated with latter species. The description and control of these sts have been discussed under "Bronzed Grackle".

Robin

Cherry - The robin is considered one of the greatest erry consumers in cherry orchards. One farmer estimates s yearly loss to average between 1 1/2 and 2 bushels of erries from his eight large cherry trees as a result of feed- by robins and catbirds (Report 13).

Strawberry - Robins have been observed eating straw- rries (Report 10) and no doubt this bird does more damage this crop for which other species are blamed than is alized.

Red-headed Woodpecker

Corn - This woodpecker has been found to attack field rn in the "milk stage" along the sides of fields, especially ose sides bounded by a woods. The writer has observed nine

odpeckers feeding on ears of corn and in each case the dam-
ed ear was in an upright position and had a narrow, elongate
le through the husks. The hole ran parallel to the axis of
e ear, sometimes starting at the tip, but frequently not
igs. 25, 26 and 27). Due to the method of attack, the ker-
ls were damaged slightly in advance of the opened husks
ig. 28). This type of damage has never been known to become
rious, but sometimes met with while the animal involved is
discovered.

Blue Jay

Corn - A blue jay was seen eating on an ear of "milk
age" corn in a field adjacent to a woods. The injury re-
embled that of grackle and red-winged blackbird. As far as
he writer's observations go the amount of damage to corn by
his bird is negligible.

Killdeer

Cucumber and Muskmelon - A farmer living in William-
ton township reported that he saw a killdeer dig up shell
nd eat several newly planted cucumber seeds. He said he shot
he bird and found the seeds inside it. A farmer living near
onroe reported that killdeer did likewise to his newly plant-
d cucumber and muskmelon seeds (Report 12). He said that he
found the king bird also guilty of these offenses. The writer
as not observed this type of damage and since such damage

ms unlikely for these birds, it may be that the species
e not correctly identified. More observations will be
ded before this matter can be satisfactorily settled.

Fox Squirrel

Corn - The writer has seen fifteen fox squirrels
different times feeding on corn and all of the corn was
the "milk stage", but the injury was very variable in
pearance even in the same field. Sometimes the bare cob
left on the stalk, the kernels having been eaten and the
sks pulled back to the base of the cob or cut off and dropp-
on the ground. The cobs may be either vertical or horizon-
l (Fig. 29). At other times, the cob is also destroyed with
e husks remaining (Fig. 30, first 2 ears on left) or the ear
y be opened on one side and only the kernels eaten (Fig. 30).
cases where the cob is destroyed portions of it can be found
the ground at the base of the stalk. Less frequently an
tire ear will be removed and carried to the top of a fence
st or stump and eaten there. In a field where there are num-
rous injured ears one can usually find upon close examination
ny toe-nail holes in some of the leaf sheaths now and then a
eaf broken back as a result of the squirrel's climbing.

This type of injury is common in cornfields bordering
r near to woods inhabited by fox squirrels. The damage is
reatest along the side of the field nearest to the woods, and

injured ears are scattered or isolated. It is apparent-
ust by chance that a squirrel will choose to eat one ear
not touch other ears nearby and equally good. The den-
of the damage is usually greater towards the edge of the
d. The portion of the field which has injured ears will
in size depending upon the squirrel population and the
ity of the strand of corn. A large squirrel population
poor stand of corn means that a relatively large area
be injured. Squirrel damage on corn can be found in the
ority of cornfields in southern Michigan which are adjacent
woods, but in spite of its prevalence, it seldom becomes
ious. In the preliminary survey of Williamston township
y one farmer made a complaint and that was a feeble com-
int since he liked to hunt squirrels.

Watermelon - A serious case of reported fox squirrel
ury to watermelons on a farm near Middleville (Barry county)
observed in September, 1931 (Report 4). That year 25
es were planted to watermelons, and the farmer said his
s on the earliest melons ran into the hundreds of dollars.
25 acres were divided among three fields. The largest
ld was bounded by woods on one side, another field had
ds on two sides and the third was completely surrounded by
ds. The field farthest removed from the timber suffered
least. Although no other case of this kind was reported,
re are perhaps other watermelon fields under similar sit-

ons which have been raided by the same animals and all ence points to the fox squirrel.

The melons are attacked while green; in fact, some attacked while very small. Portions of the injured melons eaten. Some have but a small hole penetrating the rind g. 31) while others may be nearly half eaten (Fig. 32). n though the hole through the rind is very small, rot fungi ediately enter and whole melon is lost. Teeth marks can seen around the edge of the holes and on the ground are ll chunks of the rind together with the empty hulls of the ds. It is apparent that among other things, the squirrel fond of the seed kernels.

Thinking that the squirrels were craving water, the rmer placed pans of water over the fields, but this did not b the damage. The squirrels could not be frightened away shooting in the field. It is apparent in this case, at ast, that watermelons cannot be satisfactorily grown near nber inhabited by fox squirrels. Either the timber will ve to be cut, the melons grown elsewhere or the squirrels iminated by traps and guns.

Maple and Beech Trees - A woodlot near Fremont in ich the sugar maple and beech trees were barked was exam-ed in the summer of 1952 (Report 14). The farmer was at loss for an explanation as to what animal species was in-

olved. At the time of the writer's visit to this 5-acre oodlot, very little damage was being done and although an vening, an early morning and one all-night watch were made, o clew as to the identity of the culprit was to be found. lthough the teeth marks appear to be those of a rodent and he portion of the tree barked is similar to that on squirrel amaged trees, this species was dismissed, because the indi- ations were that the damage was done at night while the squirrels were inactive. The injury was confined to trees beech and maple) between 3 and 6 inches diameter breast eight. The extent of injury on a tree varied greatly from small patch (less than a one square inch) of bark removed o complete girdling starting at the ground and reaching var- ious heights up to 4 feet (Fig. 33). Sometimes bark was re- oved from exposed roots and sometimes from the smaller ranches in the top of the tree. Apparently the outer bark as not eaten because great quantities were found at the base f the injured trees. The pieces of bark ranged from very mall chips to strips 1 inch wide and 6 inches long. The arge size of some of the chips has not been found in the ases of damage trees in which there was little doubt that ox squirrels were responsible, so it appears that an animal arger than a squirrel is guilty. Another difference between his injury and the average squirrel injury is that here deep eeth marks in the sapwood left it in a splintery condition

and the marks ran parallel to the tree (Fig. 34), whereas in the latter case the teeth marks were mere scratches and ran mostly at right angles to the tree.

This spring (1933) two cases of squirrel damage to maple trees near Lansing were reported in the same week and undoubtedly other farmers experienced similar losses, but did not report. Squirrel damage appears suddenly and in considerable quantity where it never before occurred and where it has once appeared the damage may continue year after year.

In some woodlots the injury is confined to the top of the tree and in other cases the bark may be removed all the way down to the ground. This is believed to be due to the size of the trees in various woodlots. Where the trees are large, the bark is left on the trunk, whereas in stands of smaller trees, the trunk bark is attacked. The most extreme damage noted was on a medium sized sugar maple which had all the bark removed from the trunk and the larger branches in the crown so that the entire tree was white. At the base of an injured tree is a quantity of small bark chips, the amount varying with the extent of injury. From the appearance of the injured portions, it is quite evident that the squirrel eats only the inner bark. The average tree is usually girdled at some point, and, of course, that portion above the girdle will die. If girdling is done on the trunk up in the crown,

ne tree becomes stagheaded, but if girdled at the base the ntire tree dies.

In the few cases of this kind of damage which were udied, reports were received so late that little or no more tacks were being made, and the writer has been unable to tch the culprit at work, but people who have seen known cases f fox squirrel damage say when they see samples of this dam-ge, that it is also fox squirrel damage. The teeth on skulls f fox squirrels fit exactly the teeth marks in the bark. ery (1912) says that fox squirrels have been observed to gnaw ark from dead trees, but makes no mention of bark being re-oved from living trees.

It is not known whether it is one or many squirrels hat do all the barking of trees in a woodlot. Stack reported verbal) a case occurring on the college campus several years go in which it was found that squirrels were destroying maple rees. One squirrel was killed and following that event no ore damage was done. This may have been a coincidence since uch damage usually stops as suddenly as it appears.

Shooting and trapping of squirrels during open seasons at other times with a permit will perhaps reduce materially f not completely prevent this damage. If it becomes more idespread, perhaps a deterrent sprayed on the trees will be ractical. Since the squirrel damage appeared in early spring,

;errent applied then would not affect the foliage. How-
, the case of the barking of the tree by the unknown an-
occurred in the summer so that a deterrent which had a
ency to burn the leaves would have to be used with care.

Rabbits

Ornamentals and Fruit Trees - From time to time in-
iduals report that the cotton tail rabbits are destroying
ir flowers and ornamental shrubs, but the most notable case
orted in the past two years was the Grosse Isle rabbit
blem (Report 3). Grosse Isle and Hickory Island, both
ands in the Detroit River, were closed to rabbit hunting
the Conservation Department for a period of five years
lowing a petition by the residents. This five-year period
ed in September 1931 and some of the people wanted it to
ain closed, while others did not because the rabbits had
reased to such numbers that considerable loss was suffer-
when they fed on herbaceous and shrubbery ornamentals in-
ding expensive and exotic species.

The rabbit population was found to be considerably
nser on Hickory Island than on Grosse Isle and, of course,
e damage to gardens was more severe on the former island.
e cottages here are built around the edge of the island.
e center of the island contains several acres of ideal
bbit cover. The summer cottages are raised about one foot

e the ground, and apparently the rabbits make their homes
r the cottages, at least many of them can be found under
of the buildings. The open space under a few of the
es was tightly closed with boards, but the rabbits dug
er and were even more difficult to combat. It was report-
that fifteen or twenty rabbits were driven out from under
cottage with a ferret. Numerous herbs and shrubs were
n which had been eaten to such an extent that they re-
bled stubble. Several species of plants were eaten, but
s was most severely attacked. The rabbits seem to choose
se food plants by age rather than by species, the youngest
most tender ones being preferred.

In the fruit sections of Michigan rabbits (and mice)
metimes do considerable damage to the orchards by gnawing
e bark and girdling the trees. This damage usually occurs
fall and winter. Protection against rabbits is frequently
complished by enclosing the base of the tree with a cylin-
r of heavy screening about eighteen inches high. If the
ow is deep around the trees it is possible for the rabbits
feed above the screens. Washes and sprays of various
nds have been used by some fruit growers on their trees to
revent rabbit girdling. A few commercial deterrents have
ppeared on the market.

In the cases of small rather isolated areas such as
ower Hickory Island live trapping may be found practical as

hod of control when hunting is prohibited. The ex-
of removing rabbits by live trapping on islands as
as Grosse Isle proper (over 6,000 acres) may be a
ibitive factor.

Conifers - Occasionally word is received of varying
feeding on young conifer growths. A farmer living near
City reported heavy losses on his spruce seedlings which
lanned to raise for Christmas trees. The rabbits do the
test damage during heavy snows when they can reach the new
th at the tops of the trees. Some of the cedar trees that
twenty years old were not over 3 feet tall as a result of
inual feeding on them year after year. Four acres of white
have been kept cut back to stubby growth by the rabbits.
pine was untouched. Anthony (1928) states that this
ies feeds on "foliage, twigs, bark of many species of
bs, grasses, trees, and plants".

Raccoon

Corn - The raccoon is one more of the many animals
feed on corn in the "milk stage". Both field and sweet
are eaten, but fortunately these attacks are not common.
an attack is made on sweet corn it may be quite serious.
man in Williamston township reported that in one night
lost 50 ears of corn to raccoons. A patch of sweet corn
r East Lansing containing 16 rows 40 rods long was prac-

ly a total loss.

As much or more corn is wasted than is eaten by the on and ears with one or more bites taken out of them trewn over the ground. The appearance of the ears in- es the feeding of a careless and greedy animal (Fig. Sometimes an ear is eaten on without being torn from talk (Fig. 36). In the case of sweet corn, the stalks ometimes broken so that they lie on the ground, while field corn broken stalks are typical since they must be d down before the ears can be reached. The ears may be ed away and eaten elsewhere.

Muskrat

Corn - Muskrats are capable of doing considerable e to green corn when it is adjacent to ditches or streams ied by this mammal. Only one case of actual damage of kind was observed, but two farmers in the neighborhood ted damage in previous years when they had corn planted e this ditch.

Muskrat injury is unique - unlike any other wild-life e to corn which has been observed in these studies. In njured field, mentioned above, the stalks were cut down point 8 to 9 inches above the ground. (Fig. 37). All s were cut on a slant and many had been dragged away, of the remaining ones all ears were missing. Muskrat

ks could be seen and runways through the weeds were
on. Most runways were floored with corn stalks.
rently the corn stalk is cut as a means of getting the
, because no indication of feeding on the stalks was
.

The corn in this field had been drilled in and just
ore harvest the greatest damage had occurred in an area
x 180 feet in which one-third of the corn was cut down.
ee to five stalks were usually cut each night.

Muskrat damage to corn is not common and apparently
y those fields close to muskrat habitats are subject to
ack. It is not known how far muskrats will travel for
n, but it is perhaps only a few rods.

Dikes and Dams - Every now and then the Conservation
artment receives a complaint of muskrats burrowing into
weakening earthen dikes and dams. Great losses may occur
these water retainers give away. Usually the local Con-
rvation Officer investigates and if the damage is found to
serious enough, the Department will give the land owner
rmission to trap the muskrats, but the pelts of such animals
e turned over to the Department.

Skunk

No skunk injury of any kind was observed and only a complaints were heard. These few dealt with poultry and destruction by skunks, although skunks have been seen pull-down ear corn (bantam) and eating it much like raccoon. nie, oral report).

eneral Survey of Wild-life Damage to Crops in the Southern Peninsula

In order to gain a more comprehensive idea of the e and extent of crop damage by wild-life in the southern insula, approximately 1,250 report blanks were sent out all Conservation Officers and County Agricultural Agents. se blanks contained 15 questions pertaining to damage by d-life (Sheet 2). These blanks were mailed out in early , 1932 so that they would be on hand in time for any dam- which might occur after the first plantings.

It was thought that a considerable proportion of the nks would be filled out and returned, but the fact was that ly 10 (less than 1%) came back to the Zoology Department. y so few of the blanks were returned was the question which turally arose. The answer to this question was sought through e County Agricultural Agents and Conservation Officers and

letters (Sheets 3 and 4) were sent to them asking why heir opinion more complaints of crop damage were not ived. Forty-two replies were received from 84 Conser- on Officers and 32 replies from the 56 County Agricul- l Agents, making a total of 74 replies. Forty-six 7.3% of the Southern Peninsula counties are represent- in these replies. Sheet 5 shows the distribution of the nties included. There were 84 separate opinions express- in the 74 replies since some men gave more than one son for so few blanks being returned.

Including the "indefinite" the opinions have been ided into 12 groups. Under the "indefinite" are those lies in which the writer frankly admitted he did not know well as those who gave no definite information. The lve groups of opinions with the number and percentage each are as follows:

	Number expressing each opinion	% Total
Indefinite	18	21.4
Prices of farm products too low	7	8.3
Weather conditions	3	3.6
Farmers have become interested in the wild-life on their farms	8	9.5
Farmers dislike to make out reports	5	6.0
Much or most of area is state land	3	3.6
Matters satisfactorily handled locally	3	3.6
Farmers have too many other troubles	4	4.7
Farmers derive income from hunters	1	1.1
Farmers expect damage so do not report	4	4.7
Farmers discouraged because they get no pay for crops damaged by wild-life	7	8.3
Little or no damage occurs	21	25.0

Most of these opinions are self-explanatory, but a will require further comment. "Prices of farm products low" merely means that even though damage occurred to the ps the loss in dollars was not great enough to provoke a plaint. By "Weather conditions" is meant that the open ter permitted the wild-life to obtain plenty of natural

and with the early spring growth of wild vegetation, the vated crops were fed on less than usual. Suitable weather tions tend to keep the wild-life in its natural habitat rnishing sufficient food and cover.

"Much or most of area is state land" is another way of g that there are few farms in the area and naturally very le damage could occur on farm crops regardless of how abun- wild-life may be. The single opinion "Farmers derive ne from hunters" refers to the farmers who board deer hunt- during the hunting season.

The distribution of the opinions by counties is as ows:

. Indefinite -

1. Cheboygan
2. Presque Isle
3. Otsego
4. Grand Traverse
5. Missaukee
6. Roscommon
7. Arenac
8. Clare
9. Muskegon
10. Ottawa
11. Kent
12. Lapeer
13. St. Clair
14. Livingston
15. Eaton
16. Barry
17. Van Buren
18. Wayne

2. Prices of farm products too low -

1. Clinton
2. Allegan
3. Eaton
4. Macomb
5. Van Buren
6. Monroe
7. Genesee

3. Weather conditions -

1. Oceana
2. Ionia
3. Ingham

. Farmers dislike to make out reports -

1. Emmet
2. Muskegon
3. Genesee
4. Berrien
5. Branch

. Much or most of area is in state land -

1. Otsego
2. Wexford
3. Arenac

. Matters satisfactorily handled locally -

1. Alcona
2. St. Clair
3. St. Joseph

. Farmers have too many other troubles -

1. Oceana
2. Clinton
3. Macomb
4. Calhoun

9. Farmers derive income from hunters -

1. Montmorency

0. Farmers expect damage so do not report -

1. Lake
2. Osceola
3. Alcona
4. Newaygo

1. Farmers discouraged because they get no pay for crops damaged by wild-life

1. Montmorency
2. Oscoda
3. Alcona
4. Mecosta
5. St. Clair
6. Livingston
7. Calhoun

little or no damage occurs -

1. Emmet
2. Presque Isle
3. Otsego
4. Leelanlau
5. Benzie
6. Wexford
7. Ogemaw
8. Arenac
9. Bay
10. Muskegon
11. Saginaw
12. Tuscola
13. Sanilac
14. Lapeer
15. Genesee
16. Oakland
17. Eaton
18. Barry
19. Allegan
20. Hillsdale
21. Manistee

SUMMARY OF THE MAJOR TYPES OF WILD-LIFE DAMAGE OBSERVED IN THESE STUDIES

Pheasant

ting Corn Damage

1. Sometimes the newly planted corn is dug out and
n before it germinates, but more frequently it is not
ed until it appears above ground.

2. The hole which the pheasant digs beside the stalk
bout 1 1/2 inches across the top and crater-shaped with
ing sides.

3. A small pile of dirt is left at one side of the
.

4. The green stalks are seldom eaten and may or may
be broken in two. Some are left standing after the kernel
been removed from the base while others are broken off
left lying on the ground.

5. If the soil is in the right condition footprints
be left by the pheasant. The tracks are somewhat sim-
to those of a chicken except that the toe imprints are
slender in proportion to their length. The middle toe
bout two inches long. The tracks can be told from those
he crow by the absence of a long hind toe imprint. The
l toe of the pheasant is very short and if an imprint is
it is little more than a small hole.

n Stalk Damage

1. A high school biology teacher reported an ob-
vation made by him in which he saw a pheasant pecking
o the stalks of corn while it was yet succulent. He
d the hole made was nearly round in contrast to elon-
e holes made by what the writer believes to be crows.

rn Ear Damage ("Milk Stage")

1. Some farmers claim that they have seen pheasants
anding on or clinging to the sides of ears, pecking through
e husks and feeding on the milky kernels. The writer has
ver observed this and believes it to be very rare if it
curs at all. The reported cases of pheasants perching
d feeding on corn ears which the writer has examined have
oved to be crow injury.

2. "Milk stage" corn, especially sweet corn, may be
tacked by pheasants where the ears can be reached from the
ound. The damage is similar to that of crows, but it is
metimes possible to find footprints, and the species iden-
fied in this way. Usually it is necessary to make careful
servations before determining the species involved. The
re presence of a bird in the field does not prove that it
s been feeding on the corn.

orn Ear Damage (Mature Corn)

Pheasants sometimes feed on mature corn when the kerels have been exposed by the drying husks. Only those ears hich are within reach of the ground have been known to be ttacked. Corn shocked and left in the field may be more everely injured. Quail and other birds may be responsible or part of the corn consumed at that time.

arket Garden Damage

Since several species of birds attack the various arden crops the writer has found no certain way to deterine the species involved except by actually seeing the nimal in the act of feeding. Pheasants may damage sweetorn (seedlings and ears), tomatoes, peas (seedlings and ods), strawberries, watermelons, muskmelons, and cucumbers.

Pheasant Control Measures

1. Deterrents applied to seed corn are believed by he writer to be less effective against the pheasant than gainst the crow in preventing corn digging, but experiments how that certain deterrents are of some value (p.19).

2. Corn losses in the shock can be prevented if the orn is not left in the field.

3. The greatest injuries inflicted by the pheasant e those to market gardens and nothing short of reducing the easant population has been found effective. The writer be- eves that where pheasant damage becomes very serious (as some market gardens) the state could help by permitting e farmer to shoot the birds out of season. Where gardens e within city limits the city will have to cooperate by rmitting these farmers to use firearms for this purpose. rmits to "shoot to scare" have not been satisfactory in cases.

4. Live trapping as a means of reducing pheasants uncertain since a rather severe winter is essential for success.

5. Pheasants should not be released where they are ely to use market gardens for feeding grounds.

6. In the general farming region of southern Michi- the regular hunting season is usually satisfactory as a sant control.

Crow

ling Corn Damage

1. Seedling corn damaged by crows can usually be inguished from corn damaged by pheasants. The crow does actual pulling on the stalk and two transverse depress- may be seen on those stalk which have been grasped by

e bill and pulled up.

2. The hole beside the stalk is about one inch across e top and the sides are nearly vertical as contrasted to e larger hole with sloping sides made by the pheasant.

3. The mound of dirt beside the hole, typical of easant digging, is absent in the case of crow damage.

4. Where the soil is in the proper condition foot- nts can be found. The long hind toe imprint (nearly 2 hes) is characteristic of the crow, but lacking in the easant track.

n Stalk Damage

1. Four cases of damage to the stalk of field corn e observed by the writer. The stalks are injured while are succulent and although the writer has never seen the al feeding there is considerable evidence that the crow he culprit.

2. An injured stalk has a ragged, elongate hole at base and ranging from one to four inches long.

3. A badly injured stalk falls over.

Ear Damage ("Milk Stage")

1. The crow will perch on those ears which it cannot from the ground. While on the ear the crow pecks gh the husk and feeds on the milky kernels. The typical

r, several of which may be found, is horizontal or nearly
and has the husk on the top undisturbed except for the
p, but on one or both sides the husks are shredded and the
rnels punctured. The peninsula of undisturbed husks (on
e top) runs to a point a little back of the tip of the cob.

2. In the case of sweet corn or short field corn
e ears are fed upon from the ground and are mutilated.
ey resemble ears damaged by pheasants. If pheasant or
ow tracks cannot be found or if both are present it will be
essary to make a careful observation to determine which
cies is guilty or whether both species are guilty.

kmelon Damage

1. A single case of muskmelon damage by crows was
erved. The injured melons were small and green with
ying amounts pecked out of them.

Crow Control Measures

1. Crow damage to seedling corn has been satisfac-
ly controlled by coating the seed with deterrents. Some
ers find that the damage is greatly reduced or prevented
cattering water soaked corn over the field while the
ted corn is subject to damage. The crows consume the
sed corn rather than the planted. A variety of scare-
s have been employed, but their results cannot be guar-

teed. A scarecrow which one farmer claims will give satis-
ction on his farm will not necessarily be satisfactory on
other farm. A surprisingly large number of farmers in
uthern Michigan claim that if a crow is shot and hung in
e field no crows will return, whereas shooting alone gives
ly temporary relief according to many.

2. Damage to corn ears cannot be prevented by any
nd of deterrent. However, since this type of damage is
ldom serious few farmers even attempt to curb it. Where
does become severe the farmer usually employs his favor-
type of scarecrow.

3. Little or no corn damage to melons occurs to
ches near to the farm house, but considerable loss may
ult to patches a great distance from the house. Whenever
sible the melons should be planted near the house.

Red-headed Woodpecker

n Ear Damage ("Milk Stage")

1. Corn planted near to woods may have an occasional
damaged by woodpeckers.

2. The injured ears are nearly vertical.

3. An elongate, narrow, slit-like hole through the
s and paralleling the ear is the characteristic injury.

4. At the lower end of the hole it will be found hat the kernels are punctured slightly in advance of the orn husks.

5. The damage is limited to the edge of the field.

6. The writer has never found a field in which the oss was great enough to warrant control measures.

Fox Squirrel

atermelon Damage

1. A case of fox squirrel damage to ripening water-elons was observed. The melons varied in degree of injury. ome had only a small bite taken out of them and the result-ng hole did not penetrate the rind while a few were nearly alf eaten. The injured fields were bordered on one or more ides by woods.

2. The injured melons had chunks of the rind scatter-d around them together with the empty seed coats.

3. Rather indistinct teeth marks were present on he rind.

Maple Tree Damage

1. Fox squirrels sometimes strip the bark from sugar maple trees in the spring.

2. Small pieces of the outer bark are dropped at the

ase of the tree and the inner bark eaten.

3. Teeth marks are conspicuous on the white exposed wood. Most of the marks run perpendicular to the xis of the injured branch.

4. Young trees may be almost completely denuded f bark while on the larger trees the injury seems to be nfined to the branches.

rn Ear Damage ("Milk Stage")

1. Fox squirrels very often attack ears of corn fields close to woods.

2. Injured ears may be either vertical or horintal. Sometimes an ear has nothing left to it but the re cob. Sometimes the cob is destroyed along with the kerls and small chunks of the former may be found at the base the stalk. Occasionally the entire ear is removed and rried to the top of a fence post or stump and eaten there. e remains of the corn can be found there.

3. Tiny toenail holes can be found in some of the f sheaths beneath a damaged ear and occasionally the irrel will break the midrib of a leaf when it climbs the lk.

Squirrel Control Measures

1. Corn and melon fields some distance from a woods re less likely to be injured by fox squirrels than ones ear to a woods.

2. Perhaps the best way to reduce squirrel injury s to reduce the squirrel population by shooting and trapping. is is not necessary in the case of corn damage because the ss is slight, but may be necessary where heavy losses cur on watermelons each year or where fine maple trees are lled.

Bronzed Grackle and Red-winged Blackbird

rn Ear Damage ("Milk Stage")

1. The damage to "milk stage" corn ears by these o species is similar, but since both species feed in flocks is not difficult to determine which is guilty.

2. The damaged ear is upright or nearly so and the p of it has the husks torn back for a short distance and e exposed kernels punctured.

Grackle Control Measures

1. It has been found that shooting at the grackles in the morning for three or four mornings when the first come to feed will prevent further feeding in icular field.

2. Perhaps a similar attack on the first red-winged ird visitors to a field will have the same effect on pecies.

Raccoon

ar Damage ("Milk Stage")

1. Sweet corn fields attacked by raccoons have mu- d ears strewn over the ground. Each ear has some of rnels eaten from it. The injured ear strongly suggests eding of a careless and greedy animal. Sometimes only two bites are taken on an ear.

2. A few of the sweet corn ears may be fed upon with- ing severed from the stalk.

3. In the case of field corn where the ears are the raccoon's reach he will knock down the stalk and e ear in that way. Sometimes the entire ear will be i away and eaten elsewhere.

4. All of the damaged fields which the writer has ve been near to woods.

Raccoon Control Measures

1. If corn must be planted where raccoon damage has occurred in past years, the farmer should take advantage of the open season on this mammal and attempt to reduce its numbers.

Muskrat

reen Corn Damage

1. A field of corn adjacent to streams or ditches nhabited by muskrats may be damaged by that mammal.

2. In the single field observed by the writer the ajured stalks were cut (chewed) down from 8 to 9 inches ove the ground. The cut surface was sloping.

3. The ears were removed from the fallen stalks and parently taken elsewhere to be eaten because no remains of e ear were found.

4. Muskrat tracks were abundant.

5. There were tall weeds growing on the edge of the ch. Through these weeds were numerous paths used by the krats and some were floored with cornstalks.

6. From three to five stalks were usually felled n night.

Muskrat Control Measures

1. It is not known how far muskrats will go after
rn, but perhaps it is not many rods so if the corn field is
me distance (15 - 20 rods) from the muskrat habitat the
amage may be prevented.

2. The open season gives the farmer an opportunity
o reduce the muskrat population on his farm.

CONCLUSIONS

1. The findings in these studies indicate that although damage to crops by the various species of wild-life s widespread in the Southern Peninsula, it is seldom serious n the general farming region.

2. These studies reveal that the average farmer laces an aesthetic value on wild-life as well as a money alue, and complaints are seldom made unless there is a onsiderable crop loss.

3. It was found possible to determine the species f animal involved in a number of cases by a detailed examination of the injury. There is still much room for more nformation along this line.

4. The amount of damage which any species will do n a given locality varies directly with the abundance of he species concerned, with the scarcity of natural food, nd inversely with the effectiveness of control measures.

5. Crows, pheasants, and squirrels have been found o give Southern Michigan farmers the most trouble to grain rops. Of these, the crow is the worst pest, yet the most asily controlled. Ordinary methods of control such as rightening devices, seed treatment, etc. applied to the ther two species are usually of no value and state protec-

tion has given them an added advantage.

6. In the pheasant range those market gardens within city limits or sub-divisions are damaged most by that bird. The loss sometimes runs into hundreds of dollars. The losses are much less in the general farming region, but occasionally they run high and local control is needed.

7. The pheasant problem in the general farming region of Southern Michigan is one of diplomatic relations between farmer and sportsman as well as one of biologic relations between pheasant and farm crops.

Table I (Cont'd)

Table Showi
of Cor

Repellent	No. c plete missi	to er	% of difference between control and treatment.	Ratio of the difference to the P.E. of the difference
Control #1	28			
Coal tar	30	6	23.77 ± 2.31	10.3
Gas tar	8	3	5.13 ± 2.02	2.5
Pine tar	8	5	12.41 ± 1.87	6.6
Oil	13	7	11.24 ± 1.97	5.7
Carbolineum	18	2	0.90 ± 2.19	0.4
Zenoleum	8	0	13.85 ± 1.83	7.6
Control #2	22			
Stanley's Crow Repellent	7	6	11.39 ± 1.88	6.1
Crowtox	7	5	12.72 ± 1.87	6.8
Bye Bye Blackbird	9	6	14.99 ± 1.80	8.3
Cro-shoo	16	9	8.66 ± 1.99	4.4
Corbin	8	6	12.01 ± 1.88	6.4
Lysol	18	5	26.24 ± 1.42	18.5
Control #3*	25			
Combined Controls		05		

*1 hill short
Note:- 100 hills of e

Table II

Table Showing the Effect of Various Repellents

on the Germination of Three Kinds of Corn

Polar Dent - (Field Corn)

400 Kernels per Doll

Doll	Treatment	48 hrs.	72 hrs.	96 hrs.
1*	(Control for 1	84%	98%	
	(Semesan (dry)	91%	99%	
2*	(Control for 2	90%	97.5%	
	(Semesan (liquid)	92.5%	99.5%	
3*	(Control for 3	82.5%	95%	96.5%
	(Crowtox	19.5%	65%	90.5%
4-5	Control 1 - 3 inc.	Poor start, too dry	89.5%	96.75%
6	Control 7 - 9 inc.	93.25%	98.25%	
7	Crowtox	61.5%	95%	99.25%
8	Zenoleum (dilute)	67%	87.5%	97.25%
9	Crowtox (left over from #3, heavy dose for 48 hrs.)	0.25%	10.5%	66.7%
21	Control, 22 - 25 inc.	98.75%	99%	
22	Carbolineum (dilute)	88%	99%	
23	Stanley's Crow Repellent	79.5%	98.75%	

*The first 3 dolls had sections of treated and control seeds alternating in the same dolls. This method proved to be unsatisfactory and was discarded in preference to separate control dolls.

Table II (Cont'd)

Polar Dent - (Field Corn)

400 Kernels per Doll

Doll	Treatment	48 hrs.	72 hrs.	96 hrs.
24	Kerosene	16.5%	70.5%	83%
25	Turpentine	0.75%	10%	12%
26	Control, 27 - 30 inc.	95%	98%	98.25%
27	Lysol (dilute)	92.25%	96.5%	97%
28	Nicotrol (dilute)	75.75%	83%	85.25%
29	Hammond's Weed Killer	8.25%	11.5%	14%
30	Hammond's Copper Sol'n	94.%	98%	
31	Control, 33 - 34 inc. with 32	78.25%	98.75%	
32	Control, 33 - 34 inc. with 31	76.25%	97.25%	
33	Coal tar	61%	95.75%	98.25%
34	Gas tar	62.75%	93.5%	98%
35	Pine tar	60.5%	93.5%	97%
36	Weedex	38.75%	47%	52%
37	Wilson weed killer	27.75%	32.25%	36.5%
38	Lime	75%	93%	95.25%
39	Red lead	88.75%	95.25%	98.75%
40	Salt petre	28%	56.25%	82.75%

Table II (Cont'd)

Polar Dent - (Field Corn)

400 Kernels per Doll

Doll	Treatment	48 hrs.	72 hrs.	96 hrs.
41	Chloride of Lime	39.5%	78%	92.5%
42	Copper Carbonate	84.75%	96.5%	98.25%
43	Copperas	11%	21%	53%
44	Gypsum	92%	99%	
63	Control, 64 - 67 inc.	68.25%	97.75%	98.5%
64	Carbolineum (Conc.)	28%	85.5%	94.25%
65	Kerosene and Turpentine 2:1	0%	0%	1.25%
66	Lysol (Soak 1 hr. dilute)	15.5%	50.75%	59%
67	Arsenate of Lead	64.5%	91.5%	93.25%
73	Cro-shoo	70.25%	86.5%	91.25%
74	Bye Bye Blackbird	74.5%	88.75%	98%
75	Corbin	73.5%	88.25%	96.75%
76	Pyrox	88.75%	92.5%	95.5%
77	Salt petre	28%	63.5%	93%

Table II (Cont'd)

Polar Dent - (Field Corn)

400 Kernels per Doll

Doll	Treatment	48 hrs.	72 hrs.	96 hrs.	120 hrs.
78	Lysol, 5 min. (diluted, but strong)	15%	20.5%	26.5%	
79	Arsenate of Lead	91.5%	97%	98%	
80	Copper Carbonate	84.75%	93.75%	97%	
81	Copperas	81.25%	96.5%	97.25%	
82	Chloride of Lime	24%	77%	96%	
83	Bunny Bane	86%	95.25%	97.75%	
84	Control, 73 - 83 inc.	89%	96.75%	98.5%	
100*	Control, 101 - 104 inc.	70.5%	97%	98%	98%
101	Gypsum	88.5%	98%	98.25%	98.75%
102	Carbolineum, conc.	5%	45%	72%	85.25%
103	Cro-shoo	5.75%	65.75%	89.25%	93.25%
104	Lysol, 1 hr. (dilute)	58.5%	97.25%	98.25%	98.25%

*This group of dolls (100 - 104 inc.) was run for 120 hours because accidental drying during the test retarded normal germination.

Table II (Cont'd)

Polar Dent - (Field Corn)

100 Kernels per Doll

Doll	Treatment	48 hrs.	72 hrs.	96 hrs.
149	Control, 150 - 151	85%	96%	97%
150	Oil	34%	73%	88%
151	Oil and Red lead	60%	94%	96%

Oil - Red lead 185 kernels planted in garden 95.1% grew

Untreated 185 " " " " 97.8% "

Table II (Cont'd)

Australian Hulless Popcorn

400 Kernels per Doll

Doll	Treatment	48 hrs.	72 hrs.	96 hrs.
10	Control, 11 - 15 inc.	96.5%	97%	
11	Crowtox	95.25%	97.25%	
12	Semesan (dry)	98.75%	98.75%	
13	Semesan (liquid)	95.5%	97.25%	
14	Zenoleum (dilute)	75%	89.25%	93.5%
15	Zenoleum (conc.)	0%	0%	0%
16	Control on 17 - 20 inc.	96.75%	99.5%	
17	Carbolineum (dilute)	65.25%	93.75%	95.25%
18	Stanley's Crow Repellent	94%	99.25%	
19	Kerosene	25%	53%	62.25%
20	Turpentine	8.5%	17.25%	21%
45	(Control, 47 - 62 inc.	92.5%	94.5%	95.25%
46	(Control, 47 - 62 inc.	81%	89%	90%
47	Coal tar	92.25%	97%	97.25%
48	Gas tar	96.25%	98.5%	
49	Pine tar	91%	94.25%	95.5%
50	Weedex	69.75%	73.75%	74.75%
51	Wilson Weed Killer	80.5%	83%	83.5%

Table II (Cont'd)

Australian Hulless Popcorn

400 Kernels per Doll

Doll	Treatment	48 hrs.	72 hrs.	96 hrs.
52	Lime	81%	96%	99.25%
53	Red lead	97.5%	100%	
54	Salt Petre	67.75%	87.75%	93%
55	Chloride of lime	31.5%	58.5%	81.5%
56	Copper carbonate	82%	88.75%	93.75%
57	Copperas	88%	96%	98%
58	Gypsum	82.25%	92%	93.75%
59	Hammond's Copper Sol'n	98.5%	99.5%	
60	Hammond's Weed Killer	47%	71%	77.25%
61	Nicotrol (dilute)	16%	62.5%	80.25%
62	Lysol, 5 min. (dilute)	26.25%	48.75%	69.75%
68	Control, 69 - 72 inc.	81.5%	97.75%	98.25%
69	Carbolineum	38.5%	69%	71.75%
70	Kerosene and Turpentine	0%	0%	0%
71	Lysol, 1 hr. (dilute)	2.25%	9.25%	11.25%
72	Arsenate of lead	68%	86.25%	87.5%

Table II (Cont'd)

Australian Hulless Popcorn

400 Kernels per Doll

Doll	Treatment	48 hrs.	72 hrs.	96 hrs.	120 hrs.
85*	Control, 86 - 99 inc.	52.5%	92.75%	93%	93%
86	Bye Bye Blackbird	25%	80%	86%	89%
87	Carbolineum	10%	52.5%	62.5%	73.5%
88	Cro-shoo	5%	36%	54.5%	66.5%
89	Corbin	4%	45.75%	64.25%	76.25%
90	Pyrox	70.25%	90.75%	92.25%	92.25%
91	Arsenate of lead	77%	90%	95.25%	95.25%
92	Salt Petre	67.75%	95%	94.5	94.5%
93	Lysol, 5 min. (dilute)	63.5%	93.5%	95.75%	95.75%
94	Copperas	53.75%	92%	95.25%	95.25%
95	Bunny Bane	72%	92%	93.25%	94.5%
96	Chloride of lime	55.75%	90.5%	92.25%	93.25%
97	Gypsum	61%	90.5%	93%	93.25%
98	Copper carbonate	75.5%	92%	94.25%	95%
99	Lysol, 1 hr. (dilute)	56.5%	84.5%	90.75%	91.5%

*This group of dolls (85 - 99 inc.) was run for 120 hours because accidental drying during the test retarded normal germination.

Table II (Cont'd)

M. A. C. (Field Corn)

400 Kernels per Doll

Doll	Treatment	48 hrs.	72 hrs.	96 hrs.
105	Coal tar	62%	96.25%	97.5%
106	Gas tar	83.5%	95.25%	95.25%
107	Pine tar	70%	95.5%	97.25%
108	Carbolineum, conc.	81%	95%	95.75%
109	Cro-shoo	70%	89.5%	90.25%
110	Stanley's Crow Rep.	72.25%	92.5%	95.25%
111	Crowtox	80.5%	95.25%	96.75%
112	Bye Bye Blackbird	79%	94.25%	95.25%
113	Corbin	74%	94.5%	95%
114	Copper carbonate	92.5%	96.75%	97.25%
115	Copperas	65.75%	89.25%	92.25%
116	Bunny Bane	76.25%	86.75%	89.25%
117	Salt Petre	77.5%	91.75%	95.25%
118	Pyrox	55%	66.5%	67.75%
119	Arsenate of lead	55%	71.75%	75.75%
120	Lime	63.25%	82.75%	85.5%
121	Gypsum	86.25%	93.75%	94.75%
122	Chloride of lime	78%	94.75%	95.5%
123	Red lead	90.75%	95%	95.5%

Table II (Cont'd)

M. A. C. (Field Corn)

400 Kernels per Doll

Doll	Treatment	48 hrs.	72 hrs.	96 hrs.
124	Semesan	73.75%	93.5%	95.5%
125	Ceresan	84.25%	94.25%	94.75%
126	Lysol, 1 hr. (dilute)	78.75%	91.75	93.5%
127	Lysol, 5 min. (dilute)	76.75%	88.25%	90.75%
128	Zenoleum	70.75%	93.75%	94.25%
129	Hammond's Copper Sol'n	77%	89.5%	92%
130	Control, 105 - 129 inc.	85.75%	95.5%	95.75%

Table III - Table Showing the Comparative Effect of Each Treatment on the Various Kinds of Corn

Treatment	Australian Hulless Pop Corn	M.A.C.	Polar Dent
Control	95.2%	95.75%	97.86%
Oil			88.
Red lead	100.	95.5	98.75
Oil - red lead			95.55
Crowtox	97.25	96.75	94.87
Bye Bye Blackbird	89.	95.25	98.
Cro-shoo	66.5	90.25	92.25
Corbin	76.25	95.	96.75
Stanley's Crow Rep.	99.25	95.25	98.75
Semesan	98.	95.5	99.25
Kerosene	62.25		83.
Turpentine	21.		12.
Kerosene - turpentine 2:1	0		1.25
Coal tar	97.25	97.5	98.25
Gas tar	98.5	95.25	98.
Pine tar	95.5	97.25	97.
Weedex	74.75		52.
Wilson Weed Killer	83.5		36.5

Table III - Table Showing the Comparative Effect of Each Treatment on the Various Kinds of Corn
(Cont'd)

Treatment	Australian Hulless Pop Corn	M.A.C.	Polar Dent
Lime	99.25%	85.5%	95.25%
Salt Petre	93.75	94.25	87.87
Chloride of lime	87.37	95.5	94.25
Copper carbonate	94.37	97.25	97.62
Copperas	96.62	92.25	75.12
Gypsum	93.5	94.75	98.87
Nicotrol	80.25		85.25
Lysol, 5 min. (dilute)	82.75	90.75	97.
Lysol, 1 hr. (dilute)	51.37	93.5	78.62
Hammond's Copper Sol'n	99.5	92.	98.
Hammond's Weed Killer	77.25		14.
Carbolineum, (conc.)	72.62	75.75	89.75
Carbolineum, (dilute)	95.25		99.
Arsenate of lead	91.37	75.75	96.12
Pyrox	92.25	67.75	95.5
Bunny Bane	94.5	89.25	87.75
Ceresan		94.75	
Zenoleum, (dilute)	93.5	94.25	97.25
Zenoleum, (conc.)	0.		

Table IV - Table Showing Comparative Effect of Certain Repellents on Field Corn and Pop Corn under Identical Conditions

400 Kernels per Doll

Doll	Repellent	Variety of corn	48 hrs.	72 hrs.	96 hrs
131	Bye Bye Blackbird	A.H.P.*	0	4	96.5
132	Bye Bye Blackbird	P.D.**	0	20	86.5
133	Corbin	A.H.P.	0	43.25	81.5
134	Corbin	P.D.	0	5	88.25
135	Cro-shoo	A.H.P.	0	20.5	99.
136	Cro-shoo	P.D.	0	62	91
137	Carbolineum	A.H.P.	0	10	90
138	Carbolineum	P.D.	0	34.25	93.25
139	Chloride of lime	A.H.P.	0	1	98.25
140	Chloride of lime	P.D.	0	3	83
141	Salt Petre	A.H.P.	5	71	97.5
142	Salt Petre	P.D.	0	40.75	94.5
143	Copperas	A.H.P.	14.5	68.5	98
144	Copperas	P.D.	0.5	57.5	96.75
145	Lysol, 1 hr.	A.H.P.	0	52	89
146	Lysol, 1 hr.	P.D.	0	36	95.75
147	Control, odd dolls	A.H.P.	3.5	99.25	99.25
148	Control, even dolls	A.H.P.	1.75	89.50	96.25

* Australian Hulless Popcorn
** Polar Dent

SPECIAL INVESTIGATIONS

The Game Division of the Conservation Department in cooperation with the Zoology Department made possible investigations of various kinds of wild-life depredations to agricultural crops, including market garden produce, throughout southern Michigan. Special investigations, the reports of which are to be found on the following pages, were made by the writer following complaints from the farmers concerned. Most of the complaints of wild-life damage to crops which the Zoology Department received were forwarded from the Game Division. The Extension Service of Michigan State College forwarded the crow complaint from West Branch and both organizations cooperated in the mailing of the "Report of Wild-life Damage to Crops" blanks to their representatives in the Southern Peninsula.

REPORT 1

INVESTIGATION OF CORN DAMAGE

C. E. George

Calhoun County Union City, Michigan

July 25, 1931

Part I

About 40 rods north of Mr. George's 7 1/2 acre corn field is a woods in which I saw some 200 crows go to roost. The corn was damaged while it was about 4 ft. tall and still succulent by having the pith eaten out from 4 to 8 inches above the ground. The stalk soon broke over at this point, and the plant was stunted if not killed.

In an area of corn 12 rows by 20 rows I found that over 26% of the corn stalks were injured badly enough to affect the plant. Many other stalks had slight scars. This area was more seriously damaged than any equal area in the field. A large elm tree stood at the northwest corner of the area and under the tree and on the lower leaves was considerable bird refuse. Crow feathers and tracks were found on the ground.

Mr. George said he has seen crows in his corn a week prior to July 25. He reports that this damage has occurred each year that he has grown corn in this vicinity.

Although I made careful observations the evening of July 25 and early the following morning, no birds or animals were seen to injure the corn, presumably because the latter

was more mature - the stalk tougher and the pith drier. However, all evidence points to the crow.

INVESTIGATION OF CORN DAMAGE (CONT'D)

Howard Cadwell

Kent County Rockford, Michigan

July 27, 1931

Part II

Mr. Cadwell has suffered the same injury to his corn as Mr. George, but to a lesser extent. Mr. Cadwell's 9 1/2 acre corn field is some 40 rods from a woods in which he says, "a few, not many" crows roost. He says there are very few pheasants in the neighborhood. What injury he had was limited to about the first dozen rows of corn along the fence. I noted more damage where there were trees in the fence row. A few bird droppings were seen under the trees, and a crow feather was found.

This is the first year Mr. Cadwell has noted this corn damage, but undoubtedly he has the same problem as Mr. George.

THE GRACKLE NUISANCE IN ROCKFORD, MICHIGAN

Kent County Rockford, Michigan

July 27, 1931

Part III

Each evening during the summer thousands of grackle fly into Rockford from fields for miles around. They flock into certain trees scattered over the town where they spend the night, and leave early in the morning. The grackles are a real nuisance because of their noise and their refuse. The sidewalks must be washed each morning. Shooting into the trees several nights a week by individual residents has resulted in the death of a number of birds, but still they continue to roost in the same trees.

In an effort to find some method by which the birds might be driven out of town a spotlight was tried. Before the birds had become settled for the night it was possible to frighten them out of a particular tree with the light, but they would fly to another tree a block away. As it became darker and the birds had settled down, the light had little or no effect upon them. With a spotlight applied at the proper time one might drive the grackles out of the trees in his yard, but this method does not appear practical in ridding a whole town of the pests.

REPORT 2

CROW AND PHEASANT DAMAGE TO CORN

John King

Clinton County, Near East Lansing, Michigan

August 13, 1931

I made my first trip to Mr. John King's farm on August 13. Mr. King has 80 acres three miles west of Palmer Park (Lake Lansing) and joining the Walnut Hills Golf Course on the west. At the north end of his farm is the Chandler Marsh controlled by the Lansing Hunting Club. On the west his farm joins another narrow farm beyond which are sub-divisions. With a golf course, large marsh and sub-divisions the wild-life finds excellent protection while the farms in the middle offer food.

King grew sweet corn for market. He also had 10 acres of field corn, and he showed me where both fields had been attacked by what he said were pheasants. Certainly something was securing considerable corn and judging from the type of injury, it was, no doubt, a bird of some description. The greatest damage was in some very short sweet corn whose ears were only 2 or 3 inches above the ground; the larger field corn suffered to a much less extent. All the corn was then in the "milk stage".

For about two weeks before my visit Mr. King said he had sent his children and the dog through the corn several times a day in order to rout out the pheasants. On some

CROW AND PHEASANT DAMAGE TO CORN (CONT'D)

trips he said they would flush 20 pheasants. Apparently King had done such a good job of frightening away the birds that I saw very few pheasants on my subsequent visits. Even King said the numbers had been greatly reduced in the corn.

As a result, I saw a total of only about 15 pheasants in his corn in 9 observations during the period of August 14 to August 29, inclusive. None were seen to feed on the ears of corn by standing on the ears as has been reported by many. This does not mean the farmers were not accurate in their statements. I believe at the time of my observations the young birds, which were reported to stand on the ears were too large and heavy for the ear to support them, thus they, like the mother bird, confine their feeding to the ground and possibly on the corn which has been knocked down.

I found that a certain flock of seven crows were doing much of the damage for which the pheasants were blamed. I watched one crow feed on an ear of the small sweet corn and on several occasions when I was a bit late in the morning I saw seven crows fly out of the sweet corn. Judging from my observations in other fields it would not surprise me to learn that crows were guilty of damaging part of the field corn also. The corn was some distance from the nearest woods,

CROW AND PHEASANT DAMAGE TO CORN (CONT'D)

and none of the ears displayed typical squirrel or woodpecker injury.

In my opinion, then, pheasants and crows are both guilty of injuring Mr. King's corn, but during the last half of August, at least, the pheasant was receiving much more than his share of the blame.

Suggestions - Of course, once a green ear of corn is picked into it is subject to rot which destroys the whole ear, but Mr. King is not so concerned with the few bushels (he estimates 3 or 4) of corn destroyed this year as the extra work required all day from dawn till dark to keep the pheasant out. Under normal conditions he believes pheasants are valuable as insect eaters, but under his conditions he feels the Lansing Hunting Club should endeavor to keep more of the birds in their marsh. Mr. King and I tramped through 3 or 4 miles of the marsh with the dog. The dog is good at flushing pheasants, but in the whole distance not over six birds were seen. I understand that pheasants are planted on this hunting ground each year, but when the hunting season comes around, relatively few birds are taken, apparently because they are not there. King believes the birds leave as a result of lack of food in the marsh. I saw no grain, weeds or berries which would furnish birds with food seeds when the young needed them for

growing. There were relatively few insects because many of the host plants had dried up.

It is suggested that the Lansing Hunting Club plant some sort of food plants for the birds such as corn, wheat, buckwheat, etc. This practice would benefit both the hunters and adjacent farmers by keeping more of the pheasants at home. There are several high spots in the marsh such as ditch banks which I believe would support strips of grain very well, and little or no clearing would be necessary because most of the marsh is open. If various strips of grain maturing at different times, such as wheat, corn and buckwheat, were planted around the edge of the marsh. I believe this would be a suitable barrier to hold most of the birds in during the summer. Weeds which produce seeds for pheasant food might be encouraged, and no doubt some of the lower areas of the marsh could be utilized. As it is, the pheasants must call on the farmers for most of their board, depriving the farmer of his crops and the hunter of his sport.

REPORT 3

THE GROSSE ISLE RABBIT AND PHEASANT PROBLEM

Wayne County Grosse Isle, Michigan

August 17, 1931

Upon the request of the residents of Grosse Isle, the Conservation Department closed this island township to hunting for a period of five years. On September 1, 1931, this five-year period ended. A short time ago, however, Grosse Isle sent a delegation to Lansing. This delegation asked the Conservation Department to continue the closed season for another five years, for it seems that Grosse Isle fears the hunters more than rabbit or pheasant damage. A new free bridge is being completed and naturally the Grosse Isle people anticipate a large foreign element swarming over from the mainland during the hunting season. The delegates' request was granted.

Mr. Henry George, who lives on Hickory Island, (Grosse Isle Township) wrote the Conservation Department asking for help in ridding the township of rabbits which had increased to such numbers as to be very destructive to ornamentals.

Mr. Ruhl, of the Game Division, and I drove down to Grosse Isle to obtain some first hand knowledge of this problem. We reached the island late Monday afternoon, August 17, and drove around to get an idea of cover, topography,

THE GROSSE ISLE RABBIT AND PHEASANT PROBLEM (CONT'D)

etc. We also recorded the wild-life, seen on this tour. Forty-seven (approximate count) pheasants, two marsh hawks, and one rabbit were seen.

We talked with Mr. James Bickford, a farmer, who rents 40 acres of land. He had several acres in corn to which he says the pheasants do much damage, especially in the shock, when 300 to 500 of the birds gather in his field. He took Mr. Ruhl and myself into the field where we saw several damaged ears, and we flushed about a dozen pheasants.

About dusk we crossed a small bridge and found ourselves on Lower Hickory Island. All the roads on this island are private and the residents own their own homes. Only one family besides the caretaker remains through the winter. We talked with Mr. Alspaugh, the caretaker, and learned a few details of the rabbit situation and the make-up of the island. The east one-third of the island is organized as an association while the west two-thirds is unorganized. Mr. Alspaugh receives a salary from the association only, although during the winter he also looks after the houses in the unorganized area. There are forty-eight houses on the island.

The next morning we went back to Lower Hickory to go over the island. Mr. Alspaugh introduced us to some of the

THE GROSSE ISLE RABBIT AND PHEASANT PROBLEM (CONT'D)

property owners, and all told of how the rabbits had eaten practically every kind of plant soon after it appeared above ground. The rabbits seem to choose their food plants by age rather than species.

The cottages are all raised about a foot above the ground, and we were told that it was under the houses that many of the rabbits lived. One house had been boarded up around the base, but rabbits had dug under or gnawed through the boards. Once Mr. Peabody (then Conservation officer) put a ferret under this house, and some 15 or 20 rabbits ran out, according to Mr. Alspaugh.

Tuesday afternoon, Mr. Peabody, Grosse Isle Chief of Police, introduced us to a man who is in the nursery business on Grosse Isle proper. He grows chiefly flowers and shrubs, and he reports heavy losses due to rabbits.

The pheasants give but little trouble on Hickory Island. Perhaps ripe tomatoes are damaged most by them.

Recommendations for Rabbit and Pheasant Relief - It seems that about 50% of the property owners in Grosse Isle want no "open season" whatever while the remainder would tolerate hunting as a means of reducing rabbits and pheasants. It also appears that the latter 50% are the ones who suffer

THE GROSSE ISLE RABBIT AND PHEASANT PROBLEM (CONT'D)

the most damage.

I would say that about 3/4 of the area of Grosse Isle can be hunted. The other 1/4 is mostly along the shore line where most of the houses are located. I agree with Mr. Ruhl that the best relief, no doubt, would be an open hunting season followed by live trapping. I am told one difficulty enters here in the fact that since the roads are public, fences would have to be erected (there are very few fences along the road) before the Horton tresspass law could be enforced; otherwise, controlled hunting will be difficult. If hunting is to be allowed, it will have to be controlled.

Hickory Island can easily control hunting, if hunting is chosen, because of its small size (60 acres) and because its roads are all private. Mr. Alspaugh, who is deputy sheriff as well as caretaker, should be able to handle this.

If Grosse Isle still decides to remain closed to hunting, perhaps they would permit live trapping of rabbits and pheasants which would be planted in suitable places on the mainland. No doubt, this method would be successful on Hickory Island because of its small size and nearly complete isolation from Grosse Isle proper. Mr. Alspaugh said he would be glad to live trap rabbits if that was what Hickory Island wanted and if the Conservation Department would permit.

THE GROSSE ISLE RABBIT AND PHEASANT PROBLEM (CONT'D)

I look with doubt on the success of live trapping on the larger island (some 6,000 acres) unless enough full-time men and sufficient traps were employed, and the property owners might not want to bear such an expense.

Whatever Grosse Isle desires in way of control they will have to decide as a township or at least as one of the islands, and not send a delegation to Lansing representing 50% of the people, all of one "party". Not until they have done this can the Conservation Department act upon the matter to the satisfaction of all concerned.

REPORT 4

FOX SQUIRREL INJURY TO WATERMELONS

Orin Roberts

Barry County Middleville, Michigan

September 2, 1931

Mr. Orin Roberts, who has farm lands in Sections 23 and 24, Yankee Springs Township, Barry County, five miles south of Middleville, raises watermelons on a large scale. This year he had 25 acres of melons and as in previous years, he has suffered considerable loss from fox squirrel injury.

Mr. Roberts reports his losses as hundreds of dollars a year, and each year he says the loss is more than the year before. The greatest loss results from injury to the earliest melons soon after they have set. Of course it is the early melons that bring the best price.

Type of Injury - I did not observe any squirrels in the fields when I visited them on September 2, but Mr. Roberts said he had seen many at work for several weeks before, and the appearance of the injury strongly suggests squirrels. The injured melons had various sizes of holes eaten into the rind. These holes showed teeth marks around the edge. The holes ranged from small dents which did not penetrate the entire rind to holes whose diameters were nearly equal to the diameter of the melon; that is, almost half of the melon was eaten away. As a rule, there was but one hole in a melon.

FOX SQUIRREL INJURY TO WATERMELONS (CONT'D)

The lesser injuries would be of little consequence if it were not for rot fungi entering; thus it is that practically every melon develops rot after a squirrel has fed on it. Around those melons which had holes penetrating into the meat were small chunks of rind together with the empty hulls of a quantity of the melon seeds.

Thinking that the squirrels were craving water, Mr. Roberts placed pans of water all over the fields, but this did not reduce the injury. Perhaps the squirrels like the sweet juice of the melon and drink more or less of it, but it is my belief that their chief desire is to eat the seeds.

Mr. Roberts finds that the amount of injury in a field depends upon its location to a great extent. A field near the wooded area suffers more than one further away. Mr. Roberts has considerable timber on his farm. His best fields are bounded on at least one side and one field is completely surrounded by woods. Shooting in the field, Mr. Roberts says, will not frighten away the squirrels and placing water in pans in the field has failed. Perhaps the solution to this problem will be to reduce the squirrel population with guns and traps.

REPORT 5

THE CROW NUISANCE AT WEST BRANCH

Zettle and Yancey

Ogemaw County West Branch, Michigan

September 14, 1931

Mr. Ralph B. Coulter, County Agricultural Agent, reported to Mr. C. V. Ballard, Extension Department of this college, that the farmers around West Branch were suffering from the depredations by crows in their corn. After talking with Mr. Ballard and reading Mr. Coulter's letter, it appeared that the crow damage was rather extensive. Consequently I made a trip to West Branch on September 12. I found Mr. Coulter in his office, and he gave me the names of those farmers who apparently had suffered the greatest losses. These farmers then referred me to their unfortunate neighbors also.

Perhaps the heaviest losses occurred in an area of 25 square miles south and east of West Branch, each farmer giving the same story - the only difference being in extent of the loss. The latter, of course, varies with the location of the field in relation to the house and also with the time the farmer has spent trying to keep the crows away. An equal amount of damage to corn in the corn belt region would hardly be noticed, but around West Branch where a corn field usually contains less than 10 acres, the percentage of dam-

THE CROW NUISANCE AT WEST BRANCH (CONT'D)

aged corn runs much higher.

In Mr. Zettle's field of 9 acres, the crows had worked in more than an acre of the corn and although he had shot at them several times, they had succeeded in eating over 90% of the corn in this area. Zettle estimates that he has driven out at least 200 crows at one time only to have them return again. Another farmer counted 375 crows in a flock as it left his corn. He could not count the remainder, because the birds were too far away.

One day Mr. Zettle saw "at least a thousand crows" circling around over some object (perhaps a carcass) in a field. He said that "the crows were just like a swarm of bees".

The farmers told me that they never before had seen so many crows, but that each year there are more than the previous year. Very few crows nest and raise their young in the vicinity, I was told, but "most all of them come from somewhere else".

The most damage that I saw in any one field was in Mr. Al Yancey's corn, 3 miles south of West Branch. This field of 10 acres was one-half a mile from the house and the crows had fed in every part of it. On a hillside at one corner of the field I measured an area of 12,240 feet in

THE CROW NUISANCE AT WEST BRANCH (CONT'D)

which there was not a single sound ear, and many had less than a dozen kernels left. In this same field, I estimated that between one-third and one-fourth of all the ears had been injured. It is more important to consider the total ears pecked into than the amount of corn taken off an ear, because a green ear is subject to rot once it has been opened.

The crows prefer to feed on the corn while it is in the "milk stage". On September 14 it was the late or replanted corn upon which the pests were feeding. It was claimed that because of considerable corn pulling by crows this spring most farmers had to replant some of their field.

Control Measures - The farmers tried several crow controls and a few dozen crows are shot each year, but thousands still remain.

There is a slaughter house not far from Zettle's farm and Mr. Coulter suggested that Zettle obtain some offal, poison it and expose it to the crows. It was believed that the crows might eat carrion in the presence of grain. Zettle was unable to get any offal at the time, but as one of his chickens had died that day he put strychnine on the carcass and left it in the corn field. The chicken had been touched but little when I was there and no crows were known

THE CROW NUISANCE AT WEST BRANCH (CONT'D)

to have died. About the same time that the chicken was put in the corn all the crows left and have not bothered his field since. Zettle was uncertain as to whether the crows left as a result of tasting some poison carrion or because the corn had hardened. Since most of the corn was all dented and hard, I believe the latter was the determining factor.

Zettle said his brother had managed to poison a few crows by using eggs as bait. Poison grain tried by some farmers was found to be useless when used at this time of year while other grain is abundant, but poison corn scattered on the ground in the spring about newly planted corn and peas was found to kill a number of crows.

The farmers have also tried various kinds of scarecrows. A coat and hat on cross sticks is worthless in the opinion of most farmers as the crows may use such a device for a convenient look-out post.

Many of the farmers believe that a dead crow hung on a pole in the field is the best kind of scarecrow, but its results can not be guaranteed. There is a little evidence to make us believe that the efficiency of such a scarecrow depends upon how the crow is killed. This interesting case comes from Mr. Yancey, who last spring killed 8 crows with poisoned grain. He hung the victims in his field, but he had

THE CROW NUISANCE AT WEST BRANCH (CONT'D)

hardly left the field before the pests were back pulling corn. Last Saturday noon a few hours before I called on him, Yancey had succeeded in shooting a crow. This bird he hung under a tree and although it was but a short test, Yancey was pleased to see that no crows returned that afternoon. He had shot at the birds on other occasions but never killing any, and the flock would fly half a mile away then circle back before Yancey reached his house.

Other farmers told me that they could not get even temporary relief until they had shot and hung up a crow. Whether or not poisoned crows always fail to work as well as shot crows when hung up, I do not know. A farmer in Williamston township (Ingham county) told me he had success by hanging up just a black cloth in the field.

Most of the farmers believe that the best step towards crow control would be for the county to pay a bounty on crows. "If there was a bounty on crows, more farmers would be induced to hunt when they could get a little to help pay for the ammunition", one man told me. The bounty system, especially as a means of crow control, is an unwise procedure, first, because it is impractical and ineffective and second, because it is a needless cost. In other words, a great deal of money is spent for the death of a very small percentage of the crow population.

REPORT 6

PHEASANT DAMAGE TO TRUCK GARDEN CROPS

Claude Wright

Washtenaw County Ypsilanti, Michigan

September 18, 1931

Part I

Mr. Claude Wright, who lives 2 miles west of Ypsilanti, reported to the Conservation Department that pheasants were destroying his garden. On September 18 I drove down to see Mr. Wright and to study the type and extent of injury.

Mr. Wright said at one time he counted 14 pheasants in the garden and that when they come all the chickens rush for the coops. He keeps his chickens in a pen and none have ever been in the garden. In some woods across the road from Mr. Wright's I saw a flock of perhaps 100 crows, but he says no crows have been seen in the garden and he does not blame any of this damage on the crow.

Type and Extent of Damage - Three of the crops had suffered injury, namely, melons, tomatoes, and sweet corn.

Melons - Watermelons and muskmelons were growing together and both had been attacked, but damage was confined to about one quarter of the patch or an area 20 ft. by 48 ft. and at the east end. In this area there was a total of 58 melons and 11 showed some injury. Wright said he had already

PHEASANT DAMAGE TO TRUCK GARDEN CROPS (CONT'D)

removed considerably over a dozen damaged melons. Of the 11 injured melons, 5 were watermelons and 6 were muskmelons. The injury penetrated the rind in 2 of the watermelons and 4 muskmelons. This would seem to indicate perhaps a slight preference for muskmelons. However, one watermelon had a hole in it 3" x 6" and half of the inside was eaten out.

Corn - Next to his melons Mr. Wright had 2 rows of sweet corn of which the pheasants had eaten nearly all. It is interesting to note that the pop corn on the other side of the melons (20 ft. from the sweet corn) had suffered very little. I found but 2 ears of pop corn which had been touched at all.

Tomato - It is difficult to determine the extent of injury to Mr. Wright's one row of tomatoes because he had continually picked off those which had been damaged, but perhaps it lies between 2/5 and 1/2 of the total crop. As fast as the first tomatoes would begin to ripen on one side the pheasants would peck into them at this point.

Wright says two broods have been visiting his garden until the rains of a week before my visit. Since then he had little trouble.

Although the Conservation Department had given Mr. Wright permission to shoot to scare the pheasants, he had

PHEASANT DAMAGE TO TRUCK GARDEN CROPS (CONT'D)

never gone to the trouble to do this. "Besides", he said, "the pheasants must have something to eat."

PHEASANT DAMAGE TO TRUCK GARDEN CROPS

L. E. Brown

Wayne County Inkster, Michigan

September 18, 1931

Part II

From Ypsilanti I went to Inkster to see a Mr. Lionel E. Brown, who also had reported pheasant damage to the Conservation Department. I located Mr. Brown's residence in Garden City. Mr. Brown was not at home, but his wife directed me to the farm about 3 miles west of Garden City where I found him. His farm contains 100 acres, much of which is excellent pheasant cover. While walking out to where men were working, I heard a number of pheasants crowing not far off. Mr. Brown had 4 acres of cabbage, about 4 acres of tomatoes, 4 or 5 acres of sweet corn and a small patch of cantaloup. He suffered injury to his tomatoes, sweet corn and cantaloup.

Tomatoes - Since the first tomatoes began to ripen and up until September 4, the pheasants did considerable damage to them. The greatest loss was on the early tomatoes which bring a fancy price. By pecking into the fruits as they turn yellow just previous to ripening, Brown says the pheasants destroyed between 75 and 100 bushel of tomatoes which were selling then at $5.50 and $6.00 a bushel, making a loss of between five and six hundred dollars. He harvested less than 2 bushels of sound fruit at that time.

PHEASANT DAMAGE TO TRUCK GARDEN CROPS (CONT'D)

Corn - Early in September they left the tomatoes and began on the sweet corn. When the corn began to harden, very little damage was done there. Brown considers 20% of a conservative figure in stating the loss to his corn.

Melons - Brown managed to get a few cantaloup before the pheasants did, but says that they took about 75% of them. As he grows only a few melons and does not consider them a money crop, his loss, though high in percentage, was low in dollars as compared with the other 2 crops.

His belief was that the pheasants attack the cantaloup for the seeds and that they much prefer cantaloup (or muskmelon) to watermelon. He told of a neighbor who had a cantaloup patch 4 or 5 rods from the house. Through the center of this patch was a row of watermelons, and the report was that the pheasants pecked into most of the cantaloup while the watermelons were not touched.

Mr. Brown says he first thought that the crow was his tomato competitor, but after having poisoned all the crows, the competition continued. One day he saw a flock of 52 pheasants and then he began to suspect them. Coming out to the tomato field early one morning he saw the pheasants doing the damage.

He had heard that pans of water set in the field would prevent further damage. This was tried and failed as it has

PHEASANT DAMAGE TO TRUCK GARDEN CROPS (CONT'D)

in many other instances. As a last resort, Mr. Brown tried the shotgun method of frightening the birds, but this also proved valueless. Perhaps if he had begun the shotgun method earlier he would have had more success. A Williamston farmer reported success by this method when applied early in the season, apparently before the pheasants had developed a taste for tomatoes.

REPORT 7

PHEASANT DAMAGE TO STRAWBERRIES AND CORN

J. G. Kunzleman

Livingston County Fowlerville, Michigan

September 23, 1931

Mr. J. G. Kunzleman lives six miles southeast of Webberville, Michigan in Hanly Township, Livingston County. He reported that this year just as in the past years, pheasants paid frequent visits to his garden and destroyed considerable sweet corn, pop corn and strawberries. Mrs. Kunzleman wrote to the Conservation Department giving an account of the depredations by the pheasants and asking if the state did not want to buy their farm to be used as a game refuge.

I visited the farm September 23 and found that the Kunzlemans really like to see the pheasants about them just as many other farmers do, but theirs was another case of just too many pheasants. I was told that each year the Kunzlemans try to clear a little more land so that it may be farmed.

The garden is adjacent to some very good pheasant cover, and the pheasants were there in considerable numbers. The family depends upon the sweet corn and strawberries, especially the latter, for a living. They had 8 rows of sweet corn in a strip about 20 rods long. There were approximately 50 rows of strawberries 20 rods long. Half are of the Mastodon variety, and the other half are Senators.

PHEASANT DAMAGE TO STRAWBERRIES AND CORN (CONT'D)

Type and Extent of Injury

Corn - Mrs. Kunzleman reported that she was able to pick but two messes of sweet corn this year. The pheasants ate the rest before it reached the roasting-ear stage. One small area of corn was saved for canning because of its better quality, but when it came time to pick it there was not enough to pay to can. Since the ears were so near to the ground, it was no trouble for a pheasant to peck off the kernels. Crows may have been responsible for some of the damage, but I know pheasants were present because I flushed 11 in the corn and later another was flushed.

Mrs. Kunzleman said there was injury to pop corn last spring when it was pulled by the pheasants shortly after appearing above ground.

Strawberries - Both Mastodons and Senators were attacked and the injury was simple. The ripe and ripening berries were pulled off and left lying a few inches to a foot from the vine. Some berries had a hole pecked into them while others had none.

Money was borrowed last year to buy some new plants, and this year not enough berries were picked to pay this debt. Mrs. Kunzleman reported she was able to get but 38 quarts of berries this year, whereas she used to pick 1 crate (24 quart baskets) every other day for three months. I am sure that the

PHEASANT DAMAGE TO STRAWBERRIES AND CORN (CONT'D)

dry weather was in part responsible for this loss because the berries were much smaller than normal.

I saw no pheasants in the strawberries, but had opportunity to see the damage as described above.

If the state will not buy the Kunzleman farm, Mrs. Kunzleman said they would continue to destroy pheasant cover, both to reduce pheasants and to make more cultivated land on their 80 acres. This, I believe, will be the only legal solution for the farmers until the state provides some method of protecting them against this game bird when it becomes a nuisance.

REPORT 8

BLACKBIRD AND PHEASANT DAMAGE TO SWEET CORN

D. R. Bassett

Ingham County Lansing, Michigan

June 11, 1932

Early this spring, Mr. D. R. Bassett talked with me about the pheasants which had injured his corn in past years. He said most of the injury was done in the spring when the corn was dug out, and garden peas were also dug at that time. Mr. Bassett said he would notify me as soon as the birds began their destructive work this spring.

Not having heard from Mr. Bassett since our first meeting, I visited his 12-acre farm on June 11 to find out whether he was having any pheasant injury. A considerable proportion of his small acreage was very excellent pheasant cover of dense brush and swale.

Mr. Bassett explained that he had had so little pheasant damage that he did not consider it worth a complaint. He found that the pheasants were just as plentiful as in other years (over 30 have been seen at one time), but this spring he had spread stable manure on a field and this, he believed, is the reason for so little corn injury. The manure contained a lot of grain and each morning several pheasants were seen feeding in the manure. After gorging themselves, they were not inclined to dig corn. Mr. Bassett says he will do likewise next

BLACKBIRD AND PHEASANT DAMAGE TO SWEET CORN (CONT'D)

year.

This accidental discovery did not completely eliminate the damage, but reduced it materially. Mr. Bassett estimated that one-sixth of each row of corn over an area of about 150 x 200 feet had to be replanted. The digging he said was done by both blackbirds (grackle and red-wings) and pheasants, but did not know how much to charge to each species. He pointed out to me several places in which the corn had been recently dug. There were two distinct types of holes at such places. One was typical of pheasant work; the other was more of the crow type, but may have been made by blackbirds.

REPORT 9

PHEASANT DAMAGE TO CORN

William Franklin

Eaton County Delta, Michigan

June 13, 1932

This report reached me through the Conservation Department, and I called upon Mr. Franklin on June 13. His farm of 14 acres is a long rectangle in shape, and he finds pheasant damage to corn in the fields away from the house so serious that he has already given up the idea of trying to raise corn. One year he replanted a whole field (4 acres) three times and then got a poor stand. This year he had the field planted to oats.

In another field of about 1 acre, Mr. Franklin planted corn this spring. Only half of the field was planted, because the rest of the field was low, wet and full of willows. The cultivated area was L-shaped and bounded the wet area on two sides. Franklin said that so much corn was dug out that he decided it useless to replant to corn. Instead, he planted it to melons and potatoes - two crops which the pheasants have not injured on his farm. Tomatoes and strawberries are near the house and have not been bothered.

REPORT 10

PHEASANT DAMAGE TO SWEET CORN, STRAWBERRIES AND GARDEN PEAS

S. Rymer

Ottawa County Spring Lake, Michigan

June 15, 1932

Mr. Rymer finds that the pheasants eat whatever a chicken will, and the chickens would eat practically everything he raises if they were not kept in pens. He named a long list of crops which he claimed were damaged for him by pheasants. The list included practically everything that he usually raises. To date the injured crops are corn, strawberries and peas.

Peas - This year the peas escaped very serious injury from digging because the men were working nearby during the critical period. However, Mr. Rymer expects considerable damage to the pods in a few days by the pheasants pecking into them.

Corn - Sweet corn is a money crop to Mr. Rymer and he has four acres of it this year. Due to his particular location he is able to produce corn for market several days before any one else and thus get a fancy price for the first corn. The corn which has been destroyed by the pheasants in the spring is not replanted because it would be too late in maturing.

PHEASANT DAMAGE TO SWEET CORN, STRAWBERRIES AND GARDEN PEAS (CONT'D)

He pointed out several missing hills in the corner of a field knee-high corn which he said was a result of pheasant digging. In another field of smaller corn there was a row planted in a dead furrow in which practically every hill was missing for a distance of about 100 feet. Mr. Rymer says the pheasants prefer corn in furrows because there is more chance for hiding in the depression.

After the pheasants were first liberated in this vicinity, Mr. Rymer reports a falling off of his corn harvest then a sudden rise the year following the first open season. The summer of the last closed season he harvested less than 700 dozen ears, and the following year the harvest was over 9,000 ears. His present average yield is between 8,000 and 9,000 dozen ears. He treats his seed with Ceresan Jr. to prevent root rot, and this does not affect the pheasants in any way.

Strawberries - Mr. Rymer has two rows of strawberries immediately behind his barn. From them I picked six or eight berries which had been pecked into by birds. This injury I was told was the work of pheasants. Later on, while walking cautiously through the adjacent woods I saw 5 robins in the strawberries. One soon left and each of the other two went up a row of berries, taking one or more pecks from several ripe

PHEASANT DAMAGE TO SWEET CORN, STRAWBERRIES AND GARDEN PEAS (CONT'D)

berries. It may be that the robins are responsible for as many (if not more) injured strawberries as are the pheasants.

Mr. Rymer's one hundred and fifty-two acre farm is almost completely surrounded by water (river, swales and bayous). On one side is some idle land which belongs to a hunting club and, according to Mr. Rymer, it is unnecessarily restocked each year. Beyond the waters which bound the Rymer farm I noticed that there was considerable idle land. Rymer claims that the owners of this land were forced to surrender their farming activities because of the pheasants. Now that the land is idle and furnishes less food for the pheasants, Mr. Rymer says they flock on his farm from miles around. However, the damage on this farm did not appear nearly as great as reported.

REPORT 11

PHEASANT, CROW AND GRACKLE ON CORN

Fred Peck

Eaton County Eaton Rapids, Michigan

June 23, 1932

Upon investigating Mr. Peck's damage report, I discovered that it was based chiefly upon damage done two years ago. Mr. Peck is unable to explain why there has been so little wild-life injury in the last two years. He believes that the pheasants, crows and grackles are just as numerous as they were then and that the crops have been just as well located in relation to the long swale which lies along the east line fence and runs through part of his 56 acres. However, Mr. Peck has made one change in the past two years and that is clearing a portion of the swale of brush. The grass is yet high. This year he had six acres of corn adjacent to the cleared portion, and he suffered very little damage to it.

Mr. Peck reports that two years ago the pheasants ate practically all of his sweet corn that he was saving for seed. Out of 6 or 8 rows which were about 8 rods long he says he found 2 or 3 good ears that the pheasants had not ruined. He said he had nearly all of 2 1/2 acres of field corn dug and pulled by pheasants and crows two years ago this spring and another field of 5 acres had some corn destroyed also. That

PHEASANT, CROW AND GRACKLE ON CORN (CONT'D)

same spring the cock pheasants used to visit his chicken yard and 2 or 3 white leghorn roosters were killed in battles with the pheasants. Last summer the pheasants broke off the heads of ripe, standing wheat along the edge of the field. He did not consider this injury of much importance. I have seen English sparrows do considerable damage to wheat and part of his loss may have been due to this species.

Mr. Peck is of the opinion that all pheasants, crows and grackles share honors in corn injury during the spring. He ranks crows and grackles above pheasants as destroyers of corn in the ear. The only damage to ear corn by pheasants that he has experienced was to sweet corn as described above.

Last fall the rabbits gnawed the bark off of a few peach trees. The injury that Mr. Peck pointed out to me was, in each case, on small low shoots rather than on the trunk of the three year old trees. He said the injury was done before snow fell.

Peck reports that opossums seem to be on the increase in that vicinity. He showed me a hole in which he said two or three dead chickens had been buried until an opossum dug them up recently. It was the first opossum he had seen, but he says about half a dozen have been caught in the neighborhood.

PHEASANT, CROW AND GRACKLE ON CORN (CONT'D)

Quail in that vicinity are also increasing slightly, Mr. Peck believes. They have held their own in spite of the pheasant which many report as an important quail enemy. A covey of twenty or more stayed around his farm buildings last winter.

REPORT 12

STARLINGS ON SWEET CORN AND MELONS

Andrew Kurtz

Monroe County Monroe, Michigan

June 29, 1932

Mr. Kurtz reports that the starlings caused him considerable losses on his sweet corn and melons this spring. He states that the seeds of both the corn and melons were dug up, cracked open and the insides eaten and all his first planting of corn was dug out. He said he replanted the entire three acres and of the second planting he had parts of eight or ten rows which escaped injury. The remainder of the field was from third and fourth plantings. Mr. Kurtz says that the starlings will start in on a row of newly planted corn and take each kernel as they go, "seeming to know just where the corn lies". He explained that the bill is used as a probe to reach the corn which is then removed, cracked open and eaten. It seems that no scratching is done with the feet.

Damage may continue after the corn comes up. In this case a "neat little hole is made next to the stalk and down to the kernel". The kernel is then pulled from the roots and eaten. I was told the stalk of corn may be so badly injured by root exposure that it dies.

Adjacent to his sweet corn Mr. Kurtz had planted two acres of watermelons and muskmelons about April 15 with hopes

STARLINGS ON SWEET CORN AND MELONS (CONT'D)

of having early melons. When he went out to the field a few days later to see if the plants were up he found 7 little holes on most hills instead of 7 little plants. Out of 15 rows having approximately 50 hills each Mr. Kurtz found about 15 hills which had been untouched.

Not knowing then what animal was responsible for the damage he says he replanted, but moved the rows over several inches. The same thing happened so Mr. Kurtz hid himself in the field before daybreak. From his blind he said he watched the starlings dig out the seeds, hull them and eat the insides. Less injury was done to the second planting, only about 75% of the hills were destroyed. Kurtz said the birds continued their work over a period of about five weeks and a third and fourth planting was necessary to get the partial stand which there was on June 29.

One of the fields suffered more injury than any other part so Mr. Kurtz finally planted it to beans. This portion of the field is in a slight depression and is adjacent to an orchard and buildings. Mr. Kurtz says that the orchard and buildings used to "harbor many starlings" until he began to shoot them off. Eleven dollars worth of melon seeds had been put into this field. The starlings seem to like watermelon seed and muskmelon seed equally well.

STARLINGS ON SWEET CORN AND MELONS (CONT'D)

Mr. Kurtz says he has spent several mornings and evenings in the field watching the various birds, and he finds that the killdeer will eat muskmelon and cucumber seed, but this bird has not caused any serious trouble. In the evening he has seen kingbirds eat melon seeds left lying on the ground. A farmer in Williamston township also claims to have seen a killdeer eating his cucumber seeds. It seems unlikely that killdeers would adopt such feeding habits and it is probable that there was an error in the identification of the bird.

Several hills were covered with boxes to protect the young plants from frost. These hills escaped starling injury. Mr. Kurtz plans to have about 100 of these boxes on hand next spring to cover the hills so that he can get a few early melons.

I asked Mr. Andrews, County Agricultural Agent, how many farmers had reported starling trouble to him. He said that Mr. Kurtz's report was the only one which he had on file, but "one or two other farmers had mentioned having a little trouble".

REPORT 13

DAMAGE TO ORCHARD AND GARDEN BY VARIOUS ANIMALS

L. N. Howard

Oakland County Farmington, Michigan

July 2, 1932

Mr. Howard has but a small garden and although it is near to the house he finds that the starlings are very destructive to the young plants. Pheasants are quite common but have done very little damage to the crops. Pheasants have pecked into tomatoes, but Mr. Howard finds that this bird can be frightened and made to stay away from the garden. This is not so with the starling.

This year for a month (May 15 to June 15) the starlings were very destructive, and they were seen in the early morning eating off or pulling up young plants of beets, lettuce and cabbage. Mr. Howard reported that the starling destroyed two rows of beets, 1 row of lettuce and 1 row of Chinese cabbage. Each row was about 3 rods long. The sweet corn suffered little or no injury. This is the first year that the starlings had become such a nuisance, which is perhaps one indication of their natural increase in numbers.

Mr. Howard has 40 acres of apple orchard. He finds that the "moles" (probably the meadow mouse, Microtus pennsylvanicus pennsylvanicus or the pine mouse, Microtus

DAMAGE TO ORCHARD AND GARDEN BY VARIOUS ANIMALS (CONT'D)

pinetorum scalopsoides) girdle some of the young trees while rabbits girdle the older ones. However, this damage was not considered as being serious since there was so little of it done. Last year it was first noticed that several species of birds were pecking into the ripe areas of a number of apples while still on the tree.

Robins and catbirds are the two greatest cherry consumers. Mr. Howard said that from eight good cherry trees these birds eat on an average of 1 1/2 to 2 bushels of fruit each year. He says this feeding is as costly if not more so than the feeding of all animals in his apple orchard.

REPORT 14

BARKING OF MAPLE AND BEECH TREES BY UNKNOWN ANIMAL

E. Sherman

Newaygo County Fremont, Michigan

July 19, 1932

This summer Mr. Sherman experienced a type of damage to his sugar maple and beech woods which was new to him. This damage was the tearing off of the outer bark, apparently by some rodent, and the consumption of the cambium layer.

The greatest quantity of bark was being removed in June. At that time Mr. Sherman said that each morning one could see several trees which had been freshly girdled and others, although not completely girdled, had great areas of exposed sapwood. Comparatively little damage was being done in July, 1932.

I found that the trees ranging from 3 to 6 inches d. b. h. (diameter breast height) had suffered the greatest injury to both trunk and branches. The extent of barking on trees of this size ranged from tiny patches of 1 square inch or less to complete girdling, starting near the surface of the soil and reaching as high as four feet. Larger trees had the bark removed from exposed roots. I found no trees of less than 3 inches d. b. h. that had been injured. I estimated that about one-third of all maple trees above

BARKING OF MAPLE AND BEECH TREES BY UNKNOWN ANIMAL (CONT'D)

3 inches d. b. h. in this five acre lot were damaged. The fewer beech trees which are of little value were less seriously injured.

At the base of a barked tree were the fragments of outer bark. These fragments ranged in size from tiny chips to strips nearly an inch wide and six inches long. The sapwood was slightly roughened by fine teeth marks running vertically.

Mr. Sherman does not think that the squirrels were the guilty animals. He said squirrels seemed to be no more numerous than the previous year. I saw not over 10 squirrels at different times. By concealing myself I was able to watch the squirrels at close range during evening and early morning, and I did not see the slightest indication that they were eating the bark, although there were many damaged trees in the area.

Mr. Sherman said that one porcupine was caught in the neighborhood several years ago. I do not believe, however, that this damage is done by porcupine because of the small size of the teeth marks. Neither do I believe it to be the work of woodchucks (although there are woodchucks'holes in the woods), because small branches in the tips of trees are frequently barked. The damage seems to be done while the squirrels are sleeping.

REPORT 15

PHEASANT DAMAGE TO TOMATOES

George Evanoff

Wayne County Detroit, Michigan

August 22, 1932

Mr. Evanoff has a forty-acre truck farm on the Seven Mile Road. Like many other farms on the outskirts of Detroit much of it is not under cultivation and pheasants are plentiful. The uncultivated areas are allowed to grow weeds, chiefly ragweed and wild carrot. Such places afford excellent cover for the pheasants and frequently the tomatoes are adjacent to the weeds.

Mr. Evanoff had nearly two acres of tomatoes divided among three patches. One patch was near the house and highway and as one might expect this suffered the least damage. Very rarely could one find a ripe tomato which had not been pecked into in the other two patches. The result was that by August 22 Mr. Evanoff had sold less than five bushels of tomatoes and he estimated that about sixty bushels had been thrown away.

An attempt to pick the tomatoes just before they were completely ripe was given up, because it was found that the pheasants promptly pecked the fruit just as soon as one side turned yellow or red. I found an occasional, perfectly green tomato that was damaged. Evanoff says that if the tomatoes

PHEASANT DAMAGE TO TOMATOES (CONT'D)

are picked when green and sound and allowed to ripen off of the vine they are of poorer quality.

The only method of control has been that of chasing the birds out from time to time, but they merely wait until the chaser has left then they return. Eight or ten birds have been flushed at one time by Evanoff, but he believes that there were nearly fifty feeding on his tomatoes. He believes, as do many others, that the pheasants are seeking a drink when they eat into a tomato. Although the amount of this type of damage may be somewhat increased during a dry season, it does not hold that there would be no damage during a wet season since the pheasants show a decided preference for the sweet tomato juice as compared to water.

Several good sized, but green, muskmelons were found with deep holes in them about two inches in diameter. Since no crows have been seen in the garden at any time this seems to be the work of pheasants. The melon patch of about two acres is adjacent to a damaged tomato patch. Peppers next to the tomatoes were not touched. Evanoff estimates his loss on tomatoes was between $150 and $200.

REPORT 16

PHEASANT DAMAGE TO TRUCK GARDEN

Julius Neirynck

Wayne County Lockmoor, Michigan

August 23, 1932

Mr. Neirynck rents sixty-five acres just north of the Seven Mile Road on Mack Avenue. The farm is a narrow strip of land a mile long, and it is all under cultivation. However, there is a woods on the north, and the land on the south is not tilled to any great extent. Mr. Neirynck grows tomatoes, melons, sweet corn, and cucumbers. All these furnish food for the great number of pheasants. Neirynck has counted 72 pheasants in two groups not farm from his house.

Mr. Neirynck has lived on this farm for seven years, but it was only four years ago that pheasants became a serious pest. Each year since then Neirynck as well as neighboring farmers report that this bird's depredations have become more serious. To make matters even worse, the village closed these farms to hunting at all times.

In his four acres of tomatoes, Neirynck has had the same old experience of the pheasants pecking into the fruits as soon as they begin to ripen. Of course, the damage starts with the first of the season when the price is the highest. One must see such a field to appreciate how serious a pest

PHEASANT DAMAGE TO TRUCK GARDEN (CONT'D)

pheasants can become in certain localities. A great many more bushels of tomatoes are ruined by the birds than are ever sold in fact, Neirynck could only get enough tomatoes to sell them by the basket and not by the bushel.

It is not the total quantity of tomatoes eaten by the pheasants that make such a serious problem, but rather the quantity wasted by them. A pheasant seldom pecks into a fruit which has already been fed upon. And, as Mr. Neirynck found, if an injured tomato is placed on the ground with the hole hidden underneath, the pheasants seldom if ever touch it. It requires but a single peck in a tomato to make it unmarketable.

The sweet corn was still too small for marketing, but the pheasants had already begun feeding on it. Mr. Neirynck said that when the sweet corn was gone the pheasants would start eating his field corn even as it stood in the field. He says he has seen grown pheasants fly up and hang on the side of an ear of field corn while feeding on it as do woodpeckers. I have never seen this done.

The muskmelons were not yet ripe, but a few tiny ones had been eaten. Mr. Neirynck expected considerable damage when the melons ripened. Such damage, he says, occurs each year.

PHEASANT DAMAGE TO TRUCK GARDEN (CONT'D)

The cucumber patch of two rows about 100 yards long had 6 or 8 dozen injured fruits. The birds seemed to prefer the green to the ripe cucumbers. All sizes from the smallest to the largest were pecked into. In some cases, little more than the rind remained.

Mr. Neirynck picks up the damaged crops by the bushel and computes his yearly loss by the current market price. This now comes to about $500 a year, and he is behind $400 in rent.

Mr. Fisher, a neighbor, computed his loss on two acres of tomatoes to be $200 on account of pheasant feeding this year. Mr. Fisher used to raise corn and melons also, but found that with so many pheasants on the farm (13 acres) these crops were a losing proposition.

It is unfortunate that the village puts a hunting restriction on these farms. However, this restriction has only been in effect for less than two years and in previous years the pheasants continued to increase in spite of the open season shooting.

In my opinion, the State of Michigan could do much to help farmers who are over-run with pheasants, and who do not live under any town hunting restrictions, by issuing written permits allowing the landowner or renter (with the landowner's

PHEASANT DAMAGE TO TRUCK GARDEN (CONT'D)

consent) to shoot any pheasants on his farm at any time. Most farmers like to see a few pheasants around, but when they reach such numbers that the farmers lose more than a hundred dollars a year, from pheasant feeding alone, it is not surprising that they condemn these birds. Farmers who otherwise would not think of shooting during the closed season will then shoot to kill at any time. And partly for this reason, a great deal of illegal hunting is said to be going on; in fact, some farmers do not hesitate to tell of shooting pheasants out of season.

REPORT 17

CROW DAMAGE TO SMALL MUSKMELONS

A. Wesley

Wayne County Detroit, Michigan

August 23, 1932

While tramping through the fields looking for signs of crop damage near the Seven Mile Road, I chanced to meet Mr. Wesley, who was hoeing corn. I asked him if the pheasants had been giving any trouble to his garden. He replied, "No, not very much. Oh, they occasionally dig out a few potatoes, but the crows are the bad ones. Come and I'll show you what they are doing to the muskmelons".

He took me to a melon field of six acres which was half a mile from the nearest house, but near to two woods. In the field were half a dozen scarecrows. We walked through the field, and I noticed that most of the damage was at the sides and at the far end along which were several trees in a fence row. However, there was considerable damage in other parts, except within about twenty yards of each scarecrow.

Very fresh holes in the melons indicated that the birds were still feeding upon them. Wesley felt certain that crows were the guilty birds, although he had not seen them actually feeding on the melons, but he said that each day ten or twelve crows spent some time in the patch as he had seen them from a distance. I saw no trace of pheasants, but saw

CROW DAMAGE TO SMALL MUSKMELONS (CONT'D)

a crow fly out of the melon field as I approached, and there were several crows in this vicinity all day.

This case was rather interesting since only the small green melons were eaten. The larger ones were not touched, perhaps due to the harder rind. The injured melons ranged in length from two inches to five inches. In some cases the small melons were completely hollowed out leaving only the rind with a hole a little over an inch across. I estimated that one melon out of ten or fifteen were injured over most of the six acres.

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P H O T O G R A P H S

No. 1

Close-up of hill of seedling corn damaged by pheasant.

No. 2

Typical scene of corn digging by pheasants.

No. 3

Holes left where pheasants dug out corn.

No. 4

Ripe corn fed on by pheasant.

No. 5

Result of pheasant feeding
on corn shock.

No. 6

General view of tomato field
damaged by pheasants.

No. 7

Tomatoes showing typical
pheasant injury.

No. 8

Watermelon and muskmelons damaged by pheasant.

No. 9

General view showing relationship of melon patch to pheasant cover.

No. 10

Close-up of cucumber damaged by pheasant.

No. 11

Results of captive pheasants digging on experimental corn plot.

No. 12

Typical corn stalk injury, believed to have been perpetrated by crow, occurring on College farm.

No. 13

Close-up of corn stalk injury, believed to have been perpetrated by crows, taken near Rockford, Michigan.

No. 14

Fallen corn resulting from injury to stalks. Similar to Figures 12 and 13.

No. 15

Close-up of typical crow damage to corn ear.

No. 16

Typical scene of crow damage to corn ears.

No. 17

Crow damage to corn which was fed on from the ground.

No. 18

Typical crow damage to green muskmelons.

No. 19

Close-up of one of the melons shown in Fig. 18.

No. 20

Cucumbers believed to have been damaged by crows. Taken from near corn field which was damaged by crows.

No. 21

Typical grackle damage to ear corn.

No. 22

Flock of grackles flushed from corn field upon which they had been feeding.

No. 23

Close-up of tip of corn ear showing typical red-winged blackbird injury.

No. 24

Heads of green foxtail, fed on by red-winged blackbirds, taken from a corn field.

No. 25

Slight injury to a corn ear
by a red-headed woodpecker.

No. 26

Typical red-headed woodpecker injury to corn ear.

No. 27

A slightly different form of red-headed woodpecker injury to corn.

No. 28

Cross section of ear shown in Fig. 27 showing how the kernels are injured slightly in advance of the torn husk.

No. 29

One type of fox squirrel injury to corn.

No. 30

Several corn ears showing various types of fox squirrel injury.

No. 31

Decay in watermelon resulting from a small hole eaten through the rind by fox squirrel.

No. 32

A watermelon badly damaged
by fox squirrel.

No. 33

Trunk of maple tree injured
by an unknown mammal.

No. 34

Close-up of tree shown in Fig. 33 showing teeth marks on the trunk.

No. 35

Sweet corn ear showing
typical raccoon damage.

No. 36

Sweet corn ear fed on by raccoon and left on the stalk.

No. 37

Green corn injured by muskrat showing height to which the stalks are cut.

No. 38

"Rag dolls" ready to be rolled.

No. 39

The completed "rag dolls".

REP

SHEET NO. 2

The State Depar

Outline M
Showing