FOOD OF THE COTTONTAIL IN SOUTHERN ILLINOIS

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INTRODUCTION

The cottontail rabbit, *Sylvilagus floridanus* Allen, is the most popular small game mammal in North America (Trippensee, 1948). Because of its wide-spread occurrence and abundance, several million are harvested for sport and food (Hamilton, 1943). In Illinois, hunters take more cottontails than any other game animal, with the bulk of the hunting pressure and kill occurring in the southern counties (Marquardt and Scott, 1952). This distribution of harvest probably reflects the favorable habitat of the southern one-third of Illinois.

Previous investigations of the cottontail in Illinois have largely emphasized population levels and factors affecting these levels (Yeatter and Thompson, 1952; Mohr, 1947; Ecke, 1955). The present research was undertaken to learn something about the food habits of cottontails in southern Illinois. The objectives included: an evaluation of items utilized as food; seasonal variation in food utilization; and, relationship of food utilization to land use. The period of investigation extended from January 1, 1952, to December 31, 1952.

STUDY AREAS

Two areas located in Williamson County, Illinois, were chosen for study. These included the T. M. Hill Farm, consisting of 72 acres about 3 miles east of Carterville, and 580 acres of the Crab Orchard National Wildlife Refuge 5 miles west of Marion. These areas were selected because of variety in the land use, apparent available food and cover, and absence of hunter disturbance. No attempt was made to determine the cottontail population because it was not considered highly essential to the project. Nevertheless, the large number of observations of fecal pellets and cuttings on vegetation indicated that sizable populations inhabited the two areas.

In 1952 snowfall and rainfall were subnormal and temperatures above normal (U. S. Commerce Comm., 1953). Much of the palatable vegetation became dry and undesirable during the summer as high maximum temperatures probably increased the rate of transpiration and thus hastened the drying of the plants. As a result of abnormally high minimum temperatures, many grasses contained a high moisture content during the winter. Only a small amount of snow fell during the year and this melted after a few hours.

T. M. Hill Farm.—The T. M. Hill Farm consisted of 20 acres of corn, 20 acres of soybeans, 2 acres of apple orchard, 5 acres of woodland, 20

acres of pasture, 1 acre of garden, 2 acres of fallow ground, and 2 acres of building sites, as a result of the agricultural program of 1951. In 1952, 5 and 20 acres were planted to soybeans and corn, respectively. The remaining land was allowed to lie idle and produced a heavy growth of weedy herbaceous plants.

Protective cover was available in the idle fields and orchard in the form of dense growths of broomsedge interspersed with patches of dewberry, blackberry, and Kentucky bluegrass which cottontails readily utilize for forms (Horsley, 1942). Plant growths in the fence rows, consisting of grasses, weedy herbaceous plants, and woody shrubs, furnished cover between the croplands in 1951; this cover was removed in late summer, 1952.

Crab Orchard National Wildlife Refuge.—The Refuge area was about equally divided into agricultural and non-agricultural use in 1951 and 1952. Of 303 acres which comprised the agricultural land in 1951, 65 acres were in corn, 86 acres in soybeans, 30 acres in sweet clover, 66 acres in red clover, 43 acres in lespedeza, and 13 acres in unattended apple orchards. During the 1952 growing season, 40 acres were planted to soybeans, 150 acres to corn, 20 acres to wheat, and the remaining land was allowed to lie idle. The 277 acres of permanent non-agricultural land included: fallow land, 21 acres; old building sites, 3 acres; shop and building areas, 27 acres; railroad right-of-ways, 10 acres; shrub growths, 144 acres; and woodland, 72 acres. The fence-row growth was similar to that of the T. M. Hill Farm and was allowed to grow to furnish food and cover for wildlife.

Materials and Methods

Investigations of foods utilized by the cottontails were made from fecal pellets collected from the two study areas at 10-day intervals during a 12-month period. Only freshly dropped pellets were collected, being distinguished by a shiny mucous coating. One to two pellet samples were collected from each deposit found and stored in coin envelopes. Analyses of the samples were made according to the methods described by Dusi (1949). Fecal pellets were used because they were easier to collect and store than stomachs; also it was possible to obtain a continuous collection of pellets from the same population to evaluate better the seasonal aspects of food. According to Baumgartner and Martin (1939) histological studies are more desirable than the usual laboratory methods.

As the pellets were relatively homogenous, only one-eighth of each was mounted on a microscope slide. Permanent slides were produced using Apathy's Gum Syrup as a mounting medium (Richards, 1943). Each slide was systematically examined with a compound microscope. Food items were identified by carefully surveying the fecal material and comparing the cells with prepared reference slides. The percent volume of each food item was estimated from the average of five low-power readings, one from each of the four corners of the slide and one from the center.

Prior to preparation of the pellet slides a reference collection of plants

was made and slides prepared. Tissues of leaves, fruits, buds, and bark were obtained and preserved in vials containing formalin - aceto - alcohol (Johansen, 1940). A maceration technique was used to separate the cells of the plants for staining (Dusi, 1949). Small pieces of plant material were placed in a solution of equal parts of 10% nitric acid and 10% chromic acid until the tissues could be teased apart; plant cells were stained in Mayer's hemalum. When it was possible to strip the epidermis from fresh leaves, the tissue was put through a series of alcohol dilutions before staining (Dusi, 1949).

To supplement analyses of the pellets, cuttings of vegetation by cottontails were noted as the areas were traversed in search of pellets. No observations of feeding cottontails were recorded, as the collections were made near the middle of the day when the cottontail was less active. Sweetman (1949) reported that, although cottontails were observed to prune or "bark" plants, this was not significant as an indication of food acceptability. Nevertheless, in this study it was assumed that, if considerable cutting had been done, the cottontails probably used some of these materials as food. Observations of cuttings of vegetation were an important aid in the determination of foods by histological methods, as field data often provided leads to the identity of plants being utilized.

Analysis of Results

Of the 290 samples collected for analyses, 117 were obtained from the T. M. Hill Farm from January 19 to December 6, 1952, and 173 from the Crab Orchard National Wildlife Refuge from January 5 to December 26, 1952. A total of 15 food items was identified in the samples collected from the Hill Farm and 12 food items from the Refuge. Although a large portion of the contents of each pellet could not be identified, it was believed that the general feeding trends of cottontails were indicated. Possibly much of the unidentifiable material was conductile tissue from plants whose identity was established.

T. M. Hill Farm.—On a monthly basis and according to volume, corn ranked first as a food item during January, February, April, May, September, and December and ranked number two in March and November at which time wheat and apple fruit ranked first, respectively (Fig. 1). Corn was not recorded during four months when broomsedge in June, soybeans in July and August, and Kentucky bluegrass in October ranked first by volume. Foods of lesser importance on a monthly basis were dewberry, blackberry, lespedeza, Canada bluegrass, sassafras, and red top. Other items, though occurring with some frequency, were not important from the standpoint of volume.

Analyses of the seasonal pattern of identifiable foods used by cottontails indicated: corn (7%), Kentucky bluegrass (4%) and apple fruit (3%) as the top-ranking foods in winter; broomsedge (17%), corn (8%), Kentucky bluegrass (3%), wheat (3%) and lespedeza (3%) in spring; soybeans (35%), apple fruit (7%), corn (3%) and sassafras (2%) in summer; and, apple fruit

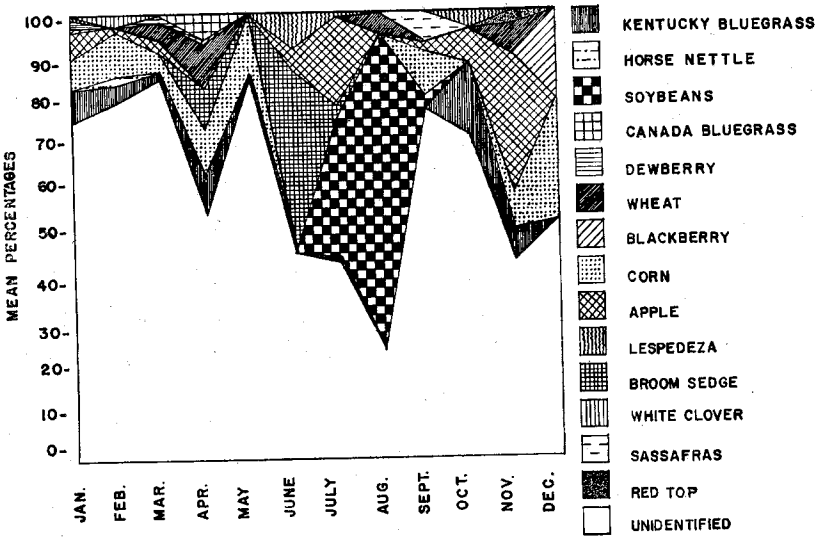

FIG. 1.—Monthly food habits of cottontails, T. M. Hill Farm.

(13%), corn (12%), Kentucky bluegrass (8%), blackberry (7%) and wheat (2%) in fall (Fig. 2). Corn, Kentucky bluegrass, apple fruit, wheat, and lespedeza appeared in the cottontail diet during each of the four seasons. However, the greatest utilization of a food item during any one season was that of soybeans in summer.

On the basis of per cent volume the annual diet showed the 10 top-ranking foods to be soybeans, corn, apple fruit, broomsedge, Kentucky bluegrass, wheat, blackberry, lespedeza, Canada bluegrass, and sassafras (Table 1). According to frequency of occurrence, apple fruit, Kentucky bluegrass, corn, soybeans, and lespedeza appeared in 10% or more of the samples.

Crab Orchard National Wildlife Refuge.—On the Crab Orchard Refuge trends in food habits of cottontails by month-periods showed Kentucky bluegrass as the top-rated food item during six months—February, March, April, July, October, and November (Fig. 3). Canada bluegrass was number one in January, soybeans in June and August, horse nettle in May, dewberry in September, and wheat in December. Except for February, June and December, corn and wheat were of no great importance in the diet of cottontails. The utilization of soybeans increased from 16% of the total volume in June to 57% in August, after which time it was not recorded. Horse nettle was identified in samples from all months except July and November, yielding from less than 1% to 49% (May) of the total volume for any one month. Primarily fruit and seeds of the plant were found in the pellet material, but cells of the leaves and stems were occasionally noted. Foods of lesser importance by month included apple fruit, lespedeza, dewberry, and blackberry.

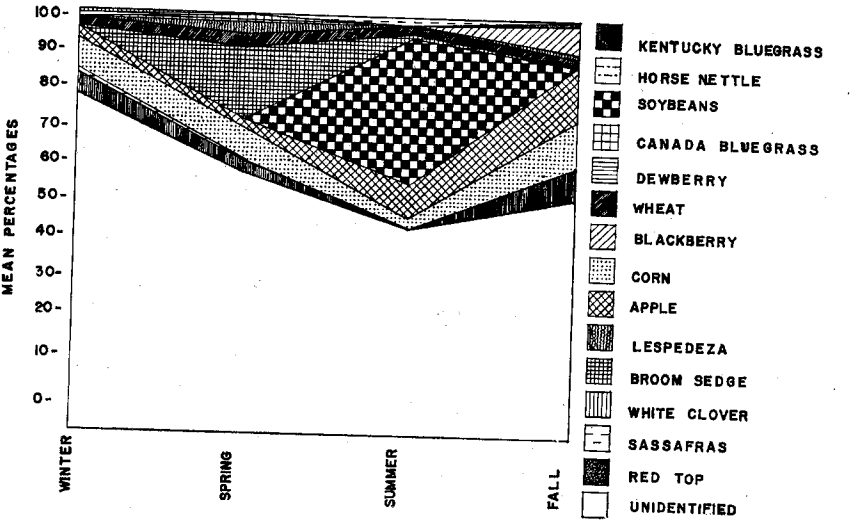

FIG. 2.—Seasonal food habits of cottontails, T. M. Hill Farm.

TABLE 1.—Summary of Trends in Foods of Cottontails on the T. M. Hill Farm, January 19—December 6, 1952.

Food items	Percent frequency of occurrence	Percent volume
Soybean	13.0	9.0
Corn	15.0	7.0
Apple	25.0	6.0
Broomsedge	9.0	5.0
Kentucky bluegrass	22.0	4.0
Wheat	6.0	2.0
Blackberry	4.0	2.0
Lespedeza	10.0	1.0
Sassafras	1.0	1.0
Canada bluegrass	2.0	1.0
Dewberry	3.0	trace
White Clover	1.0	trace
Red top	1.0	trace
Horse nettle	2.0	trace
Goldenrod	1.0	trace
Unidentified	92.0	61.0

Kentucky bluegrass and horse nettle ranked high in importance as all-season foods, being the only two items taken in appreciable quantities from spring through winter (Fig. 4). Soybeans (32%) were the number one food in summer, Kentucky bluegrass in winter (23%) and fall (18%), and horse nettle (18%) in spring. Canada bluegrass

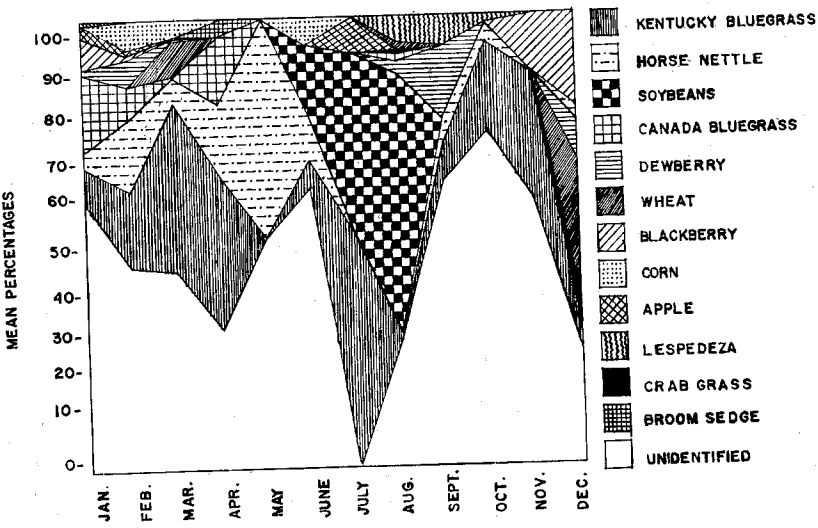

FIG. 3.—Monthly food habits of cottontails, Crab Orchard National Wildlife Refuge.

TABLE 2.—Summary of Trends in Foods of Cottontails on the Crab Orchard National Wildlife Refuge, January 5—December 26, 1952.

Food items	Percent frequency of occurrence	Percent volume
Kentucky bluegrass	51.0	19.0
Soybean	8.0	10.0
Horse nettle	25.0	8.0
Wheat	6.0	4.0
Canada bluegrass	13.0	3.0
Blackberry	6.0	3.0
Dewberry	13.0	3.0
Corn	6.0	1.0
Lespedeza	5.0	1.0
Apple	2.0	1.0
Broomsedge	2.0	trace
Crab grass	1.0	trace
Partridge pea	1.0	trace
Unidentified	70.0	46.0

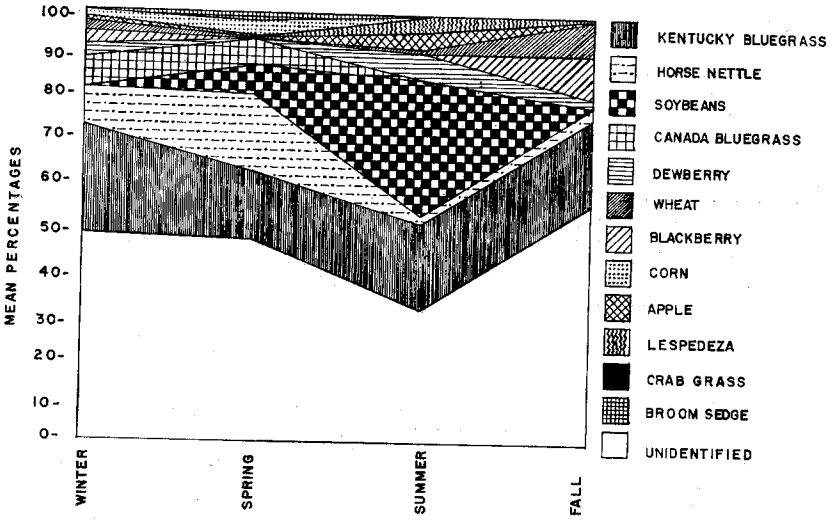

FIG. 4.—Seasonal food habits of cottontails, Crab Orchard National Wildlife Refuge.

was important as a winter (7%) and spring (6%) food. Other foods of seasonal importance were corn in winter (3%) and spring (3%), apple (3%) and lespedeza (4%) in summer, dewberry in summer (6%) and fall (2%), and blackberry in fall (10%) and winter (3%), and wheat (11%) in winter.

On an annual basis the number one identifiable food of the cottontail on the Crab Orchard National Wildlife Refuge in 1952 was Kentucky bluegrass (Table 3). According to frequency of occurrence, horse nettle, dewberry, and Canada bluegrass were second, third and fourth in importance, while by volume, soybeans, horse nettle, and wheat were second, third and fourth, respectively.

Observation of cuttings revealed 14 plants, as possible cottontail foods, which were not identified in the histological procedures (Table 3). There was no way of determining the per cent volume and frequency of occurrence of these foods, but it was apparent that some were utilized more than others. Those foods, identified only by cuttings, which seemed to be favored by the cottontail were poison ivy, goldenrod, and ragweed. Only an occasional cutting was noted on the other plants.

DISCUSSION

These data indicated that the cottontail in southern Illinois relied on herbaceous plants almost entirely for a source of food in 1952. It has been suggested by Sweetman (1949) and Dusi (1952) that snowfall was an important factor in influencing the change from herbaceous to woody plants. Because herbaceous foods were plentiful on the two study areas and snowfall was light, cottontails probably were not forced to make extensive utilization of woody plants. It was evident, however, that dewberry and blackberry were utilized the greatest during the fall and win-

TABLE 3.—Plants Considered Available to Cottontails for Food, T. M. Hill Farm and Crab Orchard Wildlife Refuge.

Common name	Scientific name (Fernald, 1950)
Cedar	*Juniperus virginiana* L.
Canada bluegrass (1, 2)*	*Poa compressa* L.
Kentucky bluegrass (1, 2)	*Poa pratensis* L.
Tumble grass	*Erogrostis sp ctabilis* (Pursh.) Steud
Purple op	*Tridens flava* (L.) Smyth.
Wheat (2)	*Triticum aestivum* L.
Red Top	*Agrostis alba* L.
Common timothy (1)	*Phleum pratense* L.
Crab grass (2)	*Digitaria sanguinalis* (L.) Scop.
Paspalum (1)	*Paspalum circulare* (Nash.) Fern.
Bristly foxtail (2)	*Setaria* sp. Beauv.
Broom-sedge (1, 2)	*Andropogon virginicus* L.
Corn (1, 2)	*Zea mays* L.
Garlic (1, 2)	*Allium* sp. L.
Lily (2)	*Lilium* sp. L.
Hickory	*Carya* sp. Nutt.
Hazelnut (1)	*Corylus americana* Walt.
Oak	*Quercus* sp. L.
Elm (1)	*Ulmus* sp. L.
Dock (1, 2)	*Rumex* sp. L.
Smartweed	*Polygonum* sp. L.
Pokeweed	*Phytolacca americana* L.
Sassafras (1, 2)	*Sassafras albidum*
Apple (1, 2)	*Pyrus malus* L.
Crab apple (1)	*Pyrus augustifolia* Ait.
Blackberry (1, 2)	*Rubus* sp. L.
Dewberry (1, 2)	*Rubus* sp. L.
Rose (2)	*Rosa* sp. L.
Honey locust (2)	*Gleditsia triacanthos* L.
Partridge pea (2)	*Cassia fasciculata* Michx.
Red clover	*Trifolium pratense* L.
White clover	*Trifolium repens* L.
Yellow sweet clover	*Melilotus officinalis* L.
White sweet clover	*Melilotus alba* Desr.
Lespedeza	*Lespedeza* sp. Michx.
Soybean (1, 2)	*Glycine max* (L.) Merr.
Wood sorrel	*Oxalis* sp. L.
Smooth sumac	*Rhus glabra* L.
Dwarf sumac	*Rhus copallina* L.
Poison ivy (1, 2)	*Rhus radicans* L.
Maple (2)	*Ac r* sp. L.
Box elder	*Acer negundo* L.
Grape	*Vitis* sp. L.
Mare's-tail	*Hippuris vulgaris* L.
Wild carrot	*Daucus carota* L.
Horse-nettle (2)	*Solanum carolinse* L.
Trumpet creeper (2)	*Campsis radicans* (L.) Seem.
Common plantain	*Plantago major* L.
Japanese honeysuckle	*Lonicera japonica* L.
White snakeroot	*Eupatorium altissimum* L.
Goldenrod (1, 2)	*Solidago* sp. L.
Boltonia	*Boltonia asteroides* (L.) L. 'Her.
Fleabane (2)	*Erigeron* sp. L.
Ragweed (1, 2)	*Ambrosia bidentata* Michx.
Giant ragweed	*Ambrosia trifida* L.
Common ragweed	*Ambrosia artemisiifolia* L.
Coneflower	*Rudbeckia hirta* L.
Spanish needle (1, 2)	*Bidens* sp. L.
Prickly lettuce	*Lactuca scariola* L.

*(1) Plants of the T. M. Hill Farm on which cottontail cuttings were recorded.
(2) Plants of Crab Orchard Refuge on which cottontail cuttings were recorded.

ter seasons, suggesting that herbs and grasses were either less available or desirable during those periods.

Perennial grasses were utilized extensively during all seasons with Kentucky bluegrass being the most important. Similar findings were reported for the cottontail in Ohio (Dusi, 1952), but an Iowa study (Hendrickson, 1938) showed little utilization of grasses. Of the coarse grasses, this study indicated that broomsedge was acceptable during early stages of growth (June to August) when moisture content was high.

Agricultural crops constituted a major portion of the cottontail diet during the entire year as corn, soybeans, and wheat ranked among the top foods utilized. Apple fruit likewise yielded a substantial portion of the accepted foods. Studies in Iowa (Hendrickson, 1938) and Michigan (Trippensee, 1938) indicated little utilization of fruit but extensive use of the bark from apple trees. Presumably this represented cuttings on small trees rather than mature ones such as those on the study areas in this investigation. Of special interest was the rather extensive use of horse nettle, a plant occurring as a weed species in intertilled crops or recently fallowed land.

The trend of food habits by months and seasons showed a correlation between utilization and availability. Suggested also was the fact that certain foods were more acceptable during some seasons than others and that possibly less desirable ones were acceptable when preferred foods were less available. The use of Kentucky bluegrass and horse nettle indicated something of universal acceptance, whereas dewberry and blackberry may have represented a second or third choice. Corn and apple fruits were highly preferred as they occurred during all times that they conceivably were available. Soybeans were probably the most desired of any food available until such time as the plants reached maturity. Wheat utilization, limited to the leaves of young plants, was directly associated with volunteer growths following the late June harvest and with fall seedings.

In comparing the data from two study areas there was an obvious difference in the food habits of cottontails. Results from the T. M. Hill Farm showed a closer relationship of the cottontail diet with agricultural activities than those from the Crab Orchard Refuge. This could possibly be explained by the fact that because of the smaller areas of idle land on the Hill Farm and the greater interspersion of these areas throughout the cropland, cottontails had more extensive access to agricultural crops. Also, the small idle areas of the Farm possibly provided a lesser supply of acceptable foods than did the larger ones of the Refuge. To be considered too were the more desirable and diversified aspects of the habitat of the fallow and idle land of the Refuge which might have offered a more complete environment for cottontails than similar but smaller areas on the private farm. Thus, the cottontails on the Refuge were possibly less dependent upon agricultural lands for an adequate or supplementary source of food throughout the year. Evident, however, was the fact that the soybeans were a pre-

ferred food under any circumstance as they ranked number one on the Hill Farm and number two on the Refuge. It was apparent, then, that cottontails of southern Illinois had definite food preferences, that these preferences were closely associated with availability, and that within poorly defined limits fallow and idle land were possibly as acceptable as agricultural lands in the provision of suitable foods.

Acknowledgments

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