LATE SUMMER AND EARLY FALL FOODS OF THE MOURNING DOVE IN ILLINOIS

JOHN C. OBERHEU AND W. D. KLIMSTRA

North Carolina Wildlife Resources Commission and Southern Illinois University

The mourning dove, *Zenaidura macroura*, L., is a highly prized game species to an increasing number of hunters because it provides both high quality sport and delicacies for the table; it is reported that 19 million were harvested in 1960. Though most biologists agree that a properly controlled harvest of mourning doves is biologically sound, there has been considerable pressure by some organizations and individuals to place this fine game bird on the protected list; biological data do not support such action. The only method of creating a responsible public and of reducing the effectiveness of uninformed pressure groups is the provision of unbiased research data. It is in this respect that the study herein presented makes a modest contribution. The results of the investigation to be reported represent an analysis of the diet of the mourning dove in the month of September.

ACKNOWLEDGMENTS

These data were presented by the senior author as a thesis for a Master's Degree in Zoology, Southern Illinois University, and represent a contribution from Project No. 2, Cooperative Wildlife Research Laboratory. Dr. Harold Hanson, Associate Game Specialist, Illinois Natural History Survey, contributed dove crops and a seed collection of central and northern Illinois plants. Dr. M. R. Matteson, Associate Professor of Zoology, University of Illinois, identified the snails; Dr. Alexander Martin, Research Biologist, Patuxent Research Refuge, classified unknown plant materials; and Dr. Earle F. Lyman, former Associate Professor of Zoology, Southern Illinois University, aided in identification of insects. The herbarium collection of the Southern Illinois University Botany Department provided a valuable reference. The University's Statistical Service assisted in the organization and analysis of the data.

TECHNIQUES

A total of 1142 crops, representing doves from central and southern Illinois, was available for study (Table 1). Included were 350 crops contributed by the Illinois Natural History Survey for 1948 through 1955, and 792 which were collected by the Cooperative Wildlife Research Laboratory, Southern Illinois University, during 1953 through 1955. Most of the crops were obtained during the regular hunting season (September 1-30) from cooperating hunters who were provided instructions and materials for preservation.

The contents of crops contributed by the Illinois Natural History Survey had been removed, dried, and stored in coin envelopes; for the majority, data on age and sex were included. Crops collected by the Cooperative Wildlife Research Laboratory were stored intact in individual coin envelopes, and allowed to dry; for most, date and location of kill were available. The storage of entire crops, although less time consuming at the time of collection, was undesirable as it was most difficult to remove the contents once the crops had dried; this was especially true for those containing pigeon "milk."

A modification of a method described by Davison (1940) was utilized to separate food items in each crop. Seeds were segregated into three or four size classes through the use of soil analysis screens of 1, 2, and 3mm meshes; this facilitated counting a reduced number of food items in each size class without individually separating the species.

Identification of food items was accomplished largely through reference to collections of insects and seeds of the Cooperative Wildlife Research Laboratory. Volume and frequency of occurrence of individual food items were determined in the manner described by Larimer (1960).

Presentation and Analysis of Data

A total of 144 species of plants representing 37 families, and 38 kinds of animal matter were recorded from the 1142 crops. In comparison, Korschgen (1955), examining 2000 crops from Missouri, found 218 species of plants representing 48 families, and 39 items of animal food; this greater variety was due not only to a larger sample, but also to the fact that the study covered a 7-month period. In the current investigation, seeds made up 99.89% of the total food volume; 0.07% of the volume consisted of animal material, and 0.04% was grit.

Collectively, two families, grasses (87%) and spurges (10%) contributed 97 per cent of the total food volume (Table 2). The utilization of grasses was identical to that reported by Korschgen (1955) and reflected also the high occurrences recorded by other investigators (Cummings and Quay, 1953; Knappen, 1939; Leopold, 1943; Russell, 1954; Rosene, 1939; Pearson and Webb, 1942; Bent, 1932; Murry, 1952; and McClure, 1941); some of the latter reported that spurges, legumes and composites were of considerable importance.

Cultivated crops (wheat, corn, rye, oats, millet, timothy, cowpea, and Korean lespedeza) yielded 62% of the total food volume. Murry (1952) found that less than 21% of the diet of doves in Louisiana was cultivated crops; Korschgen (1955) reported that corn and wheat comprised 69% in Missouri.

Wheat, corn, and foxtail grasses were the most important food items both by volume and frequency of occurrence (Table 3). Though second in occurrence, wheat ranked first volumetrically, comprising 46% of the total; corn (14%) was second by volume. Yellow foxtail occurred in the largest number of crops (58%), but was third by volume (12%). Volumetrically, three other

TABLE 1.—Counties and Years Represented by Crops of Mourning Doves Available for Analyses.

County	Year									Total Crops
	Unknown	1948	1949	1950	1951	1952	1953	1954	1955	
CENTRAL ILLINOIS										
Champaign	9	20	7	46	.....	5	.....	.....	.....	87
Hancock	.....	.....	8	.....	.....	73	.....	.....	32	113
Macoupin	.....	.....	.....	.....	.....	.....	.....	33	.....	33
Mason	6	31	8	16	30	18	.....	.....	.....	109
Total	15	51	23	62	30	96	0	33	32	342
SOUTHERN ILLINOIS										
Alexander	.....	.....	.....	.....	.....	.....	.....	12	.....	12
Clinton	.....	.....	.....	.....	.....	.....	.....	.....	6	6
Franklin	.....	.....	11	.....	.....	.....	1	.....	84	96
Hamilton	.....	.....	.....	.....	.....	.....	.....	13	.....	13
Jackson	2	.....	.....	.....	.....	.....	.....	66	116	184
Jefferson	.....	.....	.....	.....	.....	.....	.....	7	.....	7
Union	.....	.....	.....	.....	.....	.....	.....	88	35	123
Williamson	7	.....	13	.....	.....	.....	25	21	6	72
White	.....	.....	4	.....	.....	.....	.....	.....	.....	4
Total	9	0	28	0	0	0	26	207	247	517
NOT LABELED	64	1	.....	2	.....	1	78	122	15	282
GRAND TOTAL	88	52	51	64	30	97	104	362	294	1,142

TABLE 2.—Families of Plants Represented in the Diet of Mourning Doves, Illinois.

Rank	*Plant Family*	*Per Cent of Total Volume*
1	Gramineae (Grass Family)	87.0
2	Euphorbiaceae (Spurge Family)	10.0
3	Leguminosae (Pulse Family)	0.6
4	Cannabinaceae (Hemp Family)	0.6
5	Compositae (Composite Family)	0.4
6	Phytolaccaceae (Pokeweed Family)	0.2
7	Commelinaceae (Spiderwort Family)	0.2
8	Amaranthaceae (Amaranth Family)	0.2
9	Onagraceae (Evening-Primrose Family)	0.1
10	Cruciferae (Mustard Family)	0.1
11	Oxalidaceae (Wood-Sorrel Family)	0.1
12	Malvaceae (Mallow Family)	0.1
13	Capparidaceae (Caper Family)	0.1
14	Polygonaceae (Buckwheat Family)	0.1
15	Geraniaceae (Geranium Family)	trace
16	Rubiaceae (Madder Family)	T
17	Moraceae (Mulberry Family)	T
18	Cucurbitaceae (Gourd Family)	T
19	Labiatae (Mint Family)	T
20	Chenopodiaceae (Goosefoot Family)	T
21	Convolvulaceae (Convolvulus Family)	T
22	Cyperaceae (Sedge Family)	T
23	Liliaceae (Lily Family)	T
24	Anacardiaceae (Cashew Family)	T
25	Boraginaceae (Forage Family)	T
26	Caryophyllaceae (Pink Family)	T
27	Verbenaceae (Vervain Family)	T
28	Rosaceae (Rose Family)	T
29	Plantaginaceae (Plantain Family)	T
30	Potamogetonaceae (Pondweed Family)	T
31	Aizoaceae (Sea-Purslane Family)	T
32	Vitaceae (Vine Family)	T
33	Caprifoliaceae (Honeysuckle Family)	T
34	Portulacaceae (Purslane Family)	T
35	Violaceae (Violet Family)	T
36	Cornaceae (Dogwood Family)	T
37	Urticaceae (Nettle Family)	T

species of foxtail grasses ranked among the first ten food items; giant foxtail was fourth, green foxtail fifth, and Italian millet eighth. Collectively, the four species of foxtail grasses yielded 24% of the total volume.

Some food items ranked high in frequency of occurrence but were relatively unimportant volumetrically because of small size and number. Common crabgrass, ranking third in frequency, was tenth by volume. Milk purslane, having a seed less than ½mm in diameter, ranked sixth by frequency, and 30th by volume. Nodding spurge ranked fourth by frequency, and, although having one of the smallest seeds, ranked sixth volumetrically; in three instances, over 10,000 seeds of this species occurred in a single crop.

Some food items because of their large size or number ranked prominently by volume despite a low frequency of occurrence. Copperleaf, ninth by volume, occurred in about 5% of the crops, ranking 29th by frequency of occurrence. Common hemp, occurring in large numbers

in only nine crops, ranked 13th by volume.

Only ten food items in two plant families, grasses (Gramineae) and spurges (Euphorbiaceae), occurred in quantities of more than 1% of the entire food volume (Table 3). Combined, these yielded 93% of the total volume; nodding spurge, sand croton, and copperleaf were the only representatives that were not grasses. According to Korschgen (1955) doves in Missouri rely most heavily on ten important foods which comprised 90.5% of the seasonal diet. Included were four plant families: Gramineae, Euphorbiaceae, Leguminosae, and Compositae.

Animal matter yielded only 0.07% of the total volume. Ants (Formicidae) made up over one-half of this, and snails (Gastropoda) about one-fifth. Some authors (Rosene, 1939 and Pearson and Webb, 1942) suggest that the low occurrence of animal materials in the diet of mourning doves is an indication that such items are taken incidentally with seeds or grit. Korschgen (1955), however, noted the presence of both live and dead snails. This fact, together with the substantial numbers of snails taken by individual birds, was pointed out as indication that

TABLE 3.—Food Items Comprising One-tenth Per Cent or More by Volume Which Occurred in Crops of 1142 Mourning Doves, Illinois.

VOLUME		FOOD ITEM	FREQUENCY	
Rank	*Per Cent*		*Number of Crops*	*Per Cent*
1	46.4	Wheat (*Triticum aestivum*)	517	45.3
2	13.7	Corn (*Zea mays*)	388	33.9
3	12.3	Yellow Foxtail (*Setaria lutescens*)	659	57.7
4	5.6	Giant Foxtail (*Setaria faberii*)	199	17.4
5	4.1	Green Foxtail (*Setaria viridis*)	296	25.9
6	3.6	Nodding Spurge (*Chamaesyce maculata*)	410	35.9
7	3.5	Sand Croton (*Croton glandulosus*)	144	12.6
8	1.5	Italian Millet (*Setaria italica*)	77	6.7
9	1.4	Copperleaf (*Acalypha ostryaefolia*)	53	4.6
10	1.3	Common Crab Grass (*Digitaria sanguinalis*)	452	39.5
11	.6	Rye (*Secale cereale*)	31	2.7
12	.6	Prairie Tea (*Croton monanthogynus*)	42	3.7
13	.6	Common Hemp (*Cannabis sativa*)	9	.8
14	.5	Trailing Wild Bean (*Strophostyles leiosperma*)	274	23.9
15	.4	Common Ragweed (*Ambrosia artemisiifolia*)	129	11.3
16	.4	Hogwort (*Croton capitatus*)	42	3.7
17	.3	Witch Grass (*Panicum capillare*)	228	19.9
18	.3	Flowering Spurge (*Euphorbia corollata*)	69	6.0
19	.3	Switch Grass (*Panicum virgatum*)	105	9.2
20	.2	Pokeweed (*Phytolacca americana*)	137	12.0
21	.2	Day Flower (*Commelina erecta*)	19	1.7
22	.2	Painted Leaf (*Poinsettia heterophylla*)	17	1.5
23	.2	Smooth Crab Grass (*Digitaria ischaemum*)	175	15.3
24	.1	False Poinsettia (*Poinsettia dentata*)	34	2.9
25	.1	Downy Paspalum (*Paspalum pubescens*)	101	8.8
26	.1	Prostrate Amaranth (*Amaranthus graecizans*)	20	1.8
27	.1	Johnson Grass (*Sorghum halepense*)	17	1.5

they are not taken accidentally, but rather to fill a physiological need. McClure (1941) found that adult doves fed substantial numbers of snails to their young, and assumed that they filled a calcium requirement. Data from the current study supported the views of the latter two investigators. Not only were large numbers of snails found in individual crops, but the size of some was such that they could hardly have been taken accidentally.

Grit occurred in 298 crops (26%); particles were most often the texture of fine sand, but ranged in size from that of fine soil to a small soybean. Clear, quartz-like particles, sometimes tinted a light blue or red, were common. The occurrence of soil in some crops was probably due to incidental ingestion along with seeds taken in muddy or dusty situations.

Sizable, jagged-edged pieces of glass occurred in several crops. This fact, linked with an apparent preference for clear quartz-like grit particles, would suggest an attraction to bright, sparkling objects. Miscellaneous items that occurred in single crops included a ctenoid fish scale and a small mammal dropping.

Food Utilization as Related to Major Soil Types and Land Use.[1] The counties from which dove crops were available represent the major physiographic divisions (Leighton, Ekblaw and Horberg, 1948) and soil groups (Braun, 1950) of Illinois. An analysis of the food habits data was attempted to evaluate possible relationships of kinds of foods utilized with different soil types and patterns of land use. Although certain correlations are evidenced by the discussion to follow, the limitation in number as well as seasonal distribution of samples from some regions did not permit conclusive summation of the results derived.

Grey-Brown Podzolic Soils. Hancock County, on the west central border of the State, is the only representative of the grey-brown podzolic soils. Agriculturally, this County is engaged primarily in livestock production (Table 4). Over 32% of the farmland is utilized for pasture, 24% for corn, and 4% for wheat; 14% is forested.

Wheat (56%) and corn (33%) both occurred in the diet of doves in volumes larger than the average for all counties (46% and 14%, respectively). Cultivated species contributed 89% of the total food volume as compared to 62% for all counties combined. That production of these crops alone was not responsible for their relative importance in the diet of doves is shown by the fact that though acreage planted to wheat in the County is among the lowest, the occurrence of wheat in these crops is high. As doves do not utilize standing grain, cultivated seeds taken as food are usually those grains wasted in harvest or the feeding of livestock, or salvaged from livestock droppings (Pearson and Webb, 1942). Extensive livestock production is probably responsible for the high percentages of wheat and corn in the diet of doves from Hancock County.

Yellow foxtail, the third ranking food item, comprised over 7% of the

[1] For detailed tabular data consult thesis by senior author on file in Library, Southern Illinois University, Carbondale.

total volume, and made up about two-thirds of the non-cultivated foods. Prostrate amaranth (1%), the fourth most important food, did not rank in the first ten food items in any of the other counties.

Prairie Soils. Included in the prairie soils are the most fertile and productive farmlands in Illinois; Champaign County is the only representative. Land use in this County is one of intense agriculture (Table 4). The level topography, good permeability, and high fertility of the soil make inter-tilled crop production the primary and most profitable consideration. The percentage of land in corn (38%) is the highest of all the counties sampled, while that in pasture (9%) is the lowest; only 2% of the farmland is wooded.

Wheat (44%) was the number one food item of doves in Champaign County, and occurred in about the same volume (46%) as that of the statewide average. Corn (6%) did not correlate with its high production in the County as it ranked only fourth, making up less than one-half of the per cent volume (14) recorded for corn in the summary for all counties. As Champaign has little livestock feeding and the corn harvest had not begun at the time the doves were harvested, corn was not widely available. Foxtail grasses, produced in abundance between rows of inter-tilled crops such as corn and soybean, contributed 38% of the total volume.

Wisenboden Soils. Mason County, representing the wisenboden soils, shows 27% of the farmland in corn production; 11% is planted to wheat (Table 4). The rye acreage (3%) is almost five times that of any of the other counties. Only 11% of the acreage is grazed while 8% is in woodland.

By volume, cultivated species yielded 38% of the foods of doves from Mason; wheat made up 34%. This cereal, although taken in larger quantities than any other food and occupying a greater acreage than in all other counties, composed 12% less by volume of total food consumption than the total for all counties (46%). Sand croton (23%) was the second most important food in the County; it ranked no higher than fifth in any of the other counties. Yellow foxtail ranked third, contributing 16% of the total food volume. The absence of giant foxtail in appreciable amounts, however, made the total volume of foxtail grasses less than the average for all counties despite the large volume of yellow foxtail. Common crabgrass (8%), ranking fourth by volume, was five times higher than in other counties. Wild hemp, recorded only from crops in Mason, was fifth in rank yielding over 5% of the total food volume. Corn, in seventh place, showed the lowest volume (2%) of all counties. Numerous sandy areas in the Illinois River basin, and extensive idle lands in the County are probably responsible for the wide deviation from the pattern of food utilization in other counties.

Planosols. Macoupin, Clinton, Jefferson, Franklin, Williamson, and Hamilton counties and the northeastern portion of Jackson County represented the planosol soils. Because most of Jackson is included in another soil group, it will not be discussed in this section. Land use in these counties, with a few excep-

TABLE 4.—Agricultural Land-Use in 12 Counties Where Crops of Mourning Doves Were Collected. (Illinois Cooperative Crop Reporting Service 1956)

Soil Group and County	Acreage In Farms	Per cent In Corn	Per cent In Wheat	Per cent In Rye	Per cent In Pasture	Per cent In Woodland
Grey-brown Podzolic						
Hancock	457,418	24	4	0.5	32	14
Prairie Soils						
Champaign	595,667	38	5	0.1	9	2
Wisenboden Soils						
Mason	309,922	27	11	2.9	11	8
Planosols						
Clinton	277,060	21	14	0.2	15	10
Franklin	184,670	20	9	0.4	23	10
Hamilton	210,527	25	6	0.6	25	8
Jefferson	313,613	21	6	0.6	23	11
Macoupin	505,302	25	9	0.4	28	16
Williamson	133,245	18	4	0.2	35	12
Red and Yellow Podzolic						
Alexander	94,975	21	5	0.3	18	27
Jackson	291,586	18	7	0.4	18	21
Union	185,352	16	3	0.2	29	20

tions, is comparatively uniform (Table 4). Williamson, the southernmost county in the planosol group, shows the greater deviation. Here land devoted to pasture is double that of corn, the most important inter-tilled crop and wheat and rye production is the lowest of the counties.

In Macoupin, Clinton, Jefferson, Franklin, and Hamilton, 20% to 25% of the acreage is in corn. The per cent farmland planted to wheat ranges from 4 to 9 in all except Clinton where it is 14%; acreages in rye are uniformly low (0.2% to 0.6%). The per cent of land in pasture varies from 20 to 28 except in Clinton where it is only 15; woodland varies from 5% to 16%, and is the least uniform land use in these counties.

Wheat was the number one food item in all but Hamilton and Williamson where it ranked second. In Macoupin, Franklin and Clinton, this cereal composed 86%, 85% and 76% of the food volume, respectively. Corn was the highest ranking food in Hamilton and Williamson, comprising about 47% and 33% of the volume, respectively. Almost one-fourth of the food volume of doves in Jefferson County was corn; it yielded no more than 11% in the remaining counties of this soil group. Cultivated species contributed almost 97% of the food volume in Macoupin, and over 90% in Franklin.

The foxtail grasses ranked relatively high in all of the counties of this soil group except Jefferson where it yielded less than 1%. This is not significant as only seven crops of doves were available from Jefferson. In Williamson, where cultivated crops did not greatly dominate the volume of food consumed, foxtail grasses comprised over 26% of the total.

Johnson grass ranked fifth by volume in Williamson. This is the only County in which this species was one of the ten most important foods, though it grows in greater profusion in Alexander and Union.

Red and Yellow Podzolic Soils. Counties representing the red and yellow podzolic soils are Union, Alexander, and Jackson. Cereal crop production in these counties is low, livestock production high, and the percentage of woodland is highest of all the counties (Table 4). A major agronomic problem in Alexander and Union is the prevalence of Johnson grass and the vigorous competition it offers inter-tilled crops.

Alexander was the only county in which wheat did not rank among the top ten food items; it also had the distinction of being the only County in which either wheat or corn did not rank as the most important food. Copperleaf, which was among the first ten food items in only three counties, was the number one food item, composing almost 50% by volume. Cultivated crops yielded about 10% of the total volume, the lowest recorded for any county. However, Alexander was probably not sufficiently well represented by crops to offer legitimate data for making comparisons (Table 1).

Foods utilized by doves collected in Jackson County were similar to those recorded for the entire State. The most significant difference was a smaller volume of the foxtail

grasses (15% as compared to 24%) and more than a doubled volume of spotted spurge (9% versus 4%).

Though wheat was the number one item in Union County, by volume (28%) it was little more than one-half that of the average for all counties (46%). The foxtail grasses collectively comprised over 45% of the total volume. Italian millet, amounting to 11% by volume, occurred in the first ten food items in only one other county.

Yearly Comparison. Inasmuch as the crops utilized for the study were collected over an 8-year period, an attempt was made to determine the presence of trends in year to year utilization of individual food items. Because of insufficient crops from some counties for consecutive years (Table 1), the data were arranged so as to represent central and southern Illinois; each region was treated separately. Central Illinois included Champaign, Hancock, Macoupin, and Mason counties and southern Illinois Alexander, Clinton, Franklin, Hamilton, Jackson, Jefferson, Union, and Williamson counties.

A total of 342 crops from central Illinois represented every year from 1948 to 1955 except 1953. All of the crops for 1951 were from Mason County, those for 1954 from Macoupin, and those for 1955 from Hancock (Table 1). Food utilization in these years probably reflected that of a specific county rather than true yearly variations for all of central Illinois.

Crops from southern Illinois totaled 517 and represented 1949, 1953, 1954 and 1955 (Table 1). Two of the four years probably contained insufficient numbers of samples to be considered significant. Only 28 and 26 crops for 1949 and 1953, respectively, were obtained, whereas 207 were available for 1954 and 247 for 1955; 25 of the 26 crops representing 1953 were from Williamson County.

A comparison of data from the years represented in both central and southern Illinois (1949, 1954, and 1955) showed little agreement. The only similarities were a high percentage of foxtail grasses and a low percentage of spurges in 1949, and the large percentage of corn in 1955. Data from 1954 were completely different in the two analyses.

The yearly comparison of these data is probably of little value because of the large number of variables which probably distort the true picture. Some years are represented by an insufficient number of crops and others are dominated by or completely represented by a single county. As food utilization has been shown to vary greatly in the various counties, such data must be considered with caution. Even should an adequate number of crops in a complete series of years be available from a single county, the actual hunting location becomes an active and important variable.

An illustration of the importance of the location where crops are collected was provided by data from Hamilton County. All 13 crops representing this County were obtained during one hunt. The contents of these crops were virtually identical and important food items occurred in similar proportions in each crop. Twelve of the 38 food items occurred in every crop, three in 12 crops, and

TABLE 5.—Top-Ranking Foods According to Volume Eaten by Mourning Doves During Early, Middle and Late September.

Rank by % Volume	September 1 to 10	September 11 to 20	September 21 to 30
1	*Triticum aestivum* 47.9	*Triticum aestivum* 30.9	*Triticum aestivum* 44.9
2	*Zea mays* 12.3	*Setaria lutescens* 15.5	*Zea mays* 24.8
3	*Setaria lutescens* 11.9	*Setaria faberii* 12.8	*Setaria lutescens* 8.6
4	*Setaria faberii* 5.3	*Zea mays* 9.8	*Setaria viridis* 5.8
5	*Croton glandulosus* 4.3	*Chamaesyce maculata* 9.8	*Setaria faberii* 5.3
6	*Chamaesyce maculata* 3.5	*Acalypha ostryaefolia* 6.7	*Chamaesyce maculata* 4.1
7	*Setaria viridis* 3.3	*Setaria italica* 4.2	*Digitaria sanguinalis* 1.5
8	*Digitaria sanguinalis* 1.9	*Croton glandulosus* 1.6	*Ambrosia artemisiifolia* 1.1
9	*Setaria italica* 1.4	*Cannabis sativa* 1.2	*Strophostyles leiosperma* 1.1
10	*Acalypha ostryaefolia* 1.1	*Setaria viridis* 1.1	*Euphorbia corollata* 0.9

one in 11 crops. These 16 items made up 94% of the total food volume.

Because such a uniform food habit picture may be obtained from doves that have fed in the same area, it seems apparent that the contents of crops depend on when and where the birds were collected. The great mobility of the mourning dove and its utilization of foods according to availability further complicates any year to year comparison.

Seasonal Comparisons. In North Carolina, Cummings and Quay (1953) found that utilization of various foods by the mourning dove was determined largely by seasonal availability. Wheat was important through most of the summer, but was replaced in late summer by maturing pokeweed and foxtail. In the fall, when crabgrass and paspalum matured, these became the most important foods.

Though almost all of the crops utilized by the current study were taken during September (the hunting season), an effort was made to determine the occurrence of any significant change in feeding habits during this 1-month period. The ripening of various weed seeds and

TABLE 6.—Top-Ranking Foods Based on Per Cent Total Volume According to Sex and Age of Mourning Doves.

Rank by % Volume	Juvenile Male (27 crops)	Juvenile Female (21 crops)	Adult Male (66 crops)	Adult Female (66 crops)
1	*Triticum aestivum* 40.3	*Triticum aestivum* 40.7	*Triticum aestivum* 45.0	*Triticum aestivum* 47.8
2	*Croton glandulosus* 20.7	*Croton glandulosus* 24.6	*Setaria lutescens* 16.8	*Setaria lutescens* 24.0
3	*Setaria lutescens* 10.9	*Setaria lutescens* 7.6	*Setaria faberii* 9.0	*Croton glandulosus* 9.6
4	*Zea mays* 6.9	*Cannabis sativa* 7.4	*Croton glandulosus* 7.8	*Digitaria sanguinalis* 4.4
5	*Croton monanthogynus* 4.1	*Croton monanthogynus* 4.6	*Zea mays* 5.1	*Setaria faberii* 3.5
6	*Cannabis sativa* 3.4	*Commelina erecta* 4.2	*Digitaria sanguinalis* 6.2	*Cannabis sativa* 2.5
7	*Ambrosia artemisiifolia* 3.3	*Digitaria sanguinalis* 2.4	*Setaria viridis* 3.1	*Chamaesyce maculata* 2.4
8	*Setaria viridis* 2.7	*Chamaesyce maculata* 1.7	*Cannabis sativa* 2.1	*Zea mays* 2.0
9	*Chamaesyce maculata* 1.5	*Zea mays* 1.0	*Poinsettia heterophylla* 1.1	*Setaria viridis* 1.2
10	*Secale cereale* 1.4	*Setaria viridis* 0.9	*Secale cereale* 0.9	*Secale cereale* 0.7

the initiation of crop harvest might be expected to alter availability and hence utilization of various foods.

September was arbitrarily divided into three periods: 1st through 10th, 11th through 20th, and 21st through 30th. Date of kill was available for 776 crops collected during these periods. As greatest hunting enthusiasm and success appears to occur during the first part of the season, the bulk of the crops (609) was collected during the first period. The second and third periods were represented by 131 and 36 crops, respectively.

Wheat decreased from 48% in the first period to 31% in the second period, but increased to 45% in the third period (Table 5). Corn, making up 12% of the volume in the first period, totaled 2% less in the second period. This small drop is probably not significant, but a 100% increase in the third period probably reflected the beginning of the corn harvest and a subsequent source of waste grain.

Coincidental with decreased importance of cultivated crops in the second period, the foxtail grasses and spurges showed a substantial increase (Table 5). In the third period, the increase of cultivated crops to their greatest volume was accompanied by a decrease by almost one-half in the noncultivated species. This seemed to indicate that increased availability of cultivated foods resulted in a partial replacement of weed species in the diet.

Sex and Age Comparisons. Data for both sex and age were available for 180 of the crops from doves collected in central Illinois. In order to determine whether either of these classifications might affect food utilization, the crops were divided into four sex and age categories, and analyses made of each. Juvenile males were represented by 27 crops, juvenile females 21 crops, adult males 66 crops, and adult females 66 crops.

The overall ranking of food items in each category was similar (Table 6); six of the top ten food items were represented in each sex and age class. However, when volumes of individual food items were ana-

TABLE 7.—Collection Dates for 176 Crops of Mourning Doves for which Both Sex and Age Were Available.

Period Harvested	Juvenile Males (27)	Juvenile Females (20)	Adult Males (64)	Adult Females (65)
August	30%	15%	27%	23%
Sept. 1-10	48%	80%	47%	49%
Sept. 11-20	15%	5%	17%	16%
Sept. 21-30	7%	0	3%	9%
October	0	0	6%	3%
TOTAL	100%	100%	100%	100%

lyzed, differences between sexes and between age classes were apparent. It is recognized that the small number of crops for which data were available, together with variables such as differences in time of migration between sex and age classes, do not permit positive conclusions.

The volume of wheat varied less than 8% among all sex and age groups (40% to 48%), but occurred in 5% to 6% greater total volume in adult birds (Table 6). The volume of corn varied from 1% to 7% but the amount consumed by males was 2.5 to 3.5 times greater than that recorded for females.

Foxtail grasses made up 29% of the food volume of both male and female adults (Table 6). Juvenile females (9%) utilized less of this food than juvenile males (14%); the latter utilized about 50% less than adults. A close similarity between both sexes of adults and both sexes of juveniles, and the variation between adult and juvenile birds are evident.

A similar relationship to that above is apparent with regard to the spurges, which appeared in greatest quantity in crops of juvenile birds (Table 1). The 27% and 31% volumes present in juvenile males and females, respectively, were 2 to 3 times greater than in adults (9% in males and 12% in females). Most of the difference in volume of the spurges utilized by adults and juveniles was due to the large quantity of crotons consumed by juveniles.

Because variations in time of migration by the different sex and age classes might have reflected seasonal differences in food utilization, dates of collecting of doves in each class were checked. Only minor differences were apparent in the sex and age categories (Table 7). Assuming that the objective and random nature of this type of analysis equalizes other variables (location and year of collection, etc.), the marked variations noted in the different categories might be attributed to preferences.

On the basis of the data relating to sex and age, the following facts seemed apparent: (1) Wheat, though occurring in comparatively uniform volumes in each sex and age group, was more heavily utilized by adult birds. (2) Males made greater utilization of corn than did females. (3) Adult birds seemed to prefer foxtail grasses over spurges, whereas the reverse was true for juveniles.

Summary

Investigation of the food habits of mourning doves in Illinois was made on the basis of 1142 crops obtained largely during the September hunting seasons of 1948-1955. The sample represented 13 counties in central and southern Illinois.

Animal material composed 0.07% of the total volume, grit 0.04%, and plant seeds 99.89%. Only ten food items, representing two plant families, comprised more than 1% of the September diet by volume. Grasses composed 87.0% and spurges 10.4% of the volume. Cultivated species provided 62% of the food.

Yellow foxtail occurred most frequently (58%), but wheat and corn comprised a greater volume (46.4 and 13.7% respectively). Four species of foxtail grasses ranked in the

first ten food items and collectively provided 23.5% of the volume.

Analyses were made to correlate dove food habits with five major soil types represented by counties where crops were collected. Comparative food utilization by doves from the different soil types varies chiefly in the volumes of cultivated species. Correlations with soil type and crop production were not conclusive.

The greatest yearly variations in food consumed were in the utilization of cultivated crops. However, the yearly comparisons were unsatisfactory due to the large number of variables that could not be related to causative factors.

Generally food utilization showed few marked changes from early to middle to late September. However, a 100% increase in corn utilization during the last 10 days of the month possibly reflected a beginning of corn harvest.

Wheat was more heavily utilized by adult birds than young, whereas corn was taken in larger quantity by males than by females. The foxtail grasses were more heavily utilized than the spurges by adult birds, while the reverse was true for juveniles.

Literature Cited

Bent, A. C. 1932. Life histories of North American gallinaceous birds. U. S. Nat. Museum Bull., Vol. 162, 490 pp.

Braun. E. L. 1950. Deciduous forests of eastern North America. The Blakiston Company, Philadelphia, 596 pp.

Cummings, B. G., and T. L. Quay. 1953. Food habits of the mourning dove in North Carolina. Jour. Elisha Mitchell Sci. Soc., 69(2): 142-149.

Davison, V. E. 1940. A field method of analyzing game bird foods. Jour. Wildlife Mgt., 4(2): 105-116.

Illinois Cooperative Crop Reporting Service. 1956. Illinois annual farm census (1955). Ill. Dept. Ag., 48 pp.

Knappen, P. 1938. Preliminary report on some of the important foods of the mourning dove in the southeastern United States. Trans. N. Am. Wild. Conf., 3:776-781.

Korschgen, L. J. 1955. A study of the food habits of Missouri doves. Missouri Conservation Commission Fish and Game Division, P-R Series, Vol. 12, 31 pp.

Leighton, M. N., G. E. Ekblaw, and L. Horberg. 1948. Physiographic division of Illinois. Jour. Geol., 56(1): 16-33.

Leopold, A. S. 1943. Autumn feeding and flocking habits of the mourning dove in southern Missouri. Wils. Bull., 55(3): 151-154.

McClure, H. 1941. Ecology and management of the mourning dove, *Zenaidura macroura* (Linn.), in southwest Iowa. Ia. State Coll. Jour. Sci., 16(1): 93-95.

Larimer, E. J. 1960. Winter foods of the bobwhite in southern Illinois. Ill. Nat. His. Sur. Biol. Notes, 42:1-35.

Murry, R. E. 1952. A food habit study of the mourning dove in Louisiana. Unpublished M. S. thesis. La. State Univ. Libr., 49 pp.

Pearson, A. M., and L. G. Webb. 1942. Mourning dove a strict vegetarian. Ala. Conserv., 13:3, 12.

Rosene, W. Jr. 1939. A preliminary investigation of the food habits of the mourning dove in Alabama. U. S. Dept. Ag. Wildlife Mgt. Leaflet 133, 10 pp.

Russell, D. H. 1954. Kentucky mourning dove study. Kentucky Department Fish and Wildlife Resources Fed. Aid Proj. March, 90 pp.

Manuscript received July 17, 1961.