SPRING-SUMMER FOODS OF LESSER PRAIRIE CHICKENS IN NEW MEXICO[1]

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Abstract: Spring and summer foods of lesser prairie chickens (Tympanuchus pallidicinctus) in eastern New Mexico were studied in 1976-78. Spring foods were mainly green vegetation (79% volume), especially shinnery oak catkins (32%). Shinnery oak acorns were also important (15% volume). Summer foods of adult-size birds were mostly insects (55%), especially grasshoppers (Acrididae and Tettigoniidae, 39%) and treehoppers (Membracidae, 10%). Use of green vegetation was down to 23%, but use of acorns rose to 21% in summer. Foods of chicks and young juveniles were 99 to 100% insects, especially grasshoppers (chicks 62%, young juveniles 88%). The shinnery oak-grassland community is important in providing prairie chicken foods. Large-scale eradication of this community should be avoided, but control of shinnery is needed in some areas to provide tallgrass cover for nesting and other uses.

Lesser prairie chickens (Tympanuchus pallidicinctus) occupy semi-arid grasslands that typically include a large component of shrubs, either shinnery oak (Quercus havardii) or sand sagebrush (Artemisia filifolia). A number of studies of habitat-use have been conducted in these communities, but few studies have included food habits. Jones (1963a, 1963b, 1964) studied food habits in each month in the sand sagebrush-grasslands of the Oklahoma panhandle. More cursory studies were conducted in shinnery oak-grassland by Davison (1935) and Martin et al. (1951) in western Oklahoma, by Frary (1957) in eastern New Mexico, and by Crawford (1974) and Crawford and Bolen (1976a, 1976b) in northwestern Texas.

We present results from a 3-year study (1976-78) of spring and summer food habits in shinnery oak-tallgrass in eastern New Mexico.

[1]New Mexico State University Agricultural Experiment Station Journal Article No. 763. Study supported in part by United States Department of Interior, Bureau of Land Management, Contract Nos. YA-512-CT6-61; YA-512-CT7-10; YA-512-CT8-15.

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We are indebted to H.R. Suminski and other former wildlife science students at New Mexico State University for field assistance. J.F. Schwarz and several other employees of the U.S. Department of the Interior, Bureau of Land Management also assisted in collecting prairie chickens for study. The New Mexico Department of Game and Fish provided collection permits.

STUDY AREA AND METHODS

The study area (15,500 ha) is in the Mescalero Sands, immediately west of the Caprock (western edge of the Llano Estacado), north of U.S. Highway 380 and south of U.S. 70. Located 65 km east of Roswell, the area is relatively isolated from cultivation.

About 90% of the study area is occupied by sandy, often duny soil that supports a shinnery oak-tallgrass community. Principal vegetation of this community includes shinnery oak, sand bluestem (Andropogon hallii), little bluestem (Schizochyrium scoparium), three-awn (Aristida spp.), dropseed (Sporobolus spp.), hairy grama (Bouteloua hirsuta), and a variety of forbs. Various degrees of degradation resulting from grazing by livestock occur in this community. Some locations, especially far from water, support heavy stands of climax species (sand bluestem and little bluestem) interspersed with shinnery oak while other areas have heavy stands of shinnery with sparse, heavily grazed bluestem cover.

The remaining 10% of the study area consists of flat expanses of clay soil supporting a shortgrass community occurring as scattered parcels within the expansive shinnery oak-tallgrass community. Principal species are blue grama (Bouteloua gracilis), buffalograss (Buchloe dactyloides), three-awn, broom snakeweed (Xanthlocephalum sarothrae), and forbs, especially croton (Croton spp.). In some areas, mesquite (Prosopis glandulosa) is a conspicuous invader.

Climate (Maker et al. 1971) is semi-arid and continental, with distinct seasons, wide daily and annual ranges in temperature, and plentiful sunshine. Nearly 3/4 of the annual precipitation ($\bar{X}$= 35.5 cm/yr) falls during May-October, mostly from brief but often intense thundershowers.

Prairie chickens were collected randomly from the shinnery oak-tallgrass community. Age of each bird collected was determined by techniques of Copelin (1963) and Campbell (1972). Age groups used to segregate birds for food habits were chicks (approx. 1-4 weeks), young juveniles (approx. 5-10 weeks), and adult-size (approx. 11 weeks and older). Birds were placed in groups by comparing weight and plumage with birds in radio-marked broods of known-age. Composition of the diet for each season and/or age group was determined by the aggregate percent method (Martin et al. 1946).

In all 3 years, the March-April diet was mostly green vegetation and the June-August diet mostly insects. Hence, these 2 periods were readily labelled spring and summer, respectively, in terms of prairie chicken diet. However, the May diet was springlike in 1976, but was summerlike in 1977 (no crops collected May 1978). The extensive use of insects (summerlike) in May 1977 apparently was due to high rainfall in March-April (2.39 cm, compared with 0.89 in 1976 and 0.78 for 30-year mean), resulting in earlier availability of insects. As a result of the annual variation in May foods, we recognize a typical spring diet occurring in March-April each year, plus May in years typical of spring food availability. The summer diet occurs in June-August of each year, plus May in years of early insect availability. Our designation of spring and summer periods in relation to lesser prairie chicken diet essentially parallels that of Davison (1935:87), who identified spring as "...the gobbling season from late February until the crop of insects are again available."

SPRING FOODS

The spring diet (Table 1) was mostly (78.7%) green vegetation, including shinnery oak catkins (31.8%) and wild buckwheat (Eriogonum annuum) leaves (20.1%). Shinnery acorns (15.5%) were important minor foods. Shinnery oak was the species used most in spring; its catkins, acorns, and leaves collectively composed 49.1% of the diet.

Availability of food sources played a large part in determining the spring diet. Shinnery oak was the most abundant plant present, composing 29.1 to 48.8% of the vegetation (Davis et al. 1979), and its catkins were readily available in spring. Insects were relatively scarce.

Table 1. Percentage composition of the spring diet (Mar-Apr 1976-78, plus May 1976) of lesser prairie chickens in eastern New Mexico, 1976-78, N=21.

Food item	Mean	Standard error
Mast and Seeds		
Shinnery oak (Quercus havardii) acorns	15.2	5.7
Unidentified seeds	0.3	
Total mast and seeds	15.5	5.8
Vegetative Material		
Shinnery oak (Quercus havardii) catkins	31.8	9.7
Wild buckwheat (Eriogonum annuum) leaves	20.1	6.6
Broom snakeweed (Xanthocephalum sarothrae) leaves	6.4	4.6
Composite (Compositae) flowers	2.9	
Bitterweed (Hymenoxys spp.) leaves	2.7	
Downy phlox (Phlox sp.) leaves	2.7	
Shinnery oak (Quercus havardii) leaves	2.1	
Buckley penstemon (Penstemon buckleyi) leaves	2.0	
Spurge (Euphorbia spp.) leaves	1.9	
Broom groundsel (Senecio spartoides) leaves	1.5	
Unidentified leaves	0.9	
Ratany (Krameria spp.) leaves	0.8	
Unidentified sprouts	0.7	
Unidentified flowers	0.7	
Vervain (Verbena spp.)	0.7	
Rubber rabbitbrush (Chrysothamnus nauseosus) leaves	0.4	
Evening primrose (Oenothera serrulata) leaves	0.3	
Narrowleaf gromwell (Lithospermum incisum) leaves	0.1	
Total vegetative material	78.7	7.6
Animals		
Treehoppers (Membracidae)	3.7	
Scarab beetles (Scarabaeidae)	1.3	
Leaf beetles (Chrysomelidae)	0.3	
Snout beetles (Curculionidae)	0.3	
Unidentified beetles	0.3	
Ants (Formicidae)	T[a]	
Total animals	5.9	3.8

[a]Trace (less than 0.1%)

Our spring data are in general agreement with the few and limited previous studies of spring food habits in shinnery oak-grassland. Martin et al. (1951) noted that 81% of the contents of the crops of 7 birds collected in spring (Apr-May),

in western Oklahoma was plant material while 19% was animal; we found 94.2% plant and 5.8% animal. Martin et al. (1951) also noted high use of oak (52%) from fall through spring; we found 49.1% in spring. Davison (1935:87) reported that in western Oklahoma (sample size not specified):

> "Spring usually finds plenty of acorns and greens for the birds...In the spring of 1935, an acorn was a rarity and the stomachs examined contained no food except green leaves and the blossoms of the oak. Many birds were observed as they fed on these oak flowers, showing it to be their chief food."

The only previous study from shinnery oak-grassland in New Mexico (Frary 1957) provided no comparative spring data.

Our findings for spring were parallel to those of Jones (1963a, 1963b, 1964) despite his working in a different habitat (sand sagebrush-grassland), where oak was scarce or absent, and reporting data from droppings instead of crop contents. Jones (1963a:49) identified March-May as spring months, and the 291 droppings he analyzed for those months showed (Jones 1964:113) that green vegetation (although different species from our area) was the principal food in March and April. Less green material was eaten in May, when the diet became more summerlike by the inclusion of more insects and seeds.

SUMMER FOODS (ADULT-SIZE BIRDS)

A change in the diet of adult-size birds occurred between spring (Table 1) and summer (Table 2). Insects, especially grasshoppers (Acrididae and Tettigoniidae) and treehoppers (Membracidae) made up most (55.3%) of the summer diet, in contrast with low use in spring. Use of green vegetation (23.3%) was less than 1/3 its spring value, and represented largely different species, especially erect dayflower (Commelina erecta), fame flower (Talinum parviflorum), and broom snakeweed. Use of acorns (21.2%) was approximately 1/3 greater than in spring. Total use of shinnery was down nearly 1/2 (to 22.5%) in summer, reflecting the large drop in use of catkins. The main spring-to-summer changes in diet were related clearly to large changes in food availability. Shinnery oak catkins virtually disappeared by late spring, and the new crop of acorns began to mature in summer. Great increases in abundance of insects and various forbs, including erect dayflower and fame flower, were observed in the field. Increases in insects in summer were noted by Davison (1935) and were documented by Jones (1963a:51-52) for western Oklahoma.

Our summer findings may not be directly comparable to those of other workers because of probable differences in handling of data from juvenile birds. We grouped data (Table 2) specifically from birds we considered to be adult size (at least 11 weeks of age). Neither Davison (1935) nor Martin et al. (1951) commented on ages of birds collected in summer, but they likely pooled data from all birds collected because sample sizes were small. Frary (1957) was unable to collect birds during May-August, and Jones (1963:772) included data from birds over 1 month of age with those of older birds.

Table 2. Percentage composition of the summer (Jun-Aug 1976-78, plus May 1977) diet of adult-size lesser prairie chickens in eastern New Mexico, 1976-78. N=18.

Food item	Mean	Standard error
Mast and Seeds		
Shinnery oak (*Quercus havardii*) acorns	21.2	8.1
Unidentified seeds	0.2	
Total mast and seeds	21.4	8.2
Vegetative Material		
Erect dayflower (*Commelina erecta*) leaves, flowers	7.6	[illegible]
Fame flower (*Talinum parviflorum*) leaves, flowers	5.2	5.2
Broom snakeweed (*Xanthocephalum sarothrae*) leaves	4.4	
Buckley penstemon (*Penstemon buckleyi*) leaves	2.8	
Insect galls from shinnery oak (*Quercus havardii*)	1.1	
Broom groundsel (*Senecio spartoides*) leaves	0.8	
Unidentified flowers	0.6	
Shinnery oak (*Quercus havardii*) leaves	0.2	
Spurge (*Euphorbia* spp.) leaves	0.2	
Daisy fleabane (*Erigeron* sp.) leaves	0.2	
Composite (Compositae) buds	0.2	
Total vegetative material	23.3	7.2
Animals		
Short-horned grasshoppers (Acrididae)	25.4	8.6
Long-horned grasshoppers (Tettigoniidae)	13.7	6.8
Treehoppers (Membracidae)	10.2	4.9
Ants (Formicidae)	3.1	
Mantids (Mantidae)	0.8	
Shield-backed bugs (Scutelleridae)	0.5	
Darkling beetles (Tenebrionidae	0.4	
Spiders (Araneida)	0.4	
Snout beetles (Curculionidae)	0.2	
Caterpillars (Lepidoptera)	0.2	
Silken fungus beetles (Crytophagidae)	0.2	
Moths (Lepidoptera)	0.1	
Robber flies (Asilidae)	0.1	
Total animals	55.3	9.3

Despite possible differences, our summer findings were similar to those of other studies in shinnery oak-grassland. Davison (1935:86) reported the summer (Jun-Aug) diet in western Oklahoma (sample size not given) to be "mostly insects", especially grasshoppers. Martin et al. (1951:97) reported that foods of 6 birds collected in western Oklahoma were

67% animal material (we found 55.3%) and that grasshoppers were the principal item in the animal diet.

Jones (1963a, 1963b, 1964) found that in 246 droppings collected during summer (Jun-Aug per Jones 1963a:64) in the sand sagebrush grasslands of northwestern Oklahoma, animal material (insects) was the main food in June (51.3%) and August (69.3%). Insects ranked second in July at 41.1%. The mean of these values, 53.9%, was practically the same as our 55.3%. Grasshoppers provided most of the animal portion of the diet.

Other studies have documented dietary changes from predominantly plant materials and few if any insects in spring to a much larger proportion of insects in summer in the greater prairie chicken (Tympanuchus cupido) (Judd 1905, Lehmann 1941, Schwartz 1945, Grange 1948, Jones 1963b) and the sharptail grouse (Pedioecetes phasianellus) (Grange 1948, Renhowe 1968, Sisson 1976). However, insects formed only small proportions of the summer diet of adult sharptails in Nebraska (Kobriger 1975) and greater prairie chickens in Kansas (Baker 1953), Illinois (Yeatter 1943), and Missouri (Korschgen 1962), and no studies of either species have revealed as high a proportion of insects in the summer diet as found for lesser prairie chickens in our study and in those by Davison (1935), Martin et al. (1951), and Jones (1963a, 1963b, 1964). Thus, the lesser prairie chicken is the only prairie grouse that eats more insects than plant material in summer.

Table 3. Percentage composition of the diet of lesser prairie chickens approximately 1-4 weeks of age (chicks) in eastern New Mexico during June-July, 1976-78. N=10.

Food item	Mean	Standard error
Mast and Seeds		
None		
Vegetative Material		
None		
Animals		
Short-horned grasshoppers (Acrididae)	49.5	10.2
Treehoppers (Membracidae)	26.1	12.0
Long-horned grasshoppers (Tettigoniidae)	12.1	5.4
Ants (Formicidae)	4.5	3.0
Mantids (Mantidae)	2.8	
Snout beetles (Curculionidae)	2.0	
Robber flies (Asilidae)	2.0	
Darkling beetles (Tenebrionidae)	1.0	
Cockroaches (Blattidae)	T[a]	
Total animals	100.0	

[a]Trace (less than 0.1%)

Table 4. Percentage composition of the diet of lesser prairie chickens approximately 5-10 weeks of age (juveniles) in eastern New Mexico during July-August, 1976-78. N=17.

Food item	Mean	Standard error
Mast and Seeds		
Shinnery oak (Quercus havardii)	0.5	0.6
Narrowleaf gromwell (Lithospermum incisum) seeds	0.1	
Total mast and seeds	0.6	0.6
Vegetative Material		
Erect dayflower (Commelina erecta) leaves, flowers	0.1	
Total vegetative material	0.1	
Animals		
Short-horned grasshoppers (Acrididae)	80.4	5.0
Long-horned grasshoppers (Tettigoniidae)	7.7	3.1
Mantids (Mantidae)	4.4	1.7
Snout beetles (Curculionidae)	3.1	
Crickets (Gryllidae)	1.8	
Treehoppers (Membracidae)	0.6	
Robber flies (Asilidae)	0.4	
Click beetles (Elateridae)	0.3	
Unidentified insects	0.3	
Leaf beetles (Chrysomelidae)	0.1	
Silken fungus beetles (Crytophagidae)	0.1	
Flies (Diptera)	0.1	
Total animals	99.3	0.6

SUMMER FOODS (BIRDS OF THE YEAR)

The crop contents of chicks (birds less than 5 weeks of age) were 100% insects, with the 2 families of grasshoppers composing 61.6% and treehoppers 12.1% (Table 3). However, the 2 youngest birds collected (under 2 weeks of age) contained 80% treehoppers. Juveniles approximately 5-10 weeks of age ate almost entirely grasshoppers (Table 4), and use of treehoppers was much less than for chicks (Table 3).

The high use of treehoppers by chicks, especially the smallest ones, may have resulted from selection of small prey and/or being incapable of feeding on many of the larger grasshoppers. Selection of larger prey by larger birds would explain the shift from treehoppers to greater quantities of grasshoppers by juveniles as the young birds increased in size.

Treehoppers, nearly absent from the diet of juveniles, reappeared in larger amounts in adult-size birds. This is inconsistent with the simple idea that larger birds eat larger insects.

However, data from individual crops show that adult-size birds ate treehoppers almost exclusively in May, when they ate no grasshoppers. Apparently, adults ate appreciable quantities of treehoppers in May because grasshoppers were not readily available, and chicks ate treehoppers (in Jun-Jul, when grasshoppers were abundant) because of their small size.

A small sample of 1 crop and gizzard and 7 droppings analyzed by Jones (1963a:77) showed that insects also were the principal food of lesser prairie chicken broods in northwestern Oklahoma, although he found more use of plant material (14.8%) than we did. The differential use of insects by chicks and juveniles versus adult birds was also documented for greater prairie chickens (Lehmann 1941; Yeatter 1943; Schwartz 1945; Baker 1953; Jones 1963a, 1963b; Renhowe 1968), sharp-tailed grouse (Judd 1905, Hart 1950, Kobriger 1965, Renhowe 1968, Pepper 1972, Sisson 1976), and for several other species of grouse (Johnsgard 1973).

MANAGEMENT CONSIDERATIONS

Lesser prairie chickens are closely associated with the shinnery oak-grassland community in much of their occupied range. In this community, at least in New Mexico, they derive most of their diet from a rather small number of plants (and associated insects) that are common in the less grassy areas. Shinnery oak provides preferred concealment for foraging birds of all age classes in summer (Davis et al. 1979), and is the most heavily utilized food of prairie chickens on a yearlong basis; its acorns, catkins, leaves, and galls in various combinations provide adult-size birds with approximately 50% of their diet in spring (Table 1), 25% in summer (Table 2), and from 50 to 70% in fall and winter (Davis et al. 1979). Several other important food plants (Tables 1, 2; Davis et al. 1979) also occur in association with shinnery oak; insects (especially grasshoppers and treehoppers) associated with the above plants are the main summer foods of all age classes (Tables 2, 3, 4).

Because of the importance of shinnery oak-grassland to prairie chickens for both food and cover, further large-scale eradication of this community should be avoided. Even the addition of grain fields to enhance fall and winter food sources, suggested by the work of Crawford (1974) and Crawford and Bolen (1976b), should be minimal. Grain fields may improve fall and winter food sources, but they displace natural vegetation that supplies not only fall-winter food but also spring and summer food as well as cover.

Where shinnery oak and other non-grassy species dominate the community, and bluestem grasses (especially sand bluestem) are scarce, it is probable that food is abundant and suitable cover for nesting and other uses is limiting (Davis et al. 1979). In such areas, a partial reduction in shinnery oak would be desirable. The findings of Davis et al. (1979) provided insight concerning desirable combinations of shinnery and other plants. They found the greatest abundance of lesser prairie chickens where basal composition of vegetation was approximately 58% grasses (with 27% sand bluestem and 5% little bluestem), 31% shrubs (29% shinnery), and 11% forbs. These plants were well scattered in the area, so that both food and cover were available nearly everywhere. Similar composition and interspersion can be achieved in shinnery-dominated areas by partial reduction of shinnery or possibly by applying herbicides in blocks (Doerr and Guthery 1980) or in swaths, leaving some untreated areas. In either case, control of grazing would be required to allow recovery and spread of bluestem grasses.

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September 17-18
1980

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Oklahoma State University
Publishing and Printing

September, 1980