Insects in Some Nebraska Crops as Food for Pheasant Chicks

R. W. Whitmore
University of Nebraska-Lincoln

K. P. Pruess
University of Nebraska-Lincoln

R.E. Gold
University of Nebraska-Lincoln

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ABSTRACT. Insect biomass was estimated for crops grown on an organic, a dryland, and an irrigated farm from 1 June to 15 July, the time period assumed important for Ring-necked Pheasant *(Phasianus colchicus)* nesting and chick dependence on insect food. Differences due to farming system were not detected. Total insect biomass production during the season was 2,555, 2,173, and 338 mg per square m for oats-sweetclover, oats, and sweetclover, respectively. Leafhoppers were the most abundant insects in oats and oats-sweetclover, with plant bugs the most abundant in sweetclover. Mean standing crop biomass (mg per square m) of only those insects acceptable as food for chicks was oats-sweetclover (509), oats (413), sweetclover (397), wheat (247), alfalfa (163), soybeans (46), and corn (38). Oats-sweetclover and oats were the only crops providing both nesting habitat and insect food for Pheasant chicks.

Insects are essential as food for Ring-necked Pheasant chicks. It is generally believed that oats *(Avena sativa)* or oats-sweetclover *(Melilotus officinalis)* provide adequate amounts of insects (Warner 1984) but few quantitative data are available. Whitmore et al. (1986) confirmed that these crops support many insects eaten by chicks.

Intensive agriculture, with use of commercial fertilizers, has resulted in a decline in the area planted to oats-sweetclover. Warner et al. (1984) associated the declining Pheasant population in Illinois with the trend toward monoculture in farming. The Nebraska Game and Parks Commission sponsors a habitat program in which farmers and ranchers receive payment for growing oats-sweetclover for a 2-year period. Sweetclover is interseeded in oats the first year and harvest of the oats crop is permitted. Sweetclover and oats stubble provide habitat during the second year. To evaluate this program, we determined the insect biomass available to Pheasant chicks in crops grown in three farming systems.

METHODS

Study sites included a 307-ha farm which had been organically farmed for 17 years, representing a diversified management system; an adjacent 129-ha conventional dryland farm; and a 129-ha irrigated farm. All farms were near Valley, Nebraska. Crops grown on the organic farm included corn, soybeans, alfalfa, wheat, and oats-sweetclover. Corn and soybeans were grown on the dryland farm, but only continuous corn was grown on the irrigated farm. In addition, second-year sweetclover was sampled on public land near Valparaiso, Nebraska, 50 km SW of Valley.

Both insect standing crop biomass and insect biomass production were estimated for oats-sweetclover (1979), oats (1980), and sweetclover (1980). Six samples on each date for each crop were taken at 2-week intervals from May until after oats harvest. Oats and oats-sweetclover were sampled by randomly dropping a round metal frame (0.5 square m area) over the area to be sampled. This frame had a plastic screen top closed by a drawstring. A gasoline-powered suction device was used to remove insects from the enclosed area. Six linear samples, each 6 m long, were taken with the suction sampler from sweetclover where plant height prevented use of the enclosed frame. These samples were converted to square m using the calibration method of Pruess and Whitmore (1976).

Insects were killed and partially separated by using U.S.A. standard testing sieves (Whitmore et al. 1986). Mean weights of individual insects were estimated from known numbers of individuals from each species and size. Samples were oven-dried at 70°C for 24 hours, transferred to a desiccator for 24 hours, and weighed to nearest 0.01 mg.

Adults of above-ground herbivorous insects (Homoptera, Hemiptera, and Lepidoptera), with corresponding immature stages, were separated by species for calculation of biomass production. Two groups of predators, lady beetles (Coleoptera: Coccinellidae) and nabids (Hemiptera: Nabidae) were also separated for production estimates.

Biomass production estimates were calculated using the average cohort method (Benke and Waide 1977). Mean weights and numbers of each size class were used to estimate production as the sum of all insect biomass which died at any stage of development. Generation time for each species was estimated from the size-frequency distribution of growth stages over time. Because adult insects in many cases weighed more than the final immature stage, they were included as a cohort after immatures of that species became adult. Adults appearing early in the season, prior to the presence of full-grown immatures, were considered to be immigrants and included only in standing crop biomass.

Only standing crop biomass was estimated for other crops. Alfalfa and wheat were sampled with the enclosed frame described above. Corn and soybeans were sampled using the linear method., We did not achieve true replication, but subsample variation and variation between sample dates were considered in drawing conclusions. Whitmore et al. (1986) found that young Pheasants fed almost exclusively on insects greater than 3 mm length (those retained by screen sizes 12-16) and, for interpretive purposes, we report standing crops of only these larger insects.

RESULTS

Insects smaller than size 16, although abundant, contributed little to standing crop biomass but did contribute to total biomass production. Mean standing crop of insects not considered in biomass production ("other insects", Table 1) contributed as much or more biomass as did those species for which production estimates could be made.

Homoptera (leafhoppers and planthoppers) and Hemiptera (plant bugs) were the main source of insect biomass production in oats and oats-sweetclover (94% and 95% of total production, respectively). Plant bugs comprised 59% and aphids 36% of total insect production in sweetclover.

No differences in standing crops, or species present, were observed in soybeans (organic vs. dryland) or corn (organic vs. dryland vs. irrigated) and data were pooled to show means for the crops sampled (Fig. 1). Oats-sweetclover and oats had the highest mean insect standing crops during the time period we considered important (1 June to 15 July).

Seasonal changes in standing crop for oats, oats-sweetclover, and sweetclover are shown in Fig. 2. Highest standing crops occurred during the period of peak chick hatch (1 June to 20 June). Insect standing crop in sweetclover declined beginning about 1 July, when chicks would still be highly dependent on insect food. Standing crops remained high in oats and oats-sweetclover until oats harvest (about 15 July).

Table 1. Mean insect standing crop and biomass production (mg per square m) of insects in oats (O), oats-sweetclover (OS), and second-year sweetclover (S2). Only insects more than 3 mm length are included in standing crop estimates.

Insect Group	Standing crop O	OS	S2	Production O	OS	S2
Homoptera						
Leafhoppers (Cicadellidae)						
Endria inimica	46	24	-	762	322	-
Draeculacephala sp.	67	67	-	942	1,111	-
other leafhoppers	22	43	-	153	421	-
Planthoppers (Delphacidae)						
Delphacodes sp.	25	29	-	186	232	-
Aphids (Aphididae)	-	4	6	-	112	-
Hemiptera						
Plant bugs (Miridae)	7	10	37	75	100	201
Nabids (Nabidae)	8	13	-	51	206	-
Lepidoptera	-	1	-	-	21	-
Coleoptera						
Lady beetles (Coccinellidae)	2	9	5	4	29	15
Other insects *	221	213	218	-	-	-
Total	399	415	267	2,173	2,555	338

* Includes adults of above species prior to production of first generation.

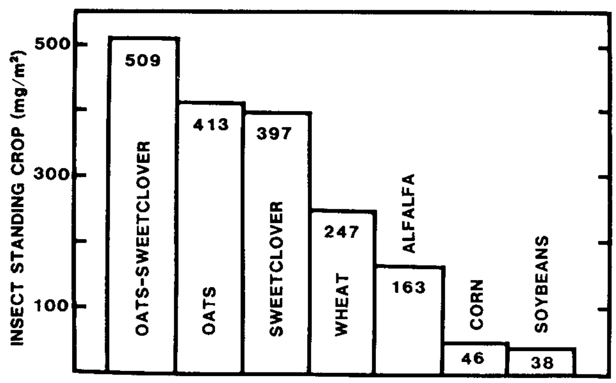

Fig. 1 Mean standing crop biomass (mg per square m) for size class 12-16 (more than 3 mm length) insects from crops sampled 1 June to 15 July.

DISCUSSION AND CONCLUSIONS

Size and stability of standing crop are probably adequate measures of an insect food resource for Pheasant chicks. Oats and oats-sweetclover, although sampled in different years, supported essentially the same insects. In Nebraska, during the first season, oats-sweetclover does not appear to be a more diverse habitat that oats alone Prior to oats harvest, sweetclover comprised less than 5% of vegetative biomass in oats-sweetclover. The most abundant insects in both crops were several leafhopper species that have a broad grass host range, excellent dispersal capabilities, high reproductive potential, and relatively long lives as adults. Whitmore et al. (1986) found these leafhoppers to be readily accepted as food by Pheasant chicks. Following oats harvest, there was a long period when all vegetation, and insects, were sparse. This occurs sufficiently late in the season that chicks would either no longer be dependent on insect food or would have sufficient nobility to move to other habitats. Oats stubble would still provide both protective cover and grain as food.

The sweetclover field observed in this study, although harboring considerable insect biomass, contained primarily insects which live in the canopy (more than 1 m) and thus would be unavailable to small chicks. Declining biomass

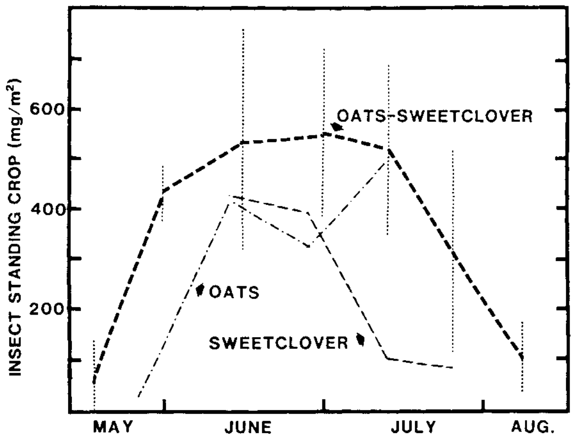

Fig. 2 Seasonal changes in insect standing crop biomass (mg per square m) for oats-sweetclover, oats, and sweetclover. Vertical lines are standard errors for oats-sweetclover estimates.

after 1 July was the result of crop drying after seed set and drought conditions that prevented new growth. However, sweetclover in combination with other vegetation, might provide excellent habitat. In our experience, alfalfa often harbors greater insect densities than found in the field sampled. But removal of the first cutting both diminishes the insect food resources as well as posing physical threat to chicks.

Winter wheat provided relatively high insect biomass early in the season, but standing crop began to decrease about 15 June as wheat began to head. Late-planted row crops such as corn and soybeans are obviously unsuited to nesting as well as lacking an insect food resource early in the season.

Insecticides were not a factor in this study. A soil insecticide for corn rootworm control was used only on the irrigated farm. This treatment, applied to a habitat unsuitable for nesting, had no measurable effect on above-ground insects. Statistical correlations sometimes found between pesticide use and wildlife decline (Warner et al. 1984), in the absence of direct evidence of wildlife mortaility, may be due to the high intercorrelation of pesticide use with monocultures. If pesticides should prove a contributing factor in Pheasant decline, then oats or oats-sweetclover might provide refuge in modern agricultural systems. Most insects found in oats feed by sucking without causing visible plant damage and insecticides are rarely applied.

The greatest value we can assign to organic farming is the inclusion of oats-sweetclover as an important component of that system. If only insect food were limiting to Pheasant production, then oats alone would appear equal to oats-sweetclover and a 1-year rather than a 2-year, program might encourage additional participation. Oats stubble would need to be left over winter, providing both grain and limited cover. The extent to which availability of insect food limits utilization of otherwise favorable habitats is still unknown. Wildlife biologists, however, seem in general agreement on other attributes of good nesting cover for Pheasants. The present 2-year program assures continuity of habitat over a longer time span, provides better residual cover during the second year, and probably has an adequate insect food resource.

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--- *R. W. Whitmore, K. P. Pruess, R. E. Gold*
Department of Entomology, University of Nebraska, Lincoln, Neb. 68583