Some relationships between mule deer and alfalfa production in Powder River County, Montana
by Joseph L Egan

A THESIS Submitted to the Graduate Faculty in partial fulfillment of the requirements for the degree of Master of Science in Fish and Wildlife Management
Montana State University

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A study of certain relationships between mule deer (Odocoileus hemionus hemionus) and alfalfa production in west-central Powder River county, Montana was conducted during portions of 1955, 1956, and 1957, Limited observations of marked deer indicated overlapping winter and summer ranges. The use of various vegetative-topographical types by deer was observed. Peak use of alfalfa fields by deer was indicated as occurring in August and September. The effects of deer use showed variability. Data presented indicated that alfalfa plants in deer exclosures under conditions present during this study produced less seed than those in control plots.

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Head, Major Department

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ABSTRACT

A study of certain relationships between mule deer (Odocoileus hemionus hemionus) and alfalfa production in west-central Powder River county, Montana was conducted during portions of 1955, 1956, and 1957. Limited observations of marked deer indicated overlapping winter and summer ranges. The use of various vegetative-topographical types by deer was observed. Peak use of alfalfa fields by deer was indicated as occurring in August and September. The effects of deer use showed variability. Data presented indicated that alfalfa plants in deer exclosures under conditions present during this study produced less seed than those in control plots.

INTRODUCTION

Although specific information is not available, mule deer (Odocoileus hemionus hemionus) numbers in southeastern Montana, including the timbered portions of Powder River county, apparently have fluctuated considerably during the past six or seven decades. Population peaks reportedly occurred in the late 1880's, the early 1900's and the late 1920's. A peak in the late 1940's was indicated by the Montana Fish and Game Department in various quarterly reports from 1948 to 1952. The reported peak of the late 20's was of small magnitude and was preceded by a period when many residents considered the deer extinct. Conversely, the peak of the late 1940's was considered the highest noted.

Accompanying these peaks in deer numbers were reports of depredation on alfalfa, particularly that grown for seed. The most recent peak resulted in many complaints by residents of the Otter Creek area (Fig. 1). Either sex deer seasons, initiated in 1951, have alleviated but not eliminated depredations.

An investigation was conducted from December 1, 1955 to September 21, 1956, and from June 17, 1957 to September 27, 1957 to determine the extent of the damage, the time when most damage occurs, and the segments of the deer population involved.

The author wishes to express sincere thanks to the Montana Fish and Game Department which made this study possible and by whom he was employed under Federal Aid Project W77R. Further thanks are extended to the following: Mr. Ed Ottesen and Mr. Earl Newcomer for permission to use

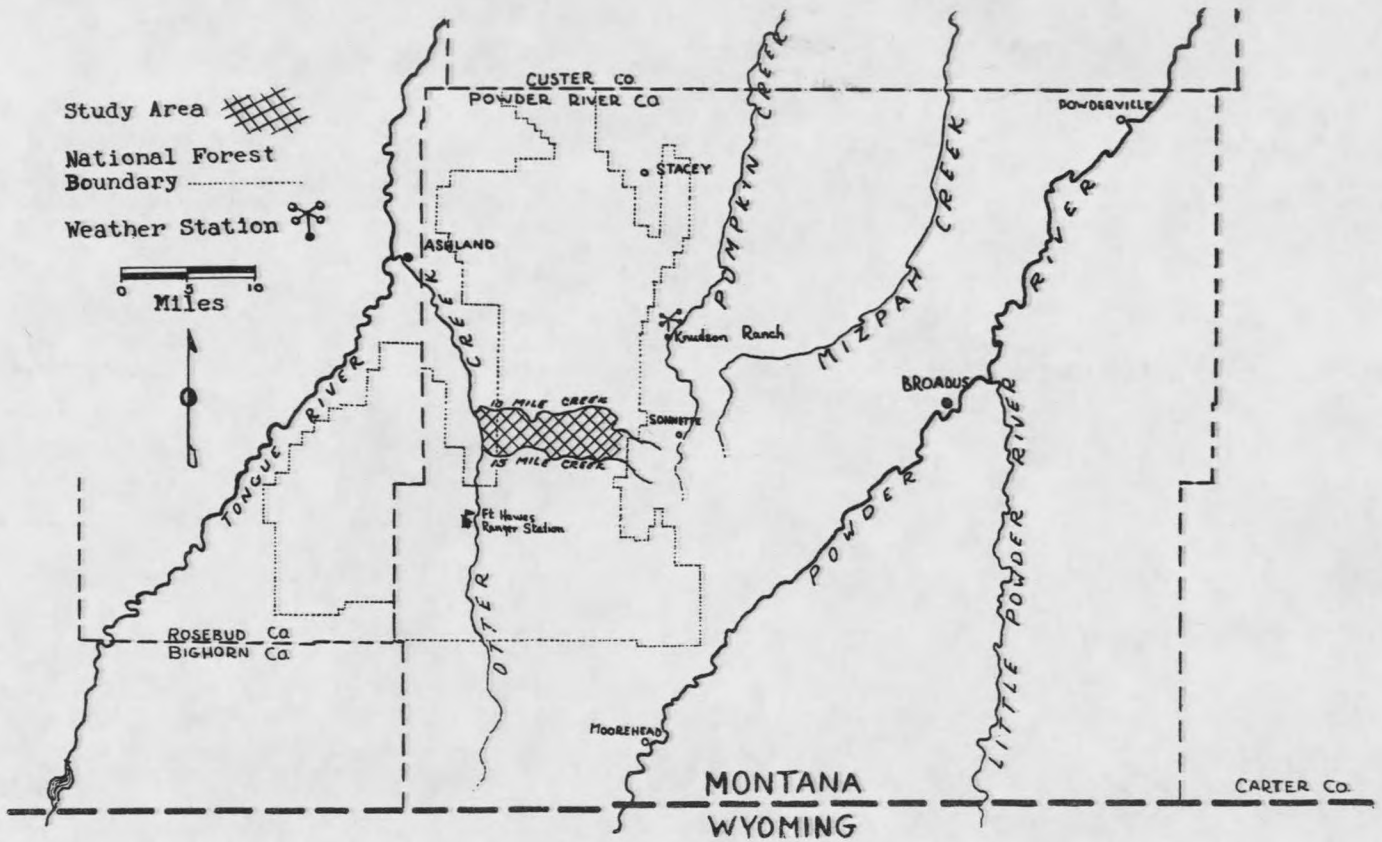


Figure 1. Location of study area

their land in connection with this study; the United States Forest Service for use of a cabin and files; Dr. D. C. Quimby of Montana State College for guidance; Dr. C. J. Mode of Montana State College for statistical assistance; District 7 personnel of the Montana Fish and Game Department for invaluable assistance throughout the study; the South Dakota Department of Game, Fish and Parks for the use of four traps; and to landowners of the area and several others who contributed aid so freely.

THE STUDY AREA

The study area, consisting of approximately 40 square miles, lies in west-central Powder River county (Fig. 1) almost wholly within the Ashland Division of the Custer National Forest. Alfalfa depredation by deer has been reported here. In general this area is similar in land use and topography to other southeastern Montana areas where deer depredations on alfalfa fields have been reported. Elevations vary between 3200 and approximately 3900 feet. The climate is semi-arid. Data from a U. S. Weather Bureau station located about 12 airline miles from the center of the area show an average annual precipitation of about 10.5 inches, 62 per cent of which comes from April to July.

The following description of surface features follows in part that given by Bass (1932) for the land just north of the study area. The surface is intricately dissected and the slopes adjacent to the water courses are in places rough. The upper reaches of many of these water courses are steep-sided gulches and the lower ends are often broad valleys up to a mile in width. Outcroppings of clinker (rocks that have

been baked by the burning of underlying coalbeds) and sandstone are common features of the landscape. Timber occurs in sparse to dense stands over much of the area, but seems to reach a climax growth in the upper ends of the steep-sided gulches. Five very broad vegetative-topographical types were recognized in the area. They are creek bottom, prairie, breaks, timber, and parks (Fig. 2).

Creek Bottom Type

In general this type occurs on the study area on three sides (Figs. 2, 3). Otter Creek usually contains water the year around, but the other streams are dry except during periods of runoff. Springs are found along these water courses, but the water soon disappears into the ground. Several stock-water reservoirs are present in this type. Green Ash (Fraxinum pennsylvanica), Inland Boxelder (Acer negundo), Western Chokecherry (Prunus virginiana var. demissa), Plains Cottonwood (Populus sargentii), Rose (Rosa spp.) and Snowberry (Symphoricarpos spp.) are common plants. Much of this type is cultivated and used for growing alfalfa, wild hay, and occasionally grain. This type remains green after the other types have become dry in summer. The native green vegetation, presence of water, and alfalfa appears to make this type attractive to deer during summer and fall. Hay stacks often attract deer in winter.

Prairie Type

This type occurs mainly adjacent to the creek bottoms and also to

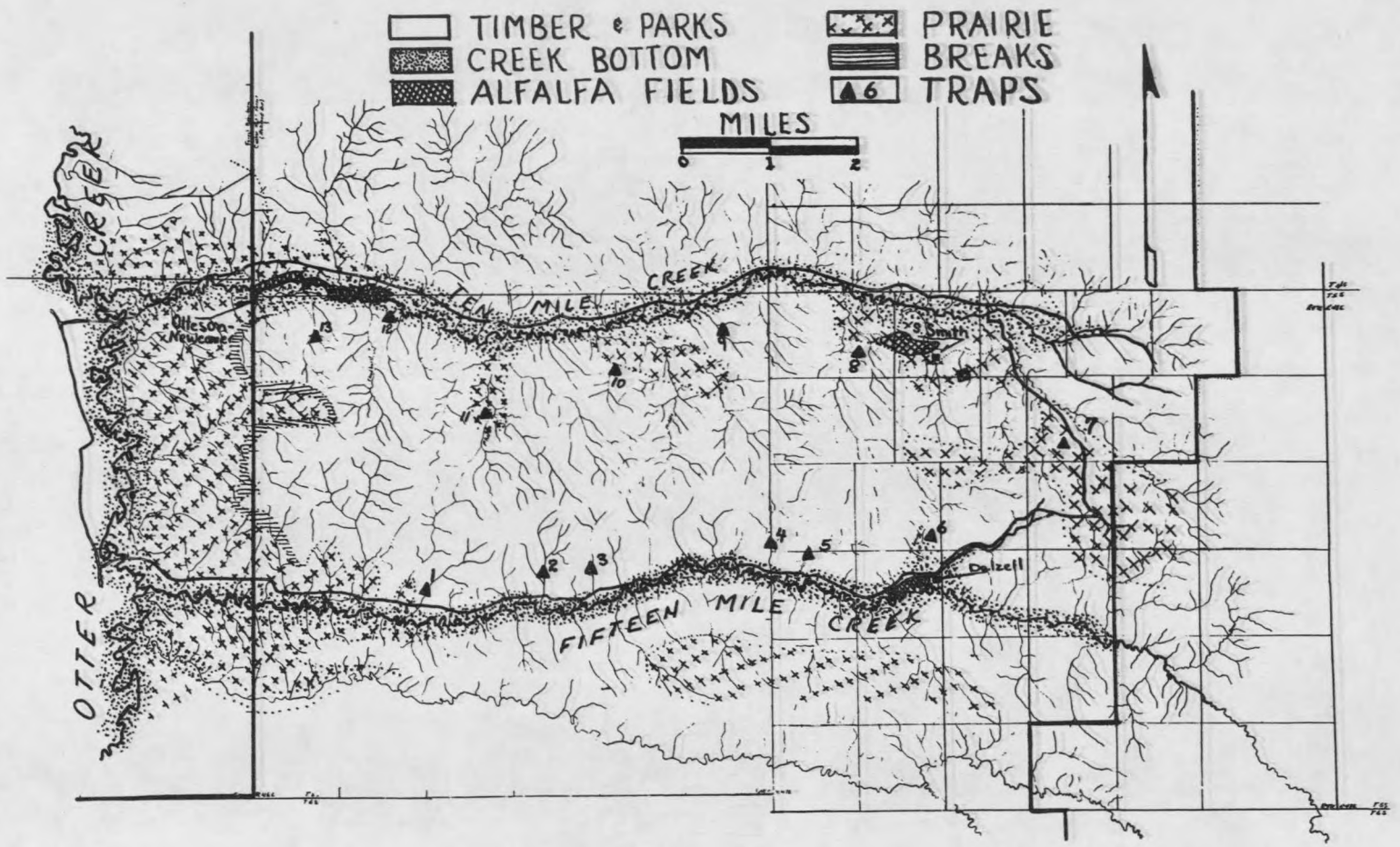


Figure 2. Location of vegetative-topographical types, traps, and alfalfa fields.

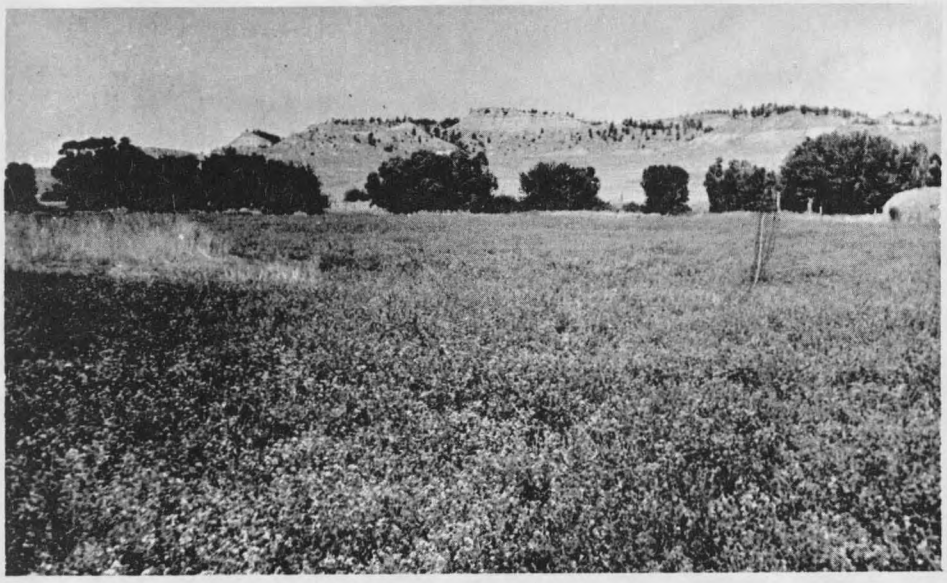


Fig. 3. Creek Bottom

Fig. 4. Prairie

a considerable extent on the divides between the larger water courses (Fig. 4). The vegetation is characterized by Needle and Thread (Stipa comata), Green Needlegrass (Stipa viridula), Blue Grama (Bouteloua gracilis), and Big Sagebrush (Artemesia tridentata). In places Downy Chess (Bromus tectorum) occurs in extensive stands.

Breaks Type

The breaks are characterized as "gumbo buttes and slopes" and are often present between timber and creek bottom or timber and prairie (Fig. 5). The predominant vegetation is Rocky Mountain Juniper (Juniperus scopulorum), Shadscale (Atriplex confertifolia), Greasewood (Sarcobatus vermiculatus), Prairie Sand Reedgrass (Calamovilfa longifolia), and Big Sage.

Timber Type

Pines frequently occur in areas underlain by clinker, and grow along the edges of the plateaus where clinker beds out-crop (Fig. 6). Occurrence of the timber type in the other types is common. Ponderosa Pine (Pinus ponderosa), Skunkbrush (Rhus trilobata), Wheatgrass (Agropyron spp.), and Side-oats Grama (Bouteloua curtipendula) are common plants.

Park Type

These are open areas usually associated with the timber type, but may occur in other types (Fig. 7). Threadleaf Sedge (Carex filifolia), Side-oats Grama, Needle and Thread, Green Needlegrass, Bluebunch Wheat-

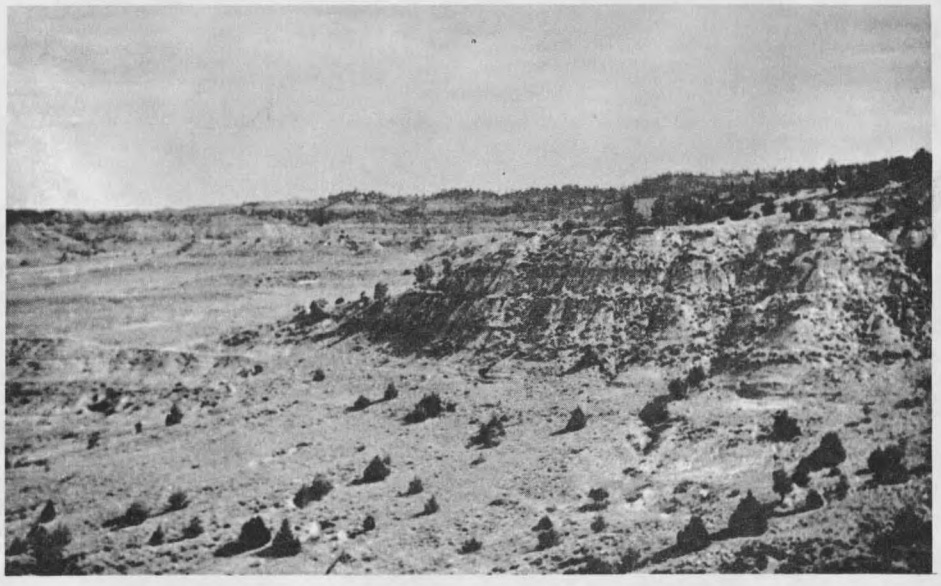


Fig. 5. Breaks

Fig. 6. Timber

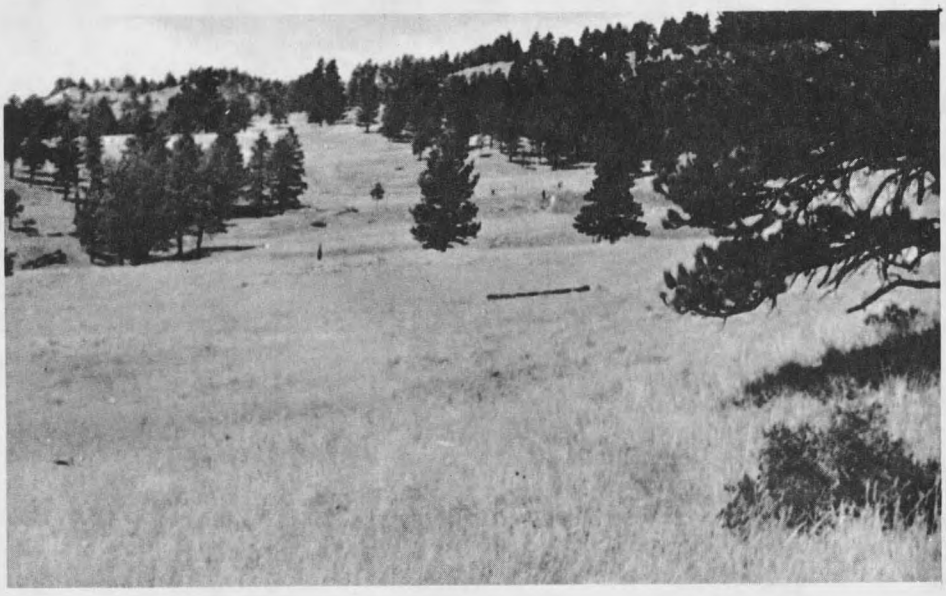


Fig. 7. Parks

grass (Agropyron spicatum), and Western Wheatgrass (Agropyron smithii) are common plants.

Skunkbrush, Threadleaf Sedge, Wheatgrass and Big Sagebrush occur throughout all types. The line of demarcation between types is usually very indistinct. About 20 per cent of the area is private land. Public land is administrated by the United States Forest Service. Private land is primarily prairie and creek bottom types. About 16 per cent of all creek bottom lands and 1.3 per cent of the total area is used to raise alfalfa.

METHODS

To help determine deer movements in relation to vegetative types, deer were live-trapped, marked and released. Thirteen box type traps (9 Michigan box, 2 Pisgahs, and 2 Clovers) designed to catch one deer at a time were in operation around the periphery of the area from early December 1955 to the middle of March 1956. Traps were baited with choice second cutting alfalfa. Ceretana brands of 12 per cent Feed Lot Fattener, Rabbit Pellets, Econ-o-pellet, and Molas-o-cake were also used. Trapped deer were individually marked with plastic ear symbols as described by Johnson (1951) or plastic ribbons of various colors. The ribbon was 0.5 inch thick extruded plastic, manufactured and supplied by the Cee-Bee Manufacturing Company. Each trapped deer was marked with a metal ear tag to which a symbol or ribbon was attached in one ear and a metal tag only in the other ear. Symbols were put in the right ear of males and in the left ear of females. The rump patch of each deer was dyed with a

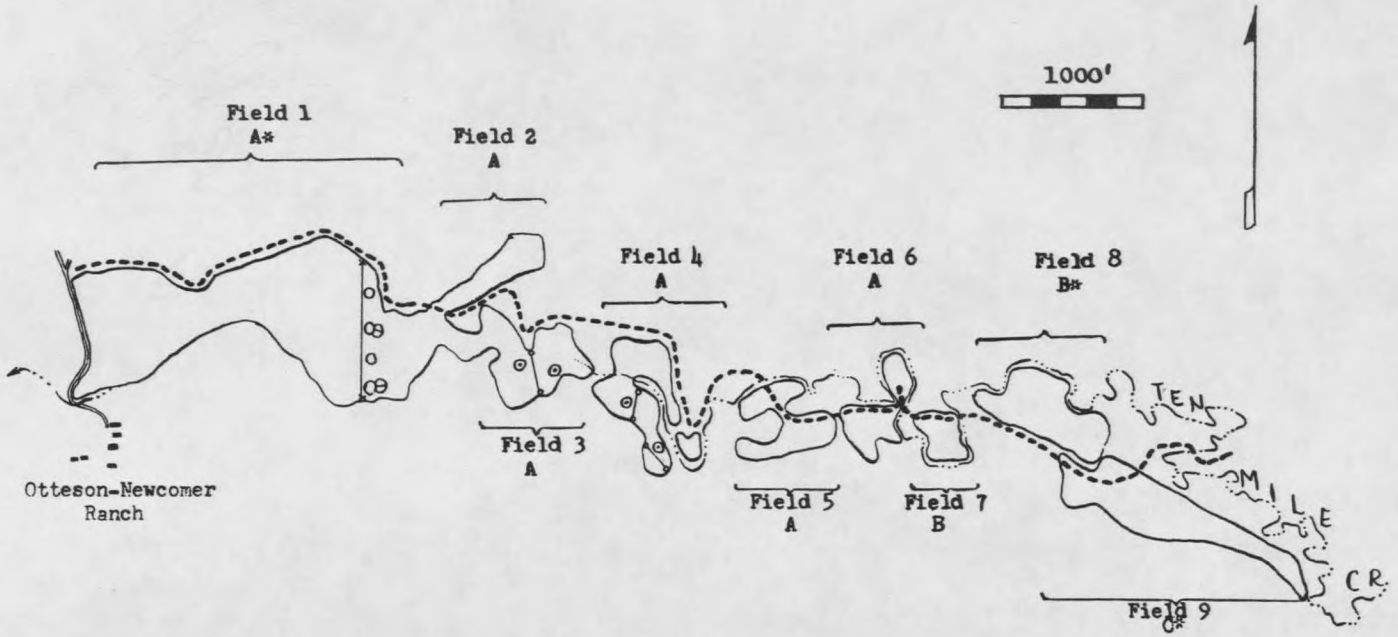
bright yellow alcohol-picric acid solution to facilitate recognition of marked animals for a short period following marking.

Occurrence of deer on the various vegetative-topographical types was noted by direct observation. Deer occurrence on alfalfa fields was obtained by weekly spotlight counts from April, 1956 until September, 1956 and from June, 1957 until September, 1957. A 25x and 40x spotting scope or 7 x 50 binoculars were used when necessary and applicable.

Actual use of alfalfa plants by deer was facilitated through use of transects and exclosures (Cole, 1956). Data were gathered from three fields in 1956 and from one in 1957 (Fig. 8).

In late June and early July, 1956, eight deer exclosures were built of 48-inch high snow fence (Fig. 9) in the alfalfa fields (Fig. 8). Each enclosed 0.02 acre. A control area surrounded each exclosure. Ten plants were randomly chosen in each exclosure and in each control area. Each plant was clipped, air-dried, weighed and the seed harvested and weighed. All weights were to the nearest 0.001 gram. No seed data were obtained for the exclosures in field-4 because the alfalfa in this field was cut before many pods had formed. A transect line was established across each of the three fields. Pods were counted on every third plant encountered along the transects. After the alfalfa was harvested, a pellet group count was made along each of the transects to establish intensities of deer usage. All pellet groups within three feet on the east side of the transects were tabulated.

In 1957 only field-1 was used (Fig. 8). Four exclosures (0.01 acre)



⊙ Exclosure of snow fence at this site in 1956

O Exclosure of snow fence at this site in 1956; of woven wire in 1957.

⊖ Exclosure of snow fence at this site in 1957

o—o One year transect - 1956 only

x—x Two year transect - 1956-57

▬▬ Route of spotlight count

A In alfalfa 1956-1957

B In alfalfa 1956
barley 1957

C "Meadow" hay 1956-1957

Figure 8. Alfalfa fields showing locations of transects, exclosures, and route of spotlight counts.

Fig. 9. Exclosure of Snow Fence

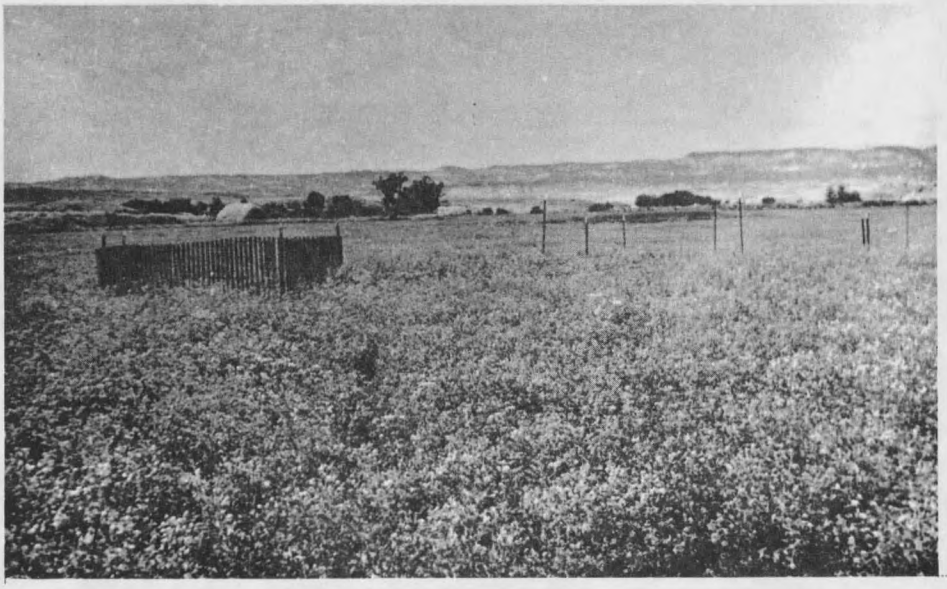


Fig. 10. Exclosures of Snow Fence and Woven Wire

of woven wire were built in July, 1957 at the approximate locations of the 1956 exclosures. Each of the woven wire exclosures was about 50 inches high and surrounded by a control area. Twenty plants were chosen at random in each exclosure and in each control area. Each plant was air-dried, weighed, and threshed. The seed was weighed. An effort was made to determine whether the snow fence type exclosure used in 1956 produced conditions that influenced the growth and seed production of enclosed plants. An exclosure of this type was built adjacent to a woven wire exclosure at two different sites (Fig. 10). Ten plants were chosen at random from each of these exclosures and these plants were subjected to the same treatment as those from the woven wire exclosures and their controls. A transect also traversed field-1 in 1957, and followed closely the path of the 1956 transect. Every fifth plant along the 1957 transect was also dried, weighed and threshed. Pellet groups three feet on both sides of the transect were counted after the 1957 alfalfa harvest.

All data for both years were obtained from the second crop of alfalfa, just prior to the harvest during the last part of September or early October.

RESULTS

Movements

Twenty mule deer were captured, marked and released (Table I). Seven provided subsequent observations. Four (Nos. 3, 7, 10, and 13) were each recaptured and observed only within 0.6 airline miles of their

Table I. Resume of deer live-trapping and tagging operations.

Animal No.	Sex & Age	Date of Capture	Trap No. [1]	Remarks
1	Ad F	12/16/55	1	No further observations.
2	Ad F	12/17/55	2	No further observations.
3	Fwn M	12/17/55	3	Recaptured 12/22/55 in trap 2, 0.6 miles from trap 3.
4	Fwn F	12/17/55	3	No further observations.
5	Fwn M	12/18/55	13	No further observations.
6	Ad M	12/22/55	6	No further observations.
7	Fwn F	12/22/55	9	Recaptured 1/8/56 in trap 9.
8	Ad M	1/ 7/56	6	Died at time of original capture.
9	Ad M	1/ 8/56	6	No further observations.
10	Yrlg F	1/12/56	9	Recaptured 1/24/56 in trap 9. Shot 10/20/56, 4.4 miles SE of trap 9.
11	Fwn M	1/13/56	5	No further observations.
12	Ad M	1/13/56	13	No further observations.
13	Ad F	1/21/56	2	Observed 1/24/56, 500 yds. W. of trap 3. Recaptured 2/6/56 in trap 2. Observed 2/28/56, 200 yds. W. of trap 3. Recaptured 3/7/56 in trap 2. Observed 3/5/56 near trap 3. Observed 7/27/57 with fawn 0.3 miles SSE of trap 2.
14	Ad M	1/21/56	10	No further observations.
15	Ad F	2/ 8/56	13	Observed 3/7/56, 3.5 miles SE of trap 13.

Table I, continued.

Animal No.	Sex & Age	Date of Capture	Trap No.	Remarks
16	Ad M	2/12/56	12	No further observations.
17	Ad F	2/13/56	11	No further observations.
18	Ad M	3/ 1/56	4	No further observations.
19	Ad F	3/ 2/56	3	This deer and No. 20 were identically marked. One or the other was observed on 3/7/56 near trap 3; on 4/19/56, 0.9 miles N. of trap 3, and on 7/27/57, 0.6 miles S. of trap 3.
20	Ad F	3/ 5/56	2	

[1] See Figure 2 for trap locations and vegetative-topographical types at trap sites.

original capture site during winter. Ten months following its last winter capture, No. 10 was shot 4.4 airline miles southeast of the original capture site, but deer No. 13 was observed on July 27, 1957 within 0.25 mile of the capture site. Deer No. 15 marked on February 8, 1956 in trap 13 on Ten Mile Creek, was observed a month later on Fifteen Mile Creek 3.5 airline miles southeast of the original capture site. Two does (Nos. 19, 20) were erroneously tagged with identical markers. Three observations of deer with this marker between March 7, 1956 and July 27, 1957 were all within the same general area of traps 2 and 3 which are 0.6 airline miles apart. The data are too few for definite conclusions but suggest overlapping winter and summer ranges.

Use of Vegetative-Topographical Types

A total of 820 deer observations were recorded for the various vegetative-topographical types (Table II). Deer observed in traps or during spotlight operations on the Ottesen-Newcomer alfalfa fields are not included. Seven, 55, and 35 deer observations were recorded for January, February, and March, 1956 respectively. All but one were in the timber type. For the 1956 April-June period, there were 265 deer observations. Of the 139 observations tabulated in April, 45 were on the creek bottom type, 24 on the prairie type, 29 in the timber type and 41 in the parks type. This seemingly indicated a seasonal change in use of types. Eleven of the 72 observations in May, 1956 and 21 of the 54 for June were on creek bottoms. By June, 1956 the data suggested use of parks had ceased, but continued use of creek bottoms, prairie, and

Table II. Occurrence by vegetative-topographical type for 820 observations of deer.

		January -March				April - June				July - September			
Type	Year	M	F	Fwns	Uncl	M	F	Fwns	Uncl	M	F	Fwns	Uncl
Creek Bottom	1956	0	0	0	0	18	17	5	37	11	18	9	21
	1957	-	-	-	-	-	-	-	-	62	53	10	75
Prairie	1956	0	0	0	0	13	12	1	28	22	10	8	13
	1957	-	-	-	-	-	-	-	-	13	21	5	7
Breaks	1956	0	0	0	0	1	0	0	0	0	0	0	0
	1957	-	-	-	-	-	-	-	-	0	0	0	0
Timber	1956	4	12	14	66	28	30	7	19	20	7	2	7
	1957	-	-	-	-	-	-	-	-	17	19	8	16
Parks	1956	0	0	0	1	0	15	10	24	1	0	0	0
	1957	-	-	-	-	-	-	-	-	0	1	2	0

timber types was indicated. In July, 1956, deer were observed frequenting the creek bottom and timber types, while in August, 1956 about 54 per cent of the deer observed were on the prairie type, 30 per cent on the creek bottom and approximately 15 per cent in the timber type. For 1956, the 511 observations were distributed as follows: 136 on the creek bottom type; 107 on the prairie type; 1 in the breaks; 216 in timber; and 51 in parks.

During the 1957 period, 310 deer observations were made from July 1 to September 27 as follows: 200 were on the creek bottoms; 47 on the prairie; 60 in the timber and three were in parks. Sixty-six, 54, and 95 per cent of the deer observed in July, August and September respectively were on the creek bottom type. Deer were observed on prairie and timber types in substantial numbers in July and August while only two observations were recorded on these types in September.

Use of Alfalfa Fields

Use of the alfalfa fields as indicated by spotlight counts was rather sporadic during the spring and reached a peak in August (Fig. 11). Commencement of alfalfa field use in the spring corresponded to a shift noted in the use of the vegetative-topographical types (see above). In 1956, 71.4 per cent of the deer observed on the Ottesen-Newcomer fields were on field-1 through field-6 (Figs. 2, 8), with field-1 (24.6 per cent) and field-4 (20.1 per cent) receiving the greatest usage. In 1957, 92.2 per cent of the deer observed were on these fields, but field-7 and field-8 were not growing alfalfa. Field-1 (26.7 per cent) and field-3

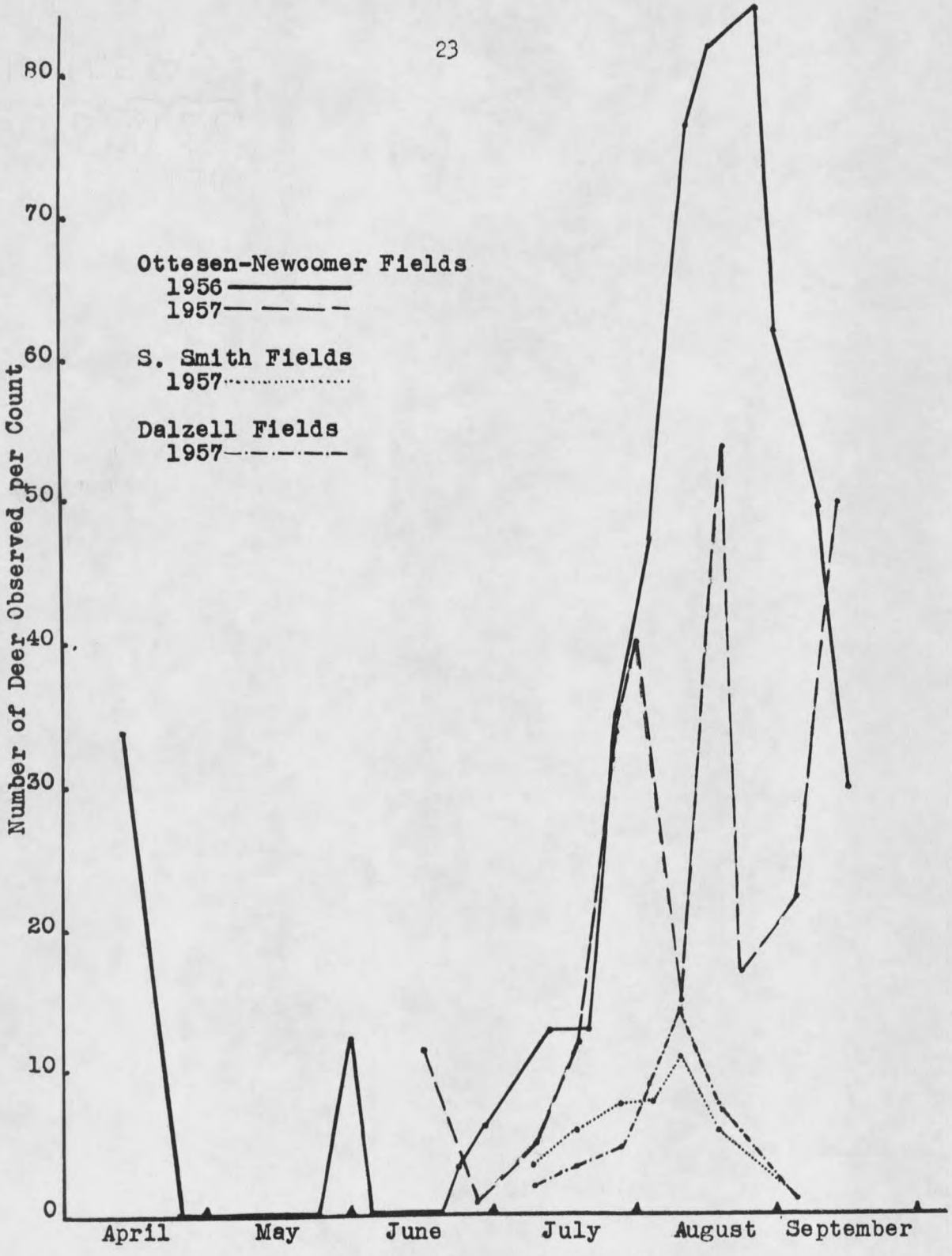


Figure 11. Numbers of deer using alfalfa fields as ascertained by weekly spotlight counts.

(18.3 per cent) received the greatest usage. The maximum counts suggested that about 84 and 54 deer were using the Ottesen-Newcomer fields in 1956 and 1957 respectively.

Of the deer observed on the Ottesen-Newcomer fields on lower Ten Mile Creek (Fig. 8) in 1956, 10.1 per cent were bucks, 23.8 per cent were does and fawns, and 66.0 per cent were unclassified, while in 1957, 12.9 per cent were bucks, 50.0 per cent were does and fawns, and 36.0 per cent were unclassified. At the S. Smith ranch on upper Ten Mile Creek (Fig. 2), the sex composition of the deer observed using these fields in 1957 was 30.0 per cent bucks, 14.0 per cent does (no fawns observed) and 56.0 per cent unclassified. On upper Fifteen Mile Creek at the Dalzell place (Fig. 2), 48.0 per cent of the deer observed on the alfalfa fields were bucks, 12.0 per cent were does and fawns, and 40.0 per cent were unclassified. The maximum count on the S. Smith fields for 1957 was 11; and on the Dalzell alfalfa field 14.

Effects of Deer Use of Alfalfa Fields

A summary of the data obtained from alfalfa plants in the deer exclosures and the control plots for 1956 and 1957 is given in Tables III and IV. The "t-test" indicated no significant differences in air-dry weights between the exclosures and their controls except in the 1956 group 6 (.05 level) and the 1957 group 2 (.10 level). It will be noted that for group 6, forage production was highest in the exclosure but the opposite was true for group 2. The "t-test" indicated a significant difference in the 1956 group 3 and group 8 seed weights. Group 3 was

Table III. Alfalfa seed and air-dry plant weights in grams from the 1956 snow fence exclosures and control plots.

Group No.	Air Dry Weight		Seed Weight	
	Ten Plants	Av. per Plant	Ten Plants	Av. per Plant
1				
Control	208.028	20.803	-	-
Exclosure	301.919	30.192	-	-
2				
Control	157.723	15.772	-	-
Exclosure	132.448	13.245	-	-
3				
Control	126.185	12.619	6.704	0.670
Exclosure	82.736	8.274	0.676	0.068
4				
Control	247.258	24.726	-	-
Exclosure	151.762	15.176	-	-
5				
Control	34.212	3.421	1.450	0.145
Exclosure	60.526	6.053	0.667	0.067
6				
Control	26.903	2.690	0.399	0.040
Exclosure	87.769	8.777	0.681	0.068
7				
Control	205.426	20.543	4.976	0.498
Exclosure	240.535	24.054	2.637	0.264
8				
Control	89.884	8.988	6.180	0.618
Exclosure	119.325	11.932	2.936	0.294

Table IV. Alfalfa seed and air-dry plant weights in grams from the 1957 woven wire fence exclosures and control plots.

Group No.	Air Dry Weight		Seed Weight	
	Twenty Plants	Av. per Plant	Twenty Plants	Av. per Plant
1				
Control	144.800	7.240	18.758	0.938
Exclosure	153.525	7.676	21.012	1.051
2				
Control	404.100	20.205	24.576	1.229
Exclosure	182.650	9.133	7.227	0.361
3				
Control	90.455	4.523	5.044	0.252
Exclosure	56.400	2.820	3.199	0.160
4				
Control	70.350	3.518	5.895	0.295
Exclosure	76.375	3.819	9.155	0.458

significant at the .01 level and group 8, significant at the .05 level. A significant difference at the .05 level was also noted in the 1957 group 2 seed weights. In each of the above instances, control plants were superior to exclosure plants in seed production.

Table V contains the data from the comparison of forage and seed production within snow fence exclosures with that within woven wire exclosures in 1957. Use of the "t-test" did not reveal a significant difference in air-dry or seed weights.

Correlation coefficients calculated for the pellet groups and the average number of pods per plant in each fifty-foot section along the 1956 transects indicated a moderate degree of association (Table VI). The correlation coefficient for the south and north transects in field-4 were -0.547 and -0.710 respectively. The coefficient for the transect in field-3 was +0.475 and for the field-1 transect -0.394. The coefficient of correlation value describing the degree of association between the air-dry weights of alfalfa plants in each 50-foot section and the number of pellet groups in these sections was -0.008 for the 1957 transect (Table VII). For seed weights and pellet groups it was +0.015.

An analysis of variance and the "F-test" was made on the pod count data from the 1956 transects. In field-4, there was no significant difference in the number of pods in the six 50-foot sections of the two transects, but in field-3 there was a significant difference in pod numbers at the .05 level but not at the .01 level. The transect across

Table V. Alfalfa seed and air-dry plant weights in grams from the 1957 snow fence and woven wire exclosures.

Group No.	Air Dry Weight		Seed Weight	
	Ten Plants	Av. per Plant	Ten Plants	Av. per Plant
2				
Woven wire	59.800	5.980	3.339	0.334
Snow fence	97.650	9.765	7.717	0.772
4				
Woven wire	37.750	3.775	4.209	0.421
Snow fence	27.000	2.700	2.543	0.254

Table VI. Number of alfalfa seed pods and deer pellet groups along successive 50-foot sections of the 1956 transects.

Field 4 (South transect)							
Section (feet)	0-50	50-100	100-150	150-200	200-250	250-285	
No. of plants	0	8	11	13	13	5	
Total pods	0	487	170	82	379	188	
Av. Pod/plant	0	60.88	15.45	6.31	29.15	37.60	
No. pellet groups	0	1	10	12	15	5	
Field 4 (North transect)							
Section (feet)	0-50	50-100	100-150	150-200	200-250	250-273	
No. of plants	12	9	15	13	10	2	
Total pods	518	191	406	580	467	122	
Av. Pod/plant	43.167	21.222	27.067	44.615	46.700	61.000	
No. pellet groups	6	18	10	14	13	8	
Field 3							
Section (feet)	0-50	50-100	100-150	150-200	200-250	250-300	
No. of plants	6	5	5	10	4	5	
Total pods	275	1046	458	1675	342	397	
Av. Pod/plant	45.833	209.200	91.600	167.500	85.500	79.400	
No. pellet groups	2	3	0	3	0	0	
Field 1							
Section (feet)	0-50	50-100	100-150	150-200	200-250	250-300	300-350
No. of plants	11	10	9	12	10	11	6
Total pods	740	662	628	681	885	1053	436
Av. Pod/plant	67.273	66.200	69.222	56.750	85.500	95.727	72.667
No. pellet groups	0	0	1	0	1	6	5
	350-400	400-450	450-500	500-550	550-600	600-650	650-700
No. of plants	6	10	8	9	6	8	10
Total pods	262	890	660	895	498	344	420
Av. Pod/plant	43.667	89.000	82.500	99.444	83.000	43.000	42.000
No. pellet groups	3	2	5	3	4	3	5

Table VI continued.

Section (feet)	700-750	750-800	800-850	850-900	900-950	950-1000	1000-1050
No. of plants	13	16	12	12	15	12	14
Total pods	312	242	364	70	338	195	382
Av. Pod/plant	24.00	15.125	30.333	5.833	22.533	16.250	27.286
No. pellet groups	2	4	7	9	5	11	11

	1050-1100
No. of plants	13
Total pods	242
Av. Pod/plant	18.615
No. pellet groups	0

Table VII. Air-dry and alfalfa seed weights and pellet groups from field-1 transect 1957.

Section (feet)	0-50	50-100	100-150	150-200	200-250	250-300	300-350
No. of plants	3	6	8	7	6	6	2
Wt.-All plants	62.800	45.600	73.000	65.950	84.800	163.050	63.400
Wt.-Av. plant	20.930	7.600	9.125	9.421	14.133	27.175	31.700
Wt.-All seed	6.600	7.704	6.982	7.515	8.140	13.367	5.105
Av. Seed Wt./Plant	2.200	1.284	0.873	1.074	1.357	2.228	2.552
No. pellet groups	0	4	3	4	9	1	5

Section (feet)	350-400	400-450	450-500	500-550	550-600	600-650	650-700
No. of plants	6	5	5	7	7	5	8
Wt.-All plants	122.850	73.250	52.800	115.175	28.850	33.100	74.300
Wt.-Av. plant	20.475	10.560	16.454	4.121	6.600	9.288	5.021
Wt.-All seed	6.026	4.801	3.067	4.163	1.045	2.266	2.280
Av. Seed Wt./Plant	1.004	0.960	0.511	0.595	0.149	0.453	0.285
No. pellet groups	4	3	2	5	1	5	4

Section (feet)	700-750	750-800	800-850	850-900	900-950	950-1000	1000-1067
No. of plants	7	8	7	9	8	9	7
Wt.-All plants	35.150	57.050	35.350	66.150	69.300	27.950	35.100
Wt.-Av. plant	5.021	7.131	5.050	7.350	8.663	3.106	5.014
Wt.-All seed	2.544	4.124	4.479	10.967	8.506	4.647	1.179
Av. Seed Wt./Plant	0.363	0.516	0.640	1.219	1.063	0.516	0.197
No. pellet groups	3	3	4	5	1	2	0

field-1 showed a significant difference in the average numbers of pods per plant among the twenty-two 50-foot sections. Pellet groups along the south transect in field-4, and the transect in field-1 apparently were not randomly distributed (.05 level) as indicated by use of Chi-square.

The plant data obtained from the 1957 transect on field-1 was also subjected to an analysis of variance and F-test. The air-dry weights of the alfalfa were significantly different among the 50-foot section at the .01 level, but seed weights from these same plants apparently were randomly distributed. Use of Chi-square in analyzing pellet group data on this transect did not indicate a random distribution at the .10 level.

Statistical methods and tables used in analyses were taken from Ostle (1954).

SUMMARY

1. A study of some relationships between mule deer and alfalfa production on a 40 square mile area in west-central Powder River county, Montana was made during portions of 1955, 1956, and 1957.

2. Twenty deer were live-trapped, individually marked, and 19 were released. Limited data on the seven deer providing subsequent observations, suggested overlapping of winter and summer ranges.

3. A total of 820 deer observations made during the course of the study on the five vegetative-topographical types indicated some difference in seasonal use of certain types. From January to March the deer seemed to prefer the timber type. Use of the creek bottoms and prairie

increased in April, May, and June. An increased use of parks was noted for April. From July through September the deer used the timber, prairie and creek bottoms almost exclusively. Very little use of breaks was noted.

4. Initial use of alfalfa fields corresponded to the shift from the timber type to the creek bottom in spring. Peak use of the alfalfa fields occurred during the last weeks in August and the first part of September. Alfalfa fields on the lower end of the area seemed to receive most use by does and fawns, while those on the upper part of the area received most use by bucks.

5. In general no significant difference in alfalfa production existed between deer exclosures and their controls. Group 6 in 1956 was an exception. The air-dry weight of the alfalfa in the control was less than for that in the exclosure. Group 2 in 1957 also displayed a difference in air-dry weight. In this case however, the control weight was greater than the exclosure weight. Significant differences noted in the 1956 seed weights resulted because seed weights from control plots were greater than those from exclosures. A similar difference was present in the 1957 group 2 seed weights.

6. Small fields seemed to be "homogenous" as regards pod counts and large fields apparently have no such pod distribution. Pellet groups displayed a somewhat erratic distribution. Correlation coefficients between pod counts and pellet groups showed a moderate degree of association in 1956, and no association in 1957 between pellet groups

and air-dry and seed weights.

7. Air-dry weights of alfalfa plants along the 1957 transect did not show a random distribution (.01 level); seed weights from these same plants, however, showed a random distribution.

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