AN ABSTRACT OF THE THESIS OF

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Title: EFFECTS OF WINTER GRAZING BY GEESE ON RYEGRASS SEED YIELD

Abstract approved Redacted for privacy

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The study was conducted from October 1974 through July 1975 in the vicinity of William L. Finley National Wildlife Refuge, 12 miles south of Corvallis, Oregon. The objectives of the study were to describe the changes in seed production of ryegrass as related to intensity of grazing by Canada geese (Branta canadensis) and to describe the pattern of foraging by geese on the study area.

Exclosures were used to compare grazed and ungrazed plots; five exclosures were placed in each of 17 fields. Numbers of geese on each field were recorded on a near daily basis from 30 October, 1974 to 24 April, 1975. These data provided an index of grazing intensity.

In November geese concentrated on the central portion of the refuge, the central and south portion in December, and the south and east portion from January through April. After the completion of the hunting season on 29 December, some geese moved off the refuge to private lands.

Vegetation measurements were taken immediately following the migration of geese north in April. Of the three types of measurements taken (height, stem density, and percent cover) height showed significant results in 7 out of 10 fields grazed by geese; grass in the ungrazed plots was taller than grass in the corresponding grazed plots. No trend in differences in stem density and percent cover between grazed and ungrazed plots was apparent.

Grass in the ungrazed and grazed plots was harvested immediately prior to the commercial harvest by farmers in summer, 1975. Grazing by geese did not reduce yield of ryegrass seed in grazed plots, compared to ungrazed, and in 2 fields significantly increased yield in grazed plots.

Effects of Winter Grazing by Geese on Ryegrass Seed Yield

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INTRODUCTION

Depredation of crops by waterfowl often causes serious economic damage and has been a recurrent management problem that resists solution (Linduska 1964). Crop depredation occurs in several ways: consumption of the harvestable portion of the crop, consumption of the new shoots of a green crop, and damage caused from the physical presence of the birds (Linduska 1964).

While the presence of feeding waterfowl in agricultural crops is often related to reduction in crop yields, such is not always the case. The relationship of grazing by geese on grass crops during winter to seed yield the following summer is not well understood. However, studies conducted by the Virginia commission of Game and Fisheries (Anon. 1952) and Kear (1970) indicate that foraging by geese on winter crops may be beneficial. Taylor (1961) found foraging by geese beneficial to seed production except in abnormally wet seasons. The objectives of this study were to describe the changes in seed production of ryegrass as related to intensity of grazing by Canada geese (Branta canadensis) and to describe the pattern of foraging by geese on the study area.

At least three subspecies of Canada geese winter in the Willamette Valley, Oregon. Population compositions vary from year to

year, the dusky Canada goose (B. c. occidentalis) comprising between 75 and 90 percent of the total numbers of geese (Jarvis and Rodgers 1976). Most of the remainder of the Canada geese are Taverner's (B. c. taverneri) and cackling (B. c. minima).

Beginning in 1964 three National Wildlife Refuges were established in the Willamette Valley with the specific objectives of providing wintering habitat for dusky Canada geese. In 1973 the Dusky Canada Goose Subcommittee of the Pacific Flyway Council (1973) set a management objective to maintain a post-hunting season population of 20, 000 to 25, 000 dusky Canada geese; this objective has now been achieved (Jarvis and Rodgers 1976).

In arriving at the goal of 20, 000 to 25, 000 geese in the post-hunting season population, crop depredation received primary consideration. Because of lack of data, the committee used complaints by farmers as an index of crop depredation, rather than actual reduction in crop yields. Chapman et al. (1969) recommended a wintering population of 50, 000 geese on the basis of the breeding grounds to provide more available nesting habitat, and the potential of the refuges and private hunting clubs to winter geese without serious crop depredation to surrounding farmlands.

Quantitative information of the effect of grazing by geese during winter on the seed yield of the subsequent grass crops is essential to the establishment of realistic population goals and the acceptance of

those goals by the public. This study was designed to provide that information.

Information on the effect of grazing by geese is also important to the grass farmers and the economy of Oregon. The Willamette Valley is the leading producer of ryegrass seed in the nation; in 1974, 200,000 acres were farmed in ryegrass in the Willamette Valley with a seed production valued at $40,000,000.00 (Youngberg 1975). Annual ryegrass (Lolium multiflorum) and perennial ryegrass (Lolium perenne) are also the major seedcrops of the Valley, constituting 63 percent of the acreage planted in grass species and 67 percent of the production value of grass seed. The Willamette Valley has large blocks of poorly drained soils, too wet for many winter crops, but ideal for ryegrass species. Thus, not only is ryegrass of economic importance, but soil types in the Valley limit the successful crops to just a few species, of which ryegrass is the dominant crop.

STUDY AREA

The study area was located in the southern part of the Willamette Valley, in the vicinity of William L. Finley National Wildlife Refuge, 12 miles south of Corvallis, Oregon. The area consisted of large blocks of ryegrass croplands and included two marshes used extensively as roosting sites.

Both annual ryegrass and perennial ryegrass were planted in the area. Annual ryegrass fields and new perennial ryegrass fields were plowed and seeded in late August through September. When the geese arrived in the latter part of October the grass was 5 to 10 cm high on most fields. Fertilization occurred from April through May and ryegrass seed was harvested from late June through July.

Seventeen fields were chosen for study (Figure 1). Ten of the fields were located on the refuge and 7 fields were located on private farmlands. Two crop types were studied: 10 annual ryegrass fields and 7 perennial ryegrass fields. The total area covered approximately 15 square miles. Within this area four observation units were designated to facilitate discussion of the pattern of grazing by geese: the north, central, east, and south observation units (Figure 1).

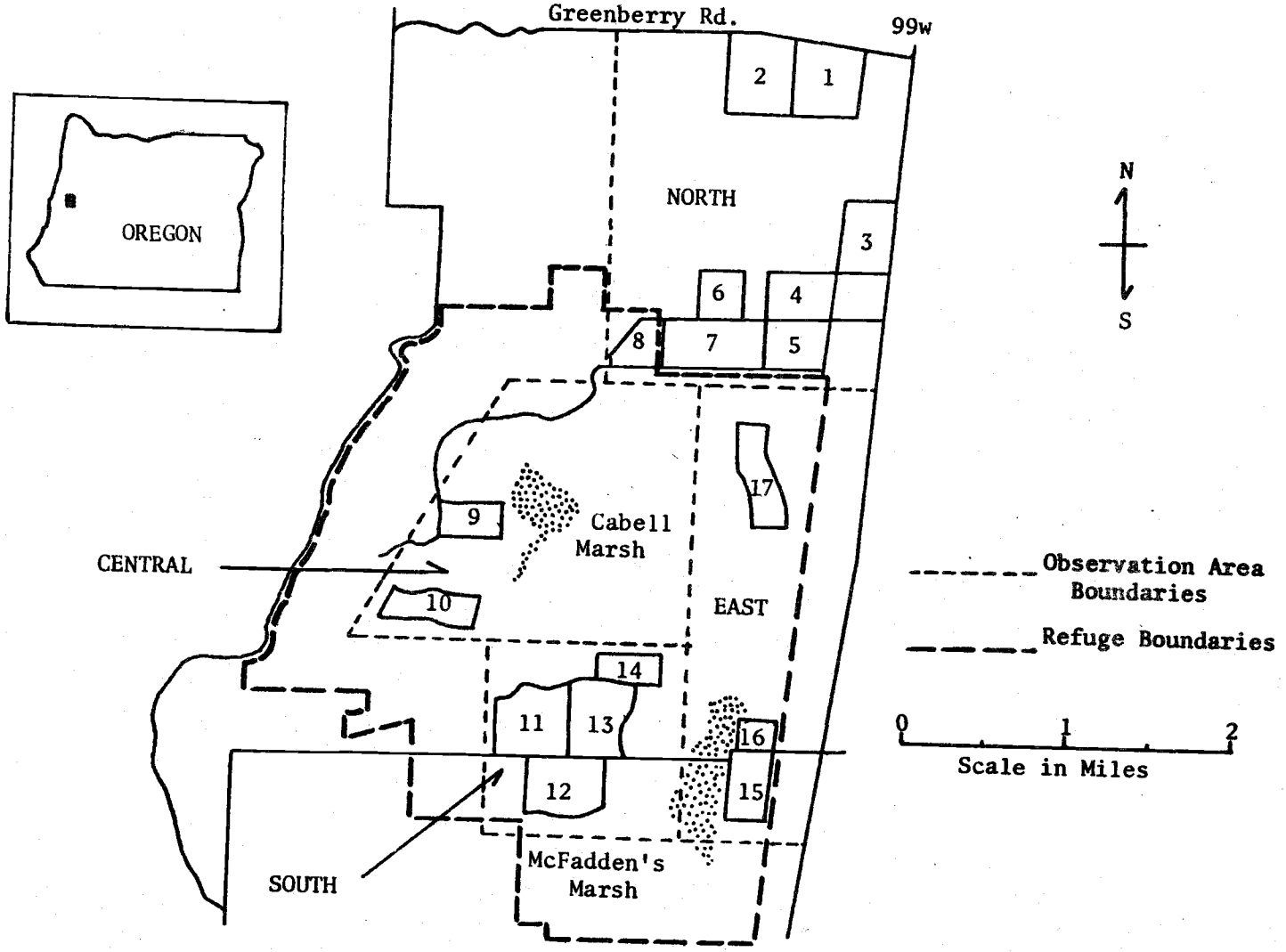

Figure 1. The study area, showing boundaries of Finley NWR, the study fields, and observation areas.

METHODS

The effect of grazing by geese during winter on seed yield was measured by comparing seed production from within exclosures (ungrazed), to seed production outside of exclosures (grazed). Five ungrazed plots were placed in each of 17 fields. Exclosures were placed approximately 50 m apart along a transect in the center of the field or in the portion of the field with a history of use by geese. Each exclosure was 1.0 m high by 1.2 m in diameter and constructed from field fencing (15.3 cm mesh); exclosures were secured with 25 cm copper stakes. Surveyor's tape was placed across the top of each exclosure to discourage geese from attempting to feed inside the exclosure and to facilitate location of the ungrazed plot from a distance.

Five grazed plots, corresponding with each ungrazed plot, were established in each field after the geese migrated north. The grazed plots were located every 50 m along a transect on the portion of the field which had the highest concentration of geese during the winter. In all except two fields, grazed plot transects were within 25 m of ungrazed plot transects.

Total counts of the numbers of geese on the study fields and their location by field were recorded on 116 days between 30 October, 1974 and 24 April, 1975. All fields were observed on each observation

day. Data were collected at different times during the day to encompass all daylight hours. An index of grazing intensity was calculated for each field by dividing the total number of geese observed on a field during the winter season by the size of the field.

The study area was also visited at night to determine roosting sites and the occurrance of feeding at night on study fields. Bimonthly counts were made from the air to supplement observations from the ground.

Exclosures were removed after the geese migrated north in April and the location of each ungrazed plot was marked with 3 flagged stakes placed flush with the soil surface. A two meter high metal post was placed three meters from each ungrazed plot to facilitate relocation of these plots in summer, prior to harvest of the fields. This procedure allowed ungrazed plots to be treated along with the rest of the field during normal farming operations.

Measurements of vegetation in grazed and ungrazed plots were taken at the time exclosures were removed to determine immediate effects of grazing by geese. Stem density was measured in fields of annual ryegrass and percent cover was measured in fields of perennial ryegrass; height of vegetation was measured in all fields.

Stem density was measured by the count quadrat method (Cain and de Oliveira Castro 1959) in three 15 cm by 7 cm quadrats in each plot. Percent cover was measured using the cover quadrat method

(Cain and de Oliveira Castro 1959) in one quadrat (0.5 m^2) in each plot; the measurements made by looking through a transparent grid held 1 m above ground level. Three measurements for average height were taken in each plot; height of the vegetation was measured at the level of greatest leaf density. Differences in measurements between grazed and ungrazed plots were analyzed with a two-way analysis of variance and a test of least significant difference.

Soil type for each field was recorded from U.S.D.A. Soil Conservation Service maps.

All plots were harvested immediately prior to commercial harvest of the fields in June through July 1975. The grass in an area 0.1 m^2 was cut from the center of each plot with electric clippers. The grass was bagged, dried in an oven, and then threshed by hand. The seed was collected, redried, and weighed. A two-way analysis of variance and test of least significant difference were used to analyze differences in yield between grazed and ungrazed plots.

RESULTS AND DISCUSSION

Pattern of Use

Geese first arrived on the study area on 30 October, 1974. During November flocks used the central observation area almost exclusively (Table 1). The central area included Cabell Marsh and two study fields, 9 and 10 (Figure 1). Public access was restricted from the majority of the central observation area during the hunting season (12 October to 29 December). An exception was field 9 located along a road open to the public. However, field 9 has traditionally been used by geese in November and the geese were not disturbed by motorized traffic. Thus, the central observation area of the refuge provided complete protection.

In December geese began to use the southern observation area along with continued use of the central area (Table 1). All fields in the southern area were large, open fields with good visibility and little disturbance. Approximately two-thirds of the fields in the southern area were open to limited numbers of hunters, 3 days a week, from 13 November to 29 December, 1974.

From January through April geese foraged on the southern and eastern observation areas (Table 1). The pressure on the birds to use the refuge as a sanctuary was relieved at the conclusion of the hunting season, at which time small flocks began to disperse over the

Willamette Valley. Use of the central observation area was minimal during January through April.

Some foraging apparently occurred at night, however visual sightings were not possible. Geese were not heard on the study fields at night, but were heard on Cabell and McFadden's marshes and on a small pond within the refuge on 6 occasions. Flocks of 30 to 50 birds were observed returning to the study area from the east and northeast between dawn and 2 hours after sunrise. Feeding at night apparently occurred 5 to 7 miles north and east of the refuge in large fields near the Willamette River (pers. comm., 1975 from R.S. Rodgers, Manager, Finley National Wildlife Refuge, Corvallis, Oregon).

Table 1. Distribution of observations of Canada geese on and adjacent to Finley National Wildlife Refuge, 1974-1975.

		Percent of geese observed			
Month	N	Central Area	Southern Area	Eastern Area	Northern Area
November[1]	17,676	88.7	11.3	0	0
December	21,789	29.0	70.3	0.6	0.1
January-April	47,677	0.1	49.3	47.5	3.2

[1]Observations from 30 and 31 October included with November.

Most feeding occurred during daylight hours with geese leaving roosting areas within two hours after dawn. Small numbers of geese

briefly returned to marshes during the day, but most remained in fields. Geese returned to marshes at dusk to roost.

During November most geese used Cabell Marsh in the central observation area as a night roosting site. In December the use of McFadden's Marsh as a night roost increased. By the end of January most geese were using McFadden's Marsh in the southern observation area as a night roosting site.

Four of the study fields were not grazed by geese (1, 2, 4, and 8), and one field (3) was essentially ungrazed (index of grazing intensity = 0.5). In four of these fields (1, 2, 3, and 4) farmers used timed exploders and human disturbance to prevent use by geese and in one field (8) no tradition of use had been established. Two additional fields were grazed exclusively by sheep (5 and 6). The remaining 11 fields were grazed by geese to a variable degree (Table 2).

Vegetation Measurements

Three measurements of vegetation (height, stem density, and percent cover) were taken immediately after the departure of geese in April. Average height of ryegrass was significantly shorter in grazed plots, than ungrazed plots, on 7 out of 10 fields grazed by geese (Table 3). Two of the 3 fields (9 and 10) in which length of grass was not significantly different between grazed and ungrazed plots had not been grazed since late December and mid-January; the third field

Table 2. Description of 17 study fields on and adjacent to Finley National Wildlife Refuge, including an index of grazing intensity, 1974-75.

Field	Area (Ha)	Ryegrass Variety	Number of Geese Observed	Number of Sheep Observed	Index of Grazing Intensity
1	55.5	Gulf Annual	0	0	0.0
2	55.5	Gulf Annual	0	0	0.0
4	23.3	Gulf Annual	0	0	0.0
8	56.7	Gulf Annual	0	0	0.0
3	46.1	Gulf Annual	24	0	0.5
6	16.2	Common Annual	0	150	8.9
7	47.6	Gulf Annual	1,512	0	31.7
5	20.2	Common Annual	0	2,992	147.8
11	24.3	Linn Perennial	5,775	0	237.9
15	29.7	Gulf Annual	11,385	0	383.3
13	24.3	Linn Perennial	9,685	0	398.9
17	17.0	Linn Perennial	7,052	0	413.2
14	8.9	Linn Perennial	4,450	0	500.0
10	13.5	Linn Perennial	7,120	0	526.6
12	34.4	Linn Perennial	18,903	0	549.5
16	6.7	Gulf Annual	4,375	0	651.0
9	11.3	Linn Perennial	14,888	0	1,341.0

Table 3. Height of ryegrass on the 17 study fields at the conclusion of the grazing period, April 1975.

Field	Index of Grazing Intensity	Average Height of Ryegrass (cm) Non-exclosed/ Grazed Plots	Exclosed/ Ungrazed Plots	Difference
Grazed by geese				
11	237.9	17.9	30.7	12.8*
15	383.3	18.2	32.8	14.6*
13	398.9	15.5	35.5	20.0*
17	413.2	13.1	25.2	12.1*
14	500.0	16.3	27.9	11.6*
12	549.5	15.5	28.5	13.0*
16	651.0	11.3	27.1	15.8*
7	31.7	15.3	16.5	1.2
10	526.6	18.5	19.7	1.2
9	1,314.0	18.6	16.2	-2.4
Grazed by sheep				
6	8.9	14.5	26.1	11.6*
5	147.8	9.5	20.0	10.5*
Not grazed				
1	0.0	30.5	29.7	-0.8
2	0.0	39.2	43.1	3.9
4	0.0	23.9	26.1	2.2
8	0.0	20.1	20.8	0.7
3	0.5	25.5	27.9	2.4

* Significant; $P < 0.05$, LSD (geese) = ± 5.67, LSD (sheep) = ± 6.78.

(7) was grazed only lightly (index of grazing intensity = 31.7).

Both fields (5 and 6) grazed by sheep had significantly shorter grass in grazed plots than in ungrazed plots, even though grazing intensity was comparatively low. That sheep had a greater effect on height of grass than geese was expected considering differences in size and grazing habits of sheep and geese.

No trend in differences of stem density and percent cover between grazed and ungrazed plots was apparent (Table 4). One perennial ryegrass field (9) had significantly greater percent cover in grazed than ungrazed plots and one annual ryegrass field (7) had significantly greater stem density in grazed than ungrazed plots. These differences in density of grass were probably not related to grazing since one field (7) had the lowest intensity of grazing by geese (31.7) and the other field (9) had the highest intensity of grazing by geese (1, 314.0).

Seed Yield

Yield of seed on grazed fields varied greatly between fields, ranging from 56.6 g/m^2 to 247.8 g/m^2. Of the 10 fields grazed by geese, yield differed significantly between grazed and ungrazed plots on only 2 fields. In both cases yield of seed was greater in grazed than ungrazed plots (Table 5). One of the 2 fields grazed by sheep had a significantly lower yield of seed in grazed than ungrazed plots. Seed yield in the other fields did not differ between grazed and ungrazed plots.

Table 4. Stem density and percent cover of ryegrass on the 17 study fields at the conclusion of the grazing period, April 1975.

Field	Percent Cover ($0.5m^2$) Non-exclosed/ Grazed Plots	Percent Cover ($0.5m^2$) exclosed/ Ungrazed Plots	Stem Density ($100cm^2$) Non-exclosed/ Grazed Plots	Stem Density ($100cm^2$) exclosed/ Ungrazed Plots	Difference
Grazed by geese					
9	57.2	30.8	--	--	26.4*
10	48.4	56.8	--	--	-8.4
11	41.2	43.2	--	--	-2.0
12	56.6	56.6	--	--	0.0
13	36.4	59.2	--	--	-22.8
14	60.8	78.4	--	--	-17.6
17	58.8	68.2	--	--	-9.4
7	--	--	40.1	26.2	13.9*
15	--	--	23.2	21.9	1.3
16	--	--	24.9	20.9	4.0
Grazed by sheep					
5	--	--	25.3	29.6	-4.3
6	--	--	25.5	24.3	1.2
Not grazed					
1	--	--	27.9	34.1	-6.2
2	--	--	35.2	38.1	-2.9
3	--	--	30.3	26.5	3.8
4	--	--	37.7	35.3	2.4
8	--	--	25.3	23.9	1.4

* Significant; $P < 0.05$, LSD (geese, percent cover) = ± 25.38, LSD (geese, stem density) = ± 8.8, LSD (sheep, stem density) = ± 6.7

Table 5. Yield of ryegrass seed on fields grazed by Canada geese or sheep during winter, Willamette Valley, 1974-75.

Field	Index of Grazing Intensity	Seed Yield (g/0.1 m^2) Non-exclosed/ Grazed Plots	Exclosed/ Ungrazed Plots	Difference
Grazed by geese				
13	398.9	23.15	11.37	11.78*
9	1,314.0	11.84	5.66	6.18**
7	31.7	15.87	10.31	5.56
11	237.9	16.66	12.20	4.46
15	383.2	16.87	17.90	-1.03
17	413.2	13.95	16.64	-2.69
14	500.0	12.05	13.95	-1.90
10	526.6	7.08	8.47	-1.39
12	549.5	11.21	13.22	-2.01
16	651.0	15.58	17.50	-1.92
Grazed by sheep				
5	147.8	16.03	24.78	-8.75*
6	8.9	9.34	10.09	-0.75

* Significant; $P < 0.05$, LSD (geese) = ± 7.0, LSD (sheep) = ± 6.9.

** Significant; $P < 0.10$, LSD (geese) = ± 5.9.

The large variability in yield of seed between fields was probably due to such things as farming methods, soil type, and age of crop in the case of perennial ryegrass, but differences in yield between fields was not related to grazing.

I conclude that grazing by geese in winter, while it may occasionally have an immediate effect on ryegrass, does not reduce yield of seed, and in some cases may increase yield. Conversely, grazing by sheep may occasionally reduce yield, although the sample size was too small to allow firm conclusions.

The present population levels of geese in the Willamette Valley are unlikely to have measureable effect on yield of ryegrass seed. Grazing by geese is a minor element in the many variables that determine yield of ryegrass seed.

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