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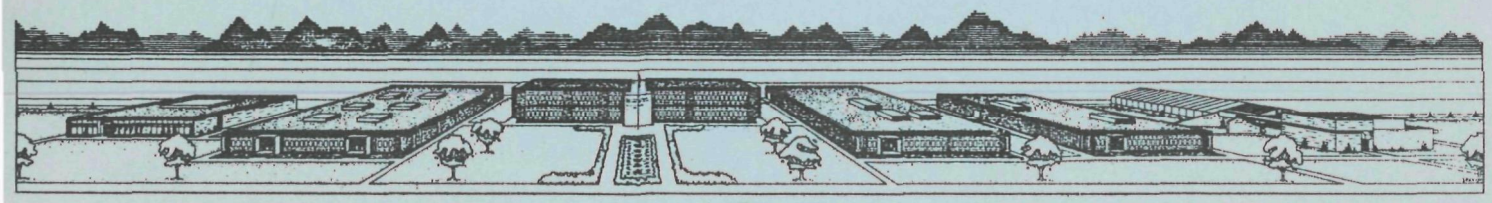
AGRONOMIC ASPECTS OF THE EXPERIMENTAL DAIRY FARM DURING 1969

by
Edgar M. Daley
Radiological Research Program
Western Environmental Research Laboratory

ENVIRONMENTAL PROTECTION AGENCY

Published July 1971

This study performed under a Memorandum of Understanding (No. SF 54 373)
for the
U.S. ATOMIC ENERGY COMMISSION



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*Formerly Southwestern Radiological Health Laboratory, part of the U. S. Department of Health, Education, and Welfare, Public Health Service, Environmental Health Service, Environmental Control Administration, Bureau of Radiological Health.

ABSTRACT

This report is one of a succession of annual reports on the agronomy practices of the experimental dairy farm at the Nevada Test Site. The report includes a narrative report and accompanying tables on irrigation, fertilization, crop production, and meteorological data during the year 1969.

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INTRODUCTION

The Western Environmental Research Laboratory (WERL) of the Environmental Protection Agency, formerly the Southwestern Radiological Health Laboratory, U. S. Public Health Service, maintains and operates an experimental dairy farm on the Nevada Test Site (NTS) with the U. S. Atomic Energy Commission.

The experimental farm is located in Area 15 of the NTS which is approximately 110 miles from WERL (see Figure 1). The farm is situated in a high desert valley (elevation 4,500 feet). The soil is a coarse, gravelly, sandy loam with cobbles intermixed. The soil has a pH of 8.5. The physical description and history of the farmstead are described in reports previously published[1,2].

The farm is maintained to support the dairy herd used in experiments and provide crops for other studies conducted by the Radiological Research Program (RRP).

This report is one of a succession of reports of the agronomy practices of the farm for the year 1969 with certain comparisons to prior years practices. The report is compiled from monthly reports written from daily sheets kept by the Crop Research Helpers. These records document the practices on the farm and supply the information that can be used in support of controlled release experiments or in "Ad Hoc" studies that may be conducted following a radioactive release from nuclear explosive tests or reactor tests conducted at the NTS or Nuclear Reactor Development Station.

The crop area consists of 16 acres which are divided into 17 plots or lands by the irrigation laterals. Each of the end lands has an area of approximately one-half acre, while the remaining 15 lands each contain one acre. Figure 2 shows the crop lands and buildings of the experimental dairy farm.

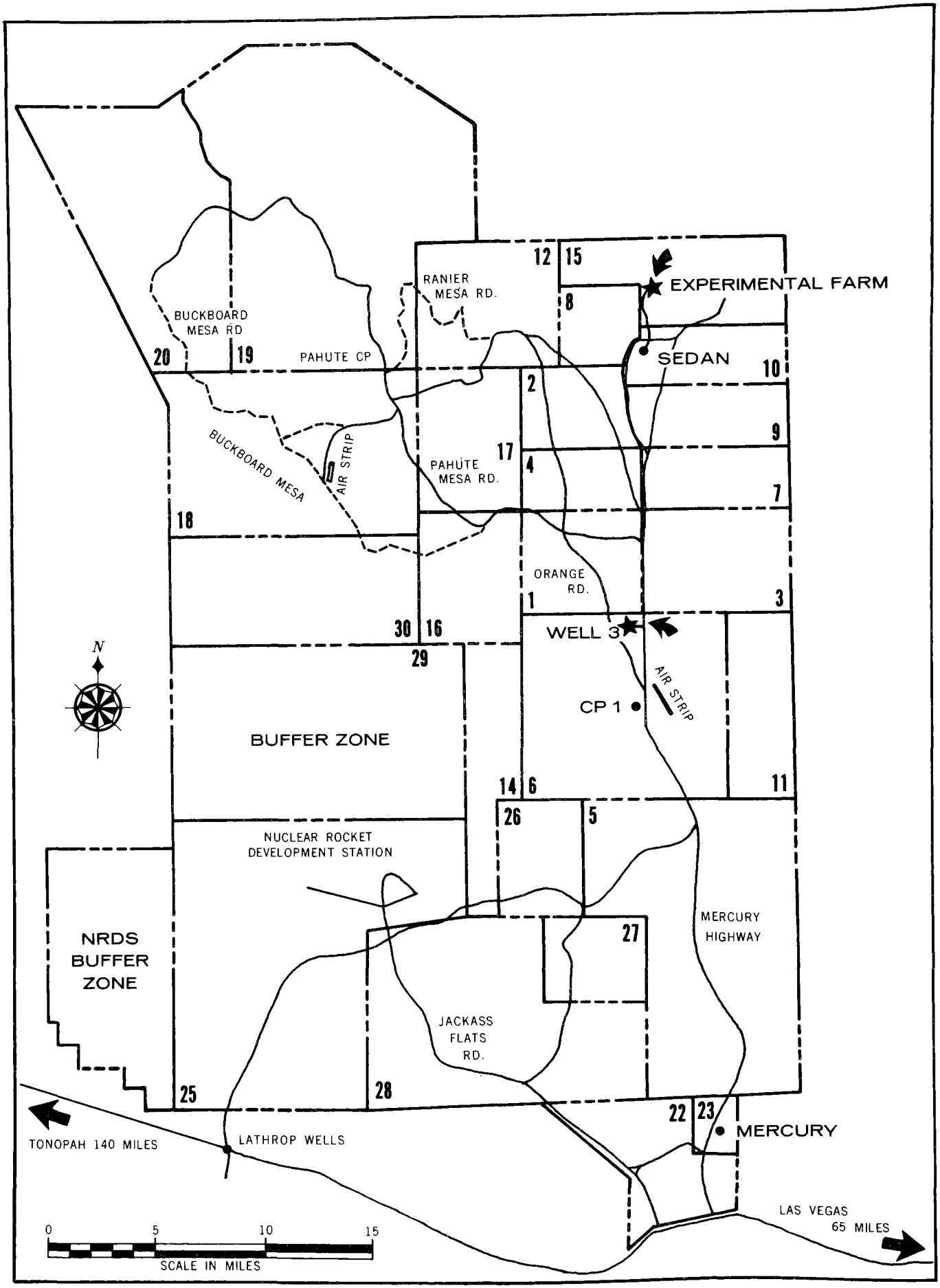

Figure 1. Location of Environmental Protection Agency facilities on the Nevada Test Site.

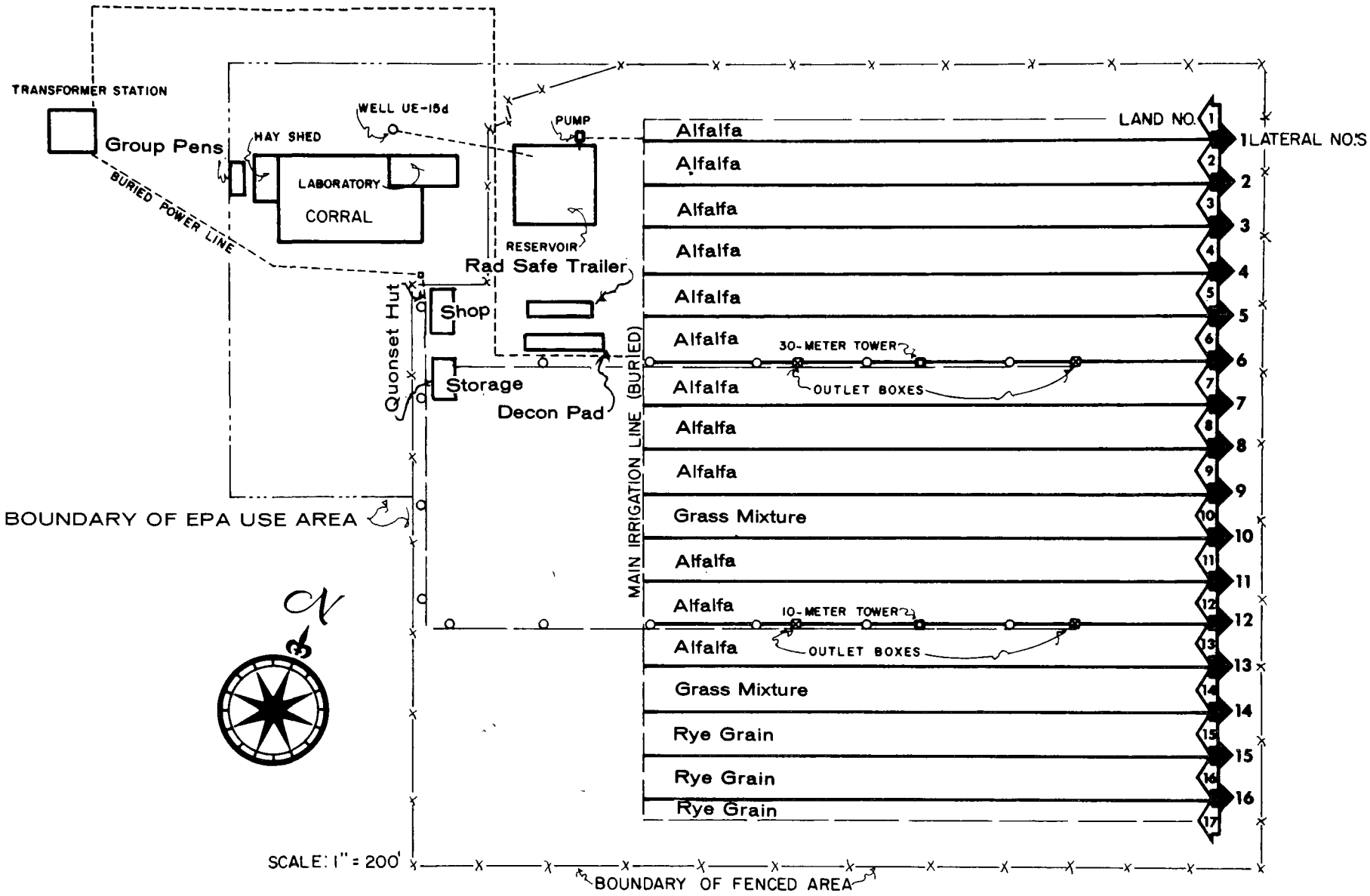

Figure 2. Crop lands and buildings of the Experimental Dairy Farm.

AGRONOMY PRACTICES

A. Irrigation

The irrigation system was installed in the fall of 1964. It consists of a centrifugal pump mounted on the north bank of the reservoir, a 900-foot main line, and sixteen 770-foot laterals connected to the main line at right angles. The laterals are 3-inch O.D. steel pipes spaced approximately 60 feet apart. Each lateral has Rainbird Model 40 B sprinkler heads spaced approximately 40 feet apart and mounted 20 inches above the laterals on 3/4-inch galvanized pipe risers. The water flow through each lateral is controlled by a gate valve located just off the main line.

The irrigation season was from March through November, with peak usage in August. The amount of water applied was 84.4 acre-feet (325,850 gallons equals one acre-foot) with an average of 5.2 acre-feet per land. Appendix I lists amounts of irrigation water applied by months to each land.

During 1968, 93.9 acre-feet with an average of 5.8 acre-feet per land were used. The 1968 irrigation started a month earlier. The amount of water applied to the total crop land during each month for the years 1968 and 1969 is shown in gallons vs. months in Figure 3.

B. Fertilization

During this reporting period the only nutrients applied were nitrogen and phosphorus. The sources of the nutrients are ammonium sulfate (21-0-0)* containing 21% nitrogen and treble super phosphate (0-45-0) containing 45% P_2O_5.

*Amount of nutrient expressed in pounds of nutrient in 100 pounds of material. N = Nitrogen, P_2O_5 = Phosphorus, K_2O = Potash (N-P_2O_5-K_2O).

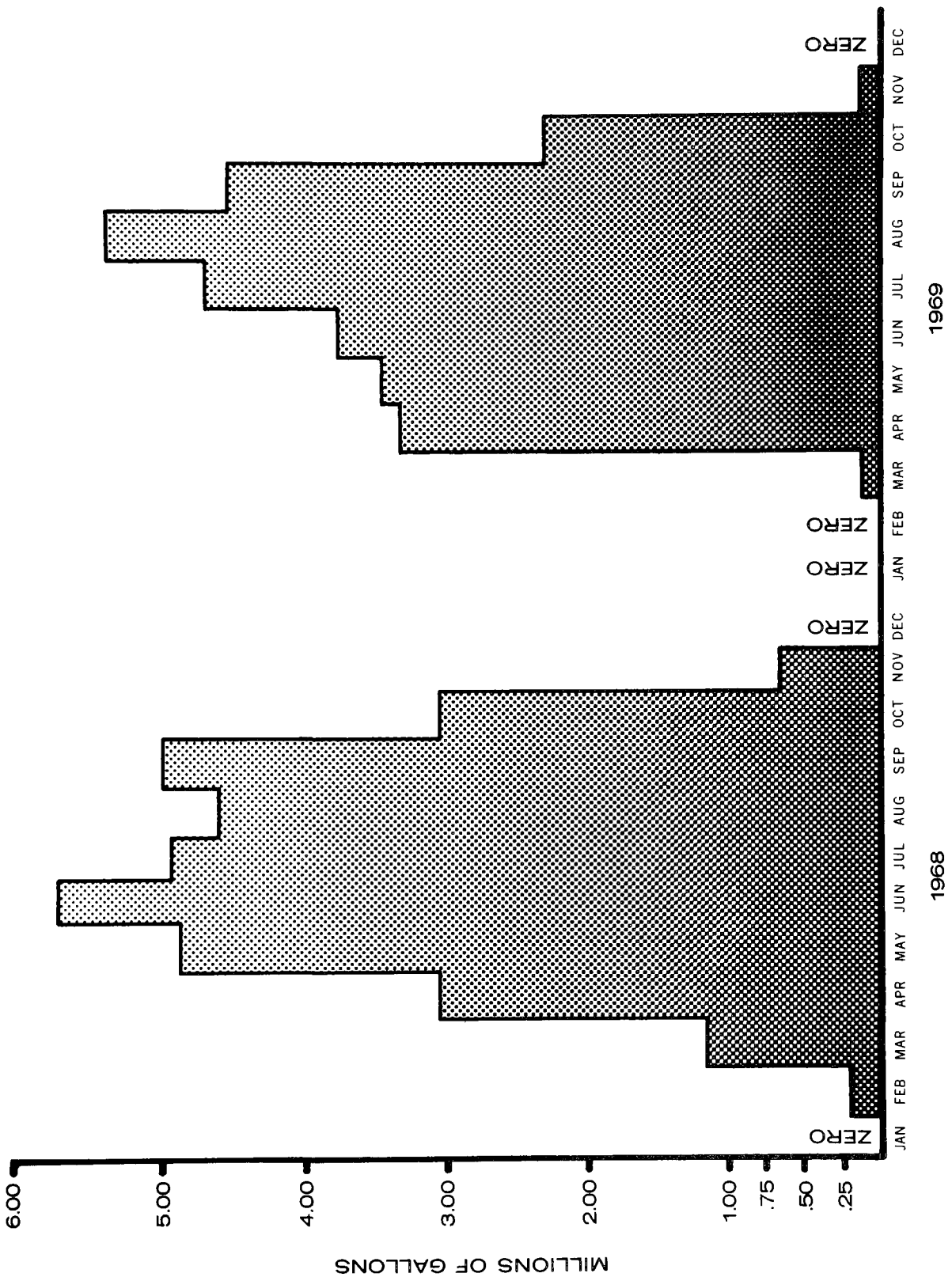

Figure 3. Gallons of irrigation water applied monthly for 1968 and 1969.

Phosphorus is the primary nutrient requirement of legumes. This is usually applied during the winter months as a top dressing for the crops. Phosphorus is also applied to small grains as a preplant fertilizer to aid in the development of a good root system.

Nitrogen is required for small grains and grasses for plant growth. Nitrogen is applied as a top dressing during the growing season and as a preplant application on small grains.

In southern Nevada the alfalfa yields are lowered by what is referred to as "midsummer slump." Split application of phosphorus is used by some operators to overcome this and has reportedly increased their yield. The practice consists of applying half of the fertilizer in the winter and the other half after the first cutting.

A fertilizer demonstration experiment was conducted at the farm to determine if this procedure would increase forage production. A single application of treble super phosphate was applied to alfalfa at the rate of 180 lbs/A P_2O_5 (78 lbs/A P) on March 5. Split applications of 90 lbs/A P_2O_5 (39 lbs/A P) to an identical plot of alfalfa were made on March 5 and June 11. The second application followed the first cutting of alfalfa. The difference in yields between the split application and the single application plots was insignificant and does not warrant the extra time and labor required for two applications.

The amounts of fertilizer expressed in pounds of nutrients applied to each land are recorded in Appendix II.

C. Crops

Green chop harvesting of winter rye began on April 4. Three varieties of rye (Secale cereale) were planted in October of 1968 on Lands 15, 16, and 17. These were Balboa, Elbon, and Oregon common. Elbon is the most winter-hardy of the varieties planted.

The alfalfa stand was established in September 1965. The first alfalfa green chop was harvested April 17. The first cutting of alfalfa hay was baled on May 14. Each land produced from four to five cuttings of alfalfa hay.

Although other areas of southern Nevada (Virgin Valley and Moapa Valley) reported severe insect damage, none was noted at the farm. This is probably due to isolation, altitude, agricultural practices (leaving short stubble on alfalfa), the cold winter, and use of resistant varieties.

During 1969, 85 ton of hay and 159 ton of green feed were produced over a 211-day growing and harvesting period. The yields for the 1968 season were 117 ton of green feed and 63 ton of hay over a 220-day harvesting period. See Figure 4 and Appendix III (a and b) for comparison and production.

The average hay production on 13.5 acres was 6.3 ton per acre. Average production of green chop per acre on 16 acres was 9.9 ton. The average production for 1968 was 4.4 ton of hay and 6.6 ton of green chop per acre.

Lands 15, 16, and 17 were fallow during July, August and September of 1969.

During the year the temperatures at the farm ranged from an average low of 28.1°F to an average high of 89.2°F, resulting in a growing season of 211 days from April 4 to November 1.

Snow storms occurred during the winter with a maximum single accumulation of snow of approximately 18 inches. Winter rain storms accounted for the greater than average 5 to 6 inches of precipitation. The total amounts for the month and number of days precipitation occurred are listed in Appendix IVa.

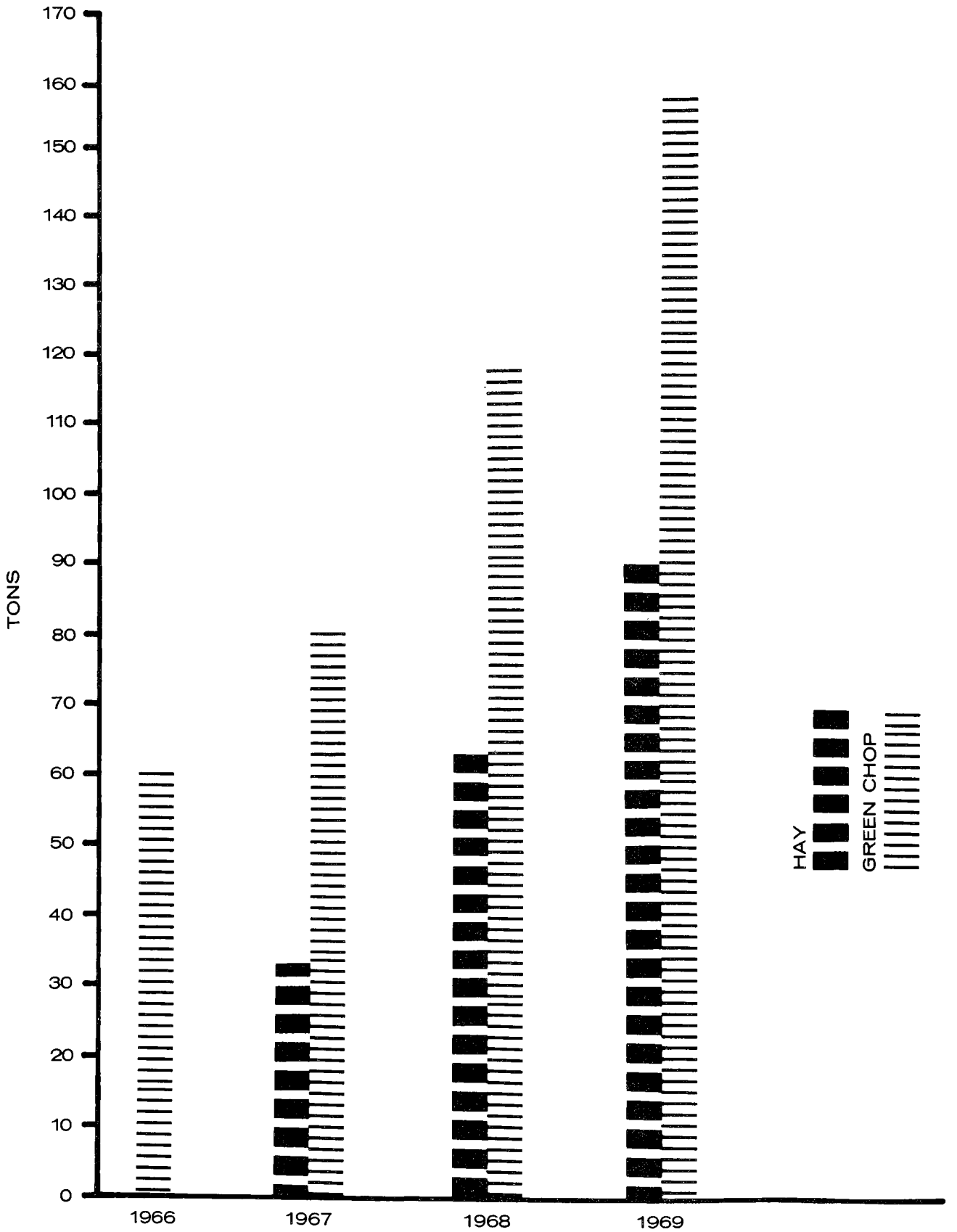

Figure 4. Forage production from 1966 through 1969.

Mechanical and chemical weed control is practiced throughout the year. At the farm there were no hard-to-control noxious weeds such as Russian knapweed, Canadian thistle, or bindweed. The noxious weeds, Russian thistle, primrose, and pigweed are present and kept under control by employing both chemical and mechanical methods of weed control. In order to prevent the introduction of noxious weeds, only certified seed is used.

Mechanical weed control consisted of scraping the soil surface of the non-crop area within the farm compound area with a tractor rear-mounted blade. Hand hoeing was employed in the vegetable crops of the micro-plots. The fallow lands were disced with a disc harrow during the summer to control the weeds.

Herbicides used for weed control were 2, 4-D and Paraquat.* The areas around the sprinkler heads, gate valves, fence rows and along the irrigation laterals were controlled by spraying with either a hand sprayer or tractor-mounted sprayer, depending on the size of the area to be sprayed. The herbicide material is put in water and a spreader added to make up the spray solution.

On October 2, Lands 15, 16, and 17 were planted with winter rye (Secale cereale) Elbon variety at 100 pounds per acre. Excellent germination resulted and there was a thick dense stand of rye. Elbon rye was selected because of its winter-hardiness.

*Paraquat-Chevron Chemical Company, Ortho Division.

AGRONOMIC COMPARISONS WITH ADJACENT AREAS

The procedures practiced on the experimental farm follow recommended practices or duplicate actual practices used by commercial farmers of this general geographic area. Direct comparisons of yield, fertilization needs, and water requirements are difficult as the farm is isolated and not part of the specific farming area. Each area has its unique characteristics that influence the agronomic practices and determine, to a great extent, crop yields. Some of these characteristics are fertility, soil pH, soil type and depth, organic matter content, altitude and length of growing season, amount of precipitation, and quality of irrigation water, etc.

A 1964 survey of the Pahrump, Nevada, farming community (70 miles south of the farm) revealed that the average annual production of alfalfa hay from established fields was eight ton per acre produced in six cuttings. The farm production in 1969 was 6.3 ton per acre produced in four cuttings plus 9.9 ton of alfalfa green chop per acre [4].

The University of Nevada Extension Service estimates that alfalfa grown in southern Nevada requires 7.5 acre-feet of water per acre per year. Small grains for the area require 3.5 acre-feet of water per acre per year. Irrigation at the experimental farm for 1969 was 5.7 acre-feet per acre per year on the alfalfa and 3.5 acre-feet per acre per year for the small grain [5].

The average production of rye green chop from 1956-1961 on the University of Nevada Agricultural Experimental Station, Logandale, Nevada (100 miles southeast of the farm) was 4.4 ton per acre dry weight or approximately 9 ton per acre wet weight. Area 15 production averaged 7.5 ton per acre wet weight in 1969 [6].

FIELD EXPERIMENTS

There were two experiments involving the controlled release of radioiodine (Project Take Up, August 15, Land 12 and Project Retake, September 8, Land 11) conducted on the farm. Both experiments utilized aerosols of diatomaceous earth of two different particle sizes which were tagged with $Na^{131}I$ and elemental $^{131}I_2$ generated over growing alfalfa.

Neither of these experiments included any feeding of contaminated feed to the dairy cows. The experiments were designed to determine the rate of binding and the effective half-life for three different artificial ^{131}I contaminants.

Results of these experiments will be published separately.

MICROPLOTS

The microplots are located adjacent to the northeast corner of the farm. The area is approximately two acres of irrigated farm land of the same soil type and pH as the farm. These plots are used to conduct studies of plant uptake in small grains and vegetable crops and movement in the soil of long-life isotopes. Results of these experiments will be published separately.

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APPENDICES

APPENDIX I. Tabulation of Monthly Irrigation by Land During 1969.

The amount of irrigation water applied per land and month is expressed in acre-inches (an acre inch = 27,154 gallons). The year's total per land is written in acre inches per year and acre feet (an acre foot = 325,850 gallons) per year.

Lands	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
								(Acre-inches)								
Jan	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Feb	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mar	0	0	0	0	0	0	0	0	0	0	0	0	.7	.7	.7	.7
Apr	2.9	6.4	6.4	7.2	8.4	7.6	7.3	7.3	6.7	6.1	7.0	9.8	10.6	10.6	7.0	10.6
May	7.3	9.7	9.7	11.9	10.9	7.7	9.2	11.4	10.9	8.1	9.0	9.0	14.6	9.8	2.3	2.2
Jun	11.9	6.1	12.6	7.8	10.2	8.2	10.0	4.1	8.0	10.6	10.5	10.4	14.2	5.5	0	0
Jul	16.8	10.4	10.4	12.5	10.4	10.4	16.2	18.1	16.8	19.1	17.4	9.7	6.5	9.0	0	0
Aug	15.7	11.4	11.4	8.9	7.5	16.0	18.4	16.2	9.1	14.8	11.4	11.8	11.8	12.0	2.0	2.0
Sep	8.1	10.2	8.1	8.1	10.2	11.8	12.8	8.4	10.4	12.0	7.5	10.6	11.2	10.6	6.0	6.0
Oct	5.8	5.0	5.0	7.2	7.2	6.4	4.1	8.6	8.6	8.6	10.0	7.6	4.3	4.3	4.3	3.3
Nov	0	0	0	0	0	0	0	0	0	0	0	0	1.1	1.1	1.1	1.1
Dec	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Acre Ins.	68.5	59.2	63.6	63.6	64.8	68.1	78.0	74.1	70.5	79.3	72.8	68.5	75.0	63.6	23.2	25.9
Total Acre Feet	5.7	4.9	5.3	5.3	5.4	5.6	6.5	6.1	5.8	6.6	6.0	5.7	6.2	5.3	1.9	2.1

APPENDIX II. Tabulation of Fertilizer Applied to Each Land January - December 31, 1969.

Fertilizer is expressed in pounds of actual nutrients applied, i.e., N represents nitrogen, P_2O_5 represents phosphorus

Lands	1	2	3	4	5	6	7	8	9
Date of Application									
March 5	90#P_2O_5	180#P_2O_5	90#P_2O_5	180#P_2O_5	90#P_2O_5	180#P_2O_5	180#P_2O_5	90#P_2O_5	180#P_2O_5
June 11			90#P_2O_5		90#P_2O_5				

Lands	10	11	12	13	14	15	16	17
Date of Application								
March 5	90#P_2O_5	135#P_2O_5	225#P_2O_5	90#P_2O_5	90#P_2O_5	72#P_2O_5	72#P_2O_5	36#P_2O_5
5	42#N					48#N	48#N	25#N
April 9						25#N	25#N	16#N
May 27	48#N				48#N			
July 8	42#N				42#N			
October 2						32#N	32#N	16#N
2						36#P_2O_5	36#P_2O_5	18#P_2O_5

APPENDIX IIIa. Crop Production During 1969.

Hay production by lands(expressed in tons).

Lands	1	2	3	4	5	6	7
May	0.75	2.25	2.25	2.25	2.25		2.25
Jun		1.50	1.50	1.50	1.75		1.50
Jul		1.50	1.50	1.75	3	1.75	
Aug		1.50	1.50	1.50	1	1	
Sep			1.75	1.75			
Total	0.75	6.75	8.50	8.75	8	2.75	3.75

Lands	8	9	10	11	12	13	14
May	2.75	3	2.25	2.25	2.25	0.75	2.25
Jun	1.75	2	1.50	2	1.75		
Jul	1.50	1.75		1.50	1.50		
Aug	1.25	1.25	1.25	1.50	2.25	1.50	
Sep	1.75	1.75					
Oct				1.50	1.50		
Total	9	9.75	5	8.75	9.25	2.25	2.25

Total hay production for the year was 85 ton.

APPENDIX IIIb. Crop Production During 1669.

Green chop production by lands (expressed in tons).

Lands	1	2	3	4	5	6	7	8	9
Apr	1.50					4.50			
May						5.50			
Jun	5					7.50			
Jul	1.50					4	8		
Aug	4	3.25				2.25	2.50		
Sep	2.25	2.50			5.50	5.75	1.75		
Oct	2.75	4.25		3.25	1.25	1.25	1.50	1.50	1.25
Nov					.50	.50			
Totals	17	10		3.25	7.25	31.25	13.75	1.50	1.25

Lands	10	11	12	13	14	15	16	17
Apr						2.75	2.75	2.75
May				6.50		4.50	7.25	2.00
Jun				5.50	5.75			
Jul	2			4.50	3.50			
Aug	5.25				3.75			
Sep	5.25			3.25	1.50			
Oct				3.25	2			
Totals	12.50			23	16.50	7.25	10	4.75

Total green chop production for the year was 159 ton.

APPENDIX IVa. Summary of the Meteorological Data from Area 15 Farm. (Temperature data)

The temperatures are the means and the extremes for the months of 1969. Temperatures are expressed in degrees Fahrenheit.

Means	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
High	49.8	45.3	53.5	67.1	79.9	79.6	88.9	89.2	79.7	62.1	57.6	51.5
Low	31.5	29.7	31.1	40.7	51.2	54.3	60.9	62.2	53.3	37.3	34.0	28.1

Extremes	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
High	70	56	77	79	91	90	94	95	90	79	70	61
Low	18	20	18	29	38	45	54	52	47	26	22	18

APPENDIX IVb. Summary of the Meteorological Data from Area 15 Farm. (Precipitation data)

The precipitation is the total for the month and the total for the year. The amount of precipitation was higher than normal for the Area 15 Farm during this period. The high months were during the winter non-growing season.

Precipitation is expressed in inches.

Month	Total for month	Number of days precipitation occurred
January	3.69	10
February	2.78	13
March	.35	3
April	.20	4
May	.19	1
June	.82	5
July	1.15	6
August	.59	4
September	.14	2
October	.04	2
November	.60	4
December	.01	1
Total for year	10.56	55

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