

ALFALFA FERTILITY EXPERIMENT

Prior to 1953 a fertility trial on potatoes and several farm field incidents indicated much higher response to high levels of sulfur than would be expected. From these situations it was thought that perhaps the reason for the lack of response to phosphate on soils relatively low in phosphate was that sulfur was the most limiting factor. Also to study the effects of large amounts of S on the yield of alfalfa hay.

To evaluate these problems, a factorial experiment with five sulfur levels, 0, 35, 70, 140, & 280# of S as gypsum; two phosphate levels, 0-100# of P₂O₅ as treblesuper phosphate; and two levels of potash, 0-100# K₂O as muriate of potash were applied alone and in all possible combinations. These twenty treatments were surface applied at 5 locations in Central Oregon. The results of the experiment indicated that sulfur did not increase yield at any level and that phosphate gave only modest, however significant, increases at two locations. The phosphate increases in the combined analysis of 4 locations was also significant.

Three of the locations, Lee Putnam, Tumalo; Charles Porter, Plainview; and Hopper and Vice, Prineville, were continued during 1954 with no further fertilization in order that yield measurements could be taken on carryover of the fertilizers.

The trials as established in 1953 consisted of three replications at the Hopper & Vice and Charles Porter locations and four replications at the Lee Putnam location. The plots were 8 x 30 feet.

Preceding harvest, 3 feet of alfalfa was trimmed from each plot. Yield estimates were taken by cutting a swath 3 feet wide through the remaining 24 foot plot with a Jari power mower. The forage was gathered and field weights were recorded. Moisture samples were taken from each plot weighed, brought to an air dry weight and reweighed. Forage was calculated on an air dry weight basis and converted to pounds per acre of air dry forage.

The Experiment by Location

The Lee Putnam farm is located in the Tumalo community and has the following legal description: NE $\frac{1}{4}$ of the NE $\frac{1}{4}$ of the SW $\frac{1}{4}$ of Sec. 18 T 16 S, R 12 E.

The soil is a Deschutes sandy loam, ranges from 16-20 inches in depth and has numerous large rocks scattered throughout the field. Several are in the trial area.

The trial area has had the following cropping history:

<u>Year</u>	<u>Crop</u>	<u>Fertilizer</u>	<u>Yield</u>
1953	Alfalfa	Fertility trial	
1952	Trebi barley seeded with alfalfa		20-25 Bu.
1951	Potatoes	5-600# 10-20-20	4-500 Bu.
1950	Potatoes	5-600# 10-16-8	4-500 Bu.
1949	Old Bluegrass pasture	None	-

Table No. 33
 Effect of Five Sulphur Fertilizer Levels, Two Phosphate Fertilizers, and Two Potash Fertilizer
 Levels, Alone and in Combinations on the Yield of Alfalfa Hay
 Yield in Pounds Per Acre Air Dry Forage
 Lee Putnam Farm - Tumalo, Oregon - First Cutting July 22, 1954

Fertilizer Application Pounds Per Acre			Pounds of Air Dry Forage Per Acre By Replication				Mean Yield
S	P ₂ O ₅	K ₂ O	I	II	III	IV	
0	0	0	3542.9	3281.5	3446.7	3469.1	3435.0
35	0	0	3092.8	4899.3	3686.9	3869.0	3887.0
70	0	0	3882.9	4449.8	4148.5	3585.8	4016.7
140	0	0	3955.5	4768.6	4029.9	4405.0	4289.7
280	0	0	3166.6	3682.0	5050.5	4253.8	4038.2
0	100	0	4850.3	4590.1	3153.3	4383.8	4244.4
0	0	100	4511.5	4524.8	2455.1	3861.1	3838.1
0	100	100	3826.6	4229.0	4610.1	3606.4	4068.0
35	100	0	4977.3	4394.1	4478.8	3870.2	4430.1
35	0	100	4412.9	4201.1	3929.5	4009.3	4138.2
35	100	100	4375.4	4996.7	4121.9	4403.2	4474.3
70	100	0	4077.7	4002.1	4044.4	4167.8	4073.0
70	0	100	3536.8	3688.7	4320.3	4020.8	3891.6
70	100	100	5273.2	4613.7	4987.6	4951.9	4956.6
140	100	0	4883.0	4563.5	3861.7	4403.2	4427.9
140	0	100	3662.1	5034.2	4115.2	3179.9	3997.9
140	100	100	3746.2	5068.7	5074.1	4134.6	4505.9
280	100	0	3776.4	4616.2	4625.2	3382.0	4100.0
280	0	100	4285.8	5169.1	4134.0	4420.7	4502.4
280	100	100	3938.6	3517.5	5092.9	4201.7	4187.7

Table No. 34
 Effect of Five Sulphur Fertilizer Levels, Two Phosphate Fertilizers, and Two Potash Fertilizer
 Levels, Alone and in Combinations on the Yield of Alfalfa Hay
 Yield in Pounds Per Acre Air Dry Forage
 Lee Putnam Farm - Tumalo, Oregon - Second Cutting Sept. 15, 1954

Fertilizer Application			Pounds of Air Dry Forage Per Acre				Mean Yield
Pounds Per Acre			by Replication				
S	P ₂ O ₅	K ₂ O	I	II	III	IV	
0	0	0	3198.6	1522.8	2382.5	2139.9	2311.0
35	0	0	2645.7	2724.9	2334.1	3823.6	2882.1
70	0	0	3389.8	3921.0	2870.7	4047.5	3557.3
140	0	0	3156.3	3897.4	3282.1	3680.8	3504.2
280	0	0	4012.4	4605.3	3951.3	5259.3	4457.1
0	100	0	4281.0	2784.8	1612.9	3136.3	2953.8
0	0	100	5998.6	2819.9	1871.9	3400.1	3522.6
0	100	100	4343.9	3175.6	3469.7	2369.8	3339.8
35	100	0	4317.9	3504.2	4271.9	3573.1	3916.8
35	0	100	4977.3	2862.9	3478.1	4012.4	3832.7
35	100	100	5041.5	4040.8	2648.1	3581.0	3827.9
70	100	0	4493.9	3042.5	3630.6	3597.9	3691.2
70	0	100	4002.1	3410.4	3907.7	2768.5	3522.2
70	100	100	5157.0	3365.6	4527.8	4203.5	4313.5
140	100	0	3394.1	4431.0	4379.0	4065.6	4067.4
140	0	100	4215.6	5235.7	3751.6	3310.0	4128.2
140	100	100	3614.9	2894.9	4378.4	4518.7	3851.7
280	100	0	4101.3	4571.4	4899.3	3127.2	4174.8
280	0	100	4283.4	6180.1	3108.5	4524.2	4524.1
280	100	100	4162.4	3095.8	3896.8	4037.8	3798.2

Table No. 35
 Summary Alfalfa Fertility Trial
 Lee Putnam Farm - Tumalo, Oregon - 1954
 Deschutes Sandy Loam

Fertilizer Application			Air Dry Forage # Per Acre		
Pounds Per Acre			By Cutting		
S	P ₂ O ₅	K ₂ O	1st	2nd	Total
0	0	0	3435.0	2311.0	5746.0
35	0	0	3887.0	2882.1	6769.1
70	0	0	4016.7	3557.3	7574.0
140	0	0	4289.7	3504.2	7793.9
280	0	0	4038.2	4457.1	8495.3
0	100	0	4244.4	2953.8	7198.2
0	0	100	3838.1	3522.6	7360.7
0	100	100	4068.0	3339.8	7407.8
35	100	0	4430.1	3916.8	8346.9
35	0	100	4138.2	3832.7	7970.9
35	100	100	4474.3	3827.9	8302.2
70	100	0	4073.0	3691.2	7764.2
70	0	100	3891.6	3522.2	7413.8
70	100	100	4956.6	4313.5	9270.1
140	100	0	4427.9	4067.4	8495.3
140	0	100	3997.9	4128.2	8126.1
140	100	100	4505.9	3851.7	8357.6
280	100	0	4100.0	4174.8	8274.8
280	0	100	4502.4	4524.1	9026.5
280	100	100	4187.7	3798.2	7985.9
			Treatment L.S.D. 5%		1679.9
			C.V. 15%		

Main Effects of Fertilizers on Total Air Dry Forage

Fertilizer Application	Air Dry Forage Yield	Deviation from No Treatment
Lbs. Per Acre	Lbs. Per Acre	
<u>S</u>		
0	6928.2	
35	7847.2	+ 919.0
70	8005.6	+1077.4
140	8193.3	+1265.1
280	8445.7	+1517.5
<u>L.S.D. 5%</u>	<u>839.9</u>	
<u>P₂O₅</u>		
0	7627.7	
<u>100</u>	<u>8140.3</u>	<u>+ 512.6</u>
<u>K₂O</u>		
0	7645.8	
<u>100</u>	<u>8122.2</u>	<u>+ 476.4</u>

Table No. 36

Lee Putnam Farm
Tumalo, Oregon

1953

Deschutes Sandy Loam

Range of Depth	pH	P2O5 ppm	K2O ppm	Total Salts ppm	Sodium ppm
0-6	5.9	20.0	340	101	90
6-12	6.2	3.4	301	105	107
12-18	6.2	3.9	238	84	95

55

To the farmer's knowledge, the field had been in bluegrass pasture for many years.

During the 1954 crop season, the trial area received seven irrigations on the following approximate dates:

- 1 - May 18
- 2 - June 8
- 3 - June 28
- 4 - July 12
- 5 - July 21
- 6 - August 28 - a heavy rain followed immediately
after irrigation
- 7 - September 14

The field was irrigated again during the fall.

The alfalfa was cut on July 22 and September 15, 1954.

The field was very dry before it received its first irrigation. Alfalfa was 3 - 5 inches tall May 19 and there was no sulfur shortage at that time.

By July 22, 1954, only slight sulfur deficiencies were noticed. However, by the time of the second cutting (September 19, 1954) sulfur deficiencies on the no treatment plots were obvious.

Table No. 36 shows the soil test analysis for the trial area as taken in 1953. The area was slightly acid in the surface six inches and quite low in phosphate below the six inch depth. The area has adequate potash as indicated by the soil test.

Tables No. 33+34 show the yield by replication and total for the cutting. Table No. 35 is a summary giving the yield by cutting, season total and the main effects of the fertilizers. Considering main effects of the fertilizers, sulfur significantly increased yield while phosphate and potash had no significant effects. There were no interactions.

In comparing individual treatments, it required 70 pounds of S alone to result in a significant increase. However, 35 pounds of sulfur in combination with phosphate or potash or both resulted in significant increases over no treatment. Phosphate and potash alone or in combination did not significantly affect yield.

While there were no significant differences between rates of S in the main effects, the trend is obvious. Each increment of S increased yield.

Charles Porter Farm

The Charles Porter farm on Collins Road is located approximately four miles northwest of Tumalo. The trial area has the following legal description:

NW $\frac{1}{4}$ of the NW $\frac{1}{4}$ of the SE $\frac{1}{4}$ of Section 27 T 16 S, R 11 E.

Table No. 37
 Effect of Five Sulphur Fertilizer Levels, Two Phosphate Fertilizers, and Two Potash Fertilizer
 Levels, Alone and in Combinations on the Yield of Alfalfa Hay
 Yield in Pounds Per Acre Air Dry Forage
 Charles Porter Farm - Tumalo, Oregon - 1st Cutting, July 15, 1954

Fertilizer Application Pounds Per Acre			Lbs. of Air Dry Forage Per Acre By Replication			Mean Yield
S	P ₂ O ₅	K ₂ O	I	II	III	
0	0	0	3273.1	2323.2	2686.2	2760.8
35	0	0	4604.1	2008.6	2680.2	3097.6
70	0	0	1917.9	3097.6	3188.4	2734.6
140	0	0	3545.3	3067.3	2668.1	3093.6
280	0	0	3926.5	3575.6	3630.0	3710.7
0	100	0	3303.3	2922.2	3242.8	3156.1
0	0	100	2516.8	3242.8	2613.6	2791.1
0	100	100	2492.6	3914.4	4767.4	3724.8
35	100	0	1530.7	4948.9	4229.0	3569.5
35	0	100	1343.1	2365.6	2305.1	2004.6
35	100	100	3527.2	3569.5	3303.3	3466.7
70	100	0	4235.0	4386.3	2910.1	3843.8
70	0	100	3678.4	2510.8	3049.2	3079.5
70	100	100	3799.4	2371.6	3557.4	3242.8
140	100	0	2504.7	5245.4	3642.1	3797.4
140	0	100	2662.0	3696.6	3599.8	3319.5
140	100	100	2710.4	5311.9	3853.9	3958.7
280	100	0	4017.2	3968.8	2407.9	3464.6
280	0	100	3527.2	3291.2	3872.0	3563.5
280	100	100	4331.8	4301.6	3617.9	4083.8

Table No. 38
 Effect of Five Sulphur Fertilizer Levels, Two Phosphate Fertilizers, and Two Potash Fertilizer
 Levels, Alone and in Combinations on the Yield of Alfalfa Hay
 Yield in Pounds Per Acre Air Dry Forage
 Charles Porter Farm - Tumalo, Oregon - 2nd Cutting, September 21, 1954

Fertilizer Application			Lbs. of Air Dry Forage Per Acre			Mean Yield
Pounds Per Acre			By Replication			
S	P ₂ O ₅	K ₂ O	I	II	III	
0	0	0	2190.1	1089.0	1766.6	1681.9
35	0	0	4325.8	1609.3	1681.9	2539.0
70	0	0	847.0	1809.0	3019.0	1891.7
140	0	0	2172.0	2504.7	2347.4	2341.4
280	0	0	3999.1	3188.4	3551.4	3579.6
0	100	0	2329.3	1482.3	2214.3	2008.6
0	0	100	1415.7	1494.4	1966.3	1625.5
0	100	100	1966.3	2510.8	3745.0	2740.7
35	100	0	1197.9	3926.5	2335.3	2486.6
35	0	100	877.3	1204.0	1899.7	1327.0
35	100	100	2855.6	2044.9	2528.9	2476.5
70	100	0	3436.4	3478.8	2940.3	3285.2
70	0	100	2625.7	2522.9	2571.3	2573.3
70	100	100	2401.9	1446.0	2607.6	2151.8
140	100	0	1567.0	3448.5	2649.9	2555.1
140	0	100	1869.5	3146.0	3279.1	2764.9
140	100	100	1809.0	4253.2	3339.6	3133.9
280	100	0	3073.4	2686.2	2135.7	2631.8
280	0	100	2347.4	2347.4	3170.2	2621.7
280	100	100	3394.1	3654.2	3993.0	3680.4

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Table No. 39
 Summary Alfalfa Fertility Trial
 Charles Porter - Plainview, Oregon - 1954
 Deschutes Sandy Loam

Fertilizer Application			Air Dry Forage in #		Per Acre
Pounds Per Acre			By Cutting		Total
S	P ₂ O ₅	K ₂ O	1st	2nd	Forage
0	0	0	2760.8	1681.9	4442.7
35	0	0	3097.6	2539.0	5636.6
70	0	0	2734.6	1891.7	4626.3
140	0	0	3093.6	2341.4	5435.0
280	0	0	3710.7	3579.6	7290.3
0	100	0	3156.1	2008.6	5164.7
0	0	100	2791.1	1625.5	4416.6
0	100	100	3724.8	2740.7	6465.5
35	100	0	3569.5	2486.6	6056.1
35	0	100	2004.6	1327.0	3331.6
35	100	100	3466.7	2476.5	5943.2
70	100	0	3843.8	3285.2	7129.0
70	0	100	3079.5	2573.3	5652.8
70	100	100	3242.8	2151.8	5394.6
140	100	0	3797.4	2555.1	6352.5
140	0	100	3319.5	2764.9	6084.4
140	100	100	3958.7	3133.9	7092.6
280	100	0	3464.6	2631.8	6096.4
280	0	100	3563.5	2621.7	6185.2
280	100	100	4083.8	3680.4	7764.2
			LSD @ 5%		NS
					C.V. 26.8%

Main Effects of Fertilizers on Total Air Dry Forage

Fertilizer Application	Air Dry Forage Yield	Deviation from No Treatment
Lbs. Per Acre	Lbs. Per Acre	
<u>S</u>		
0	5122.4	
35	5241.9	+ 119.5 ⁽¹⁾
70	5700.7	+ 578.3
140	6241.1	+1118.7
280	6834.1	+1711.7
<u>P₂O₅</u>		
0	5310.2	
100	6345.9	+1035.7 ⁽²⁾
<u>K₂O</u>		
0	5823.0	
100	5833.1	10.1

(1) Linear increase
 (2) Significant at 5% level

Table No. 40
Charles Porter Farm
Tumalo, Oregon

1953

Deschutes Sandy Loam

Range of Depth	pH	P2O5 ppm	K ₂ O ppm	Total Salts ppm	Sodium ppm
0-6	5.7	15.0	243	87	77
6-12	6.0	15.0	245	102	95
12-18	6.0	16.8	275	91	102

The soil is a Deschutes sandy loam. The soil analysis (Table No. 40) as taken in the spring of 1953 indicates that the soil is slightly acid but by present estimates, not low in phosphate or potash.

The trial area has been previously cropped as follows:

<u>Year</u>	<u>Crop</u>	<u>Fertilizer</u>	<u>Yield</u>
1953	Alfalfa	Fertility trial	
1952	Alfalfa	60# Ag. Sulf.	2½ Tons
1951	Alfalfa	200# Superphosphate	2½ Tons
1950	Alfalfa	200# Superphosphate	2½ Tons
1949	Seeded with grain companion crop		

The area was the first locality in Central Oregon to give a response to superphosphate.

During 1954 the trial received irrigation on the following approximate dates:

- 1 - May 10
- 2 - May 25
- 3 - July 10
- 4 - August 15
- 5 - September 15

After a brief period in the spring, marked differences, presumably from the lack of sulfur, could be noted in the trial. The treatments lacking in color were lacking in color and vigor and density of stand. The vigor could be noted between sulfur rates.

The trial area was harvested on July 15 and September 21, 1954.

The air dry forage by replication for the first and second cutting are presented in Table No. 37+38. A summary table showing the mean yields for the first and second cuttings and the season total, and the main effects of the fertilizers are shown in Table No. 39.

The results, as shown by the main effects, indicate a linear response to sulfur. Starting with 35 pounds of S, each time the sulfur rate was doubled there was an average increase of 531.7 pounds of air dry alfalfa hay. There was a significant increase to phosphate. Potash had no significant effect on yield.

Treatment differences were not significant.

Hopper and Vice Farm

The Hopper and Vice farm lies approximately 5 miles northwest of Prineville on the Prineville-Madras Highway. The legal description of the trial area is as follows: NE ¼ of the SE ¼ of the NW ¼ of Sec. 22, T. 14 S, R 15 E.

Table No. 41
 Effect of Five Sulphur Fertilizer Levels, Two Phosphate Fertilizers, and Two Potash Fertilizer
 Levels, Alone and in Combinations on the Yield of Alfalfa Hay
 Yield in Pounds Per Acre Air Dry Forage
 Roscoe Hopper Farm - 1954 - 1st Cutting, July 12, 1954

	Fertilizer Application			Pounds of Air Dry Forage Per Acre			Mean Yield
	Pounds Per Acre			By Replication			
	S	P ₂ O ₅	K ₂ O	I	II	III	
1	0	0	0	6854.7	5783.8	6195.2	6277.9
2	35	0	0	7635.1	6152.9	6431.2	6739.7
3	70	0	0	8778.6	5366.4	6630.8	6925.3
4	140	0	0	6189.2	4247.1	6624.8	5687.0
5	280	0	0	7502.0	5529.7	6509.8	6513.8
6	0	100	0	7538.3	5112.3	6037.9	6229.5
7	0	0	100	6189.2	5753.6	5439.0	5793.9
8	0	100	100	7744.0	6624.8	5910.9	6759.9
9	35	100	0	7580.7	6068.2	6939.4	6862.8
10	35	0	100	6933.3	5360.3	5493.4	5929.0
11	35	100	100	7961.8	5808.0	5904.8	6558.2
12	70	100	0	7901.3	4797.7	7078.5	6592.5
13	70	0	100	6564.3	6183.1	7405.2	6717.5
14	70	100	100	7526.2	5209.1	5517.6	6084.3
15	140	100	0	7393.1	5826.2	5517.6	6245.6
16	140	0	100	6310.2	5293.8	6630.8	6078.3
17	140	100	100	6600.6	6697.4	5372.4	6223.5
18	280	100	0	6715.5	5892.7	7381.0	6663.1
19	280	0	100	6394.9	5705.2	5874.6	5991.6
20	280	100	100	6340.4	6606.6	5971.4	6306.1

Table No. 42
 Effect of Five Sulphur Fertilizer Levels, Two Phosphate Fertilizers, and Two Potash Fertilizer
 Levels, Alone and in Combinations on the Yield of Alfalfa Hay
 Yield in Pounds Per Acre Air Dry Forage
 Roscoe Hopper Farm - 2nd Cutting - September 14, 1954

Fertilizer Application Pounds Per Acre			Pounds of Air Dry Forage Per Acre By Replication			Mean Yield
S	P ₂ O ₅	K ₂ O	I	II	III	
0	0	0	4546.0	4693.6	5186.7	4808.8
35	0	0	5047.5	4438.9	4864.2	4783.5
70	0	0	4573.2	4740.8	4307.6	4540.5
140	0	0	4910.8	4402.0	4949.5	4754.1
280	0	0	4905.9	5328.2	4739.0	4991.0
0	100	0	4402.6	5659.1	4924.7	4995.5
0	0	100	5363.3	4546.6	4348.7	4752.9
0	100	100	4264.6	5570.8	5099.5	4978.3
35	100	0	4289.5	5143.7	4611.9	4681.7
35	0	100	4297.9	5118.3	4300.9	4572.4
35	100	100	4743.8	5065.1	4768.6	4859.2
70	100	0	4066.8	4456.4	4555.0	4359.4
70	0	100	4317.9	4916.8	5073.5	4769.4
70	100	100	5439.0	4302.2	5428.7	5056.6
140	100	0	4875.7	4183.0	4317.9	4458.9
140	0	100	3839.3	4738.4	4732.9	4436.9
140	100	100	4875.1	4823.7	4972.5	4890.4
280	100	0	4181.2	5195.1	5069.3	4815.2
280	0	100	5704.5	6646.5	4760.1	5703.7
280	100	100	4251.3	4771.6	5148.6	4723.8

Table No. 43
 Summary of the Hopper & Vice Alfalfa Fertility Trial
 Hopper & Vice Farm - Prineville, Oregon - 1954
 Powder Sandy Loam

Fertilizer Application			Air Dry Forage in Lbs. Per Acre		
Pounds Per Acre			By Cutting		Total
S	P ₂ O ₅	K ₂ O	1st	2nd	Forage
0	0	0	6277.9	4808.8	11086.7
35	0	0	6739.7	4783.5	11523.2
70	0	0	6925.3	4540.5	11465.8
140	0	0	5687.0	4754.1	10441.1
280	0	0	6513.8	4991.0	11504.8
0	100	0	6229.5	4995.5	11225.0
0	0	100	5793.9	4752.9	10546.8
0	100	100	6759.9	4978.3	11738.2
35	100	0	6862.8	4681.7	11544.5
35	0	100	5929.0	4572.4	10501.4
35	100	100	6558.2	4859.2	11417.4
70	100	0	6592.5	4359.4	10951.9
70	0	100	6717.5	4769.4	11486.9
70	100	100	6084.3	5056.6	11140.9
140	100	0	6245.6	4458.9	10704.5
140	0	100	6078.3	4436.9	10515.2
140	100	100	6223.5	4890.4	11113.9
280	100	0	6663.1	4815.2	11478.3
280	0	100	5991.6	5703.7	11695.3
280	100	100	6306.1	4723.8	11029.9
				L.S.D. 5%	NS
				C.V. 7.9%	

Main Effects of Fertilizers on Total Air Dry Forage					
S		Deviation from Check	P ₂ O ₅		Deviation from Check
0	11149.2	-	0	11076.7	-
35	11246.6	+ 9.74	100	11234.5	+ 157.8
70	11261.4	+ 112.2			
140	10693.7	- 455.5	K ₂ O		
280	11427.0	+ 277.8	0	11192.6	-
			100	11118.6	- 74.0

Table No. 44
Soil Analysis

Roscoe Hopper Farm
Prineville, Oregon

1953

Powder Sandy Loam

Range of Depth	pH	P ₂ O ₅ ppm	K ₂ O ppm	Organic Matter %
0-8	7.8	6.9	310	1.63
8-16	8.2	4.5	313	.79
16-24	8.2	4.9	360	.46

The soil in the trial area has been tentatively classified as a Powder sandy loam, and judging from a nearby drain ditch, at least 10 feet deep without a restrictive layer.

The soil analysis (Table No. 44) indicates the soil to be slightly alkaline with low phosphate and high potash. Even though the phosphate level is low, there are no indications of phosphate response in the area.

The trial area has following cropping history:

<u>Year</u>	<u>Crop</u>	<u>Fertilizer</u>	<u>Yield</u>
1953	Alfalfa	Fertility trial	
1952	Alfalfa	200# Gypsum & 200 # superphosphate	5 Tons
1951	Alfalfa	200# Gypsum & 200# superphosphate	5 Tons
1950	Alfalfa	200# Gypsum & 200# superphosphate	5 Tons
1949	Barley	None	
1948	Barley	None	
1947	Potatoes		

During the 1954 season the trial area was irrigated on the following dates:

- 1 - April 14
- 2 - April 29
- 3 - May 22
- 4 - June 24
- 5 - July 21

The field was irrigated during the fall after the second cutting. During the growing season no color or vegetative differences could be noted at any time.

Hay cuttings were made July 12 and September 14, 1954. Yield data by replication for each cutting are presented in Tables 41 & 42. Table No. 43 is a summary showing the mean yield by cutting, the season total yield, and the main effects of the fertilizers. The results indicate that no significant responses or even reliable trends were obtained from any of the fertilizers.

General Results

The results of this experiment fall in two general categories, i.e., the responses obtained from deep soils with probably a fair silt content and shallow sandy soils probably low in the silt and clay fraction.

On the deep soil, characterized in this experiment by a Powder sandy loam (Hopper and Vice Farm), no responses were obtained from sulfur, phosphate or potash for either 1953 or 1954.

On the shallow, typically pumice soil characterized by the Deschutes sandy loam (Porter Farm and Putnam Farm) responses to sulfur and phosphate are obtained.

At the Porter location there was a linear response to sulfur from doubling the rate of sulfur starting at 35# to and including 280 pounds. The air dry alfalfa increased on an average 531.7 pounds each time the fertilizer rate was doubled. This same trend was noted at the Putnam location but was not significant. The increase in yield from sulfur was significant at the Putnam location, however.

The increase in yield to phosphate at the Porter location has been significant for the 1953 and 1954 seasons. As shown by the main effects, the increase in yield from phosphate was greater in 1954 than in 1953 (1035 pounds compared to 685 pounds),.

At the Putnam location the response to phosphate was significant in 1953 but not in 1954. However, the total air dry forage during 1954 was roughly double the 1953 yield while the increases from phosphate stayed the same. The yields at the Porter location remained approximately the same.

The lack of significant phosphate response at the Putnam farm indicates at least two possible answers. One, that with the low phosphate level in the subsoil there was no carryover of phosphate fertilizer, and two, that the increase in yield is significant but masked by error. However, by comparing increase against total yield, this year's increase from phosphate was only one half that of last year's increase.

The response to potash, while substantial at the Putnam farm, was not significant.

Summary

During the early spring of 1953, a factorial experiment consisting of five levels of sulfur, 0, 35, 70, 140, and 280 pounds per acre; two levels of phosphate, 0 and 100; and two levels of potash, 0 and 100 pounds per acre, was established to determine whether a limited soil sulfur supply was causing a lack of response to phosphate in generally phosphate deficient soils. Also to determine the sulfur requirement of alfalfa in Central Oregon.

The 1953 results indicated a significant response to phosphate at two out of five locations and no response to sulfur at any location.

It was decided to continue the experiment another year with no additional fertilizer applied. The 1954 results indicated that one deep soil, even though the soil tested low in phosphate, no phosphate responses were obtained. The plots lacking sulfur showed no deficiency symptoms at any time. Sulfur fertilization did not increase the yield. No potash responses were obtained.

On shallow pumice soils (Porter and Putnam locations) strong sulfur responses were obtained where no responses were noted during 1953. Phosphate responses were significant on one of the two locations which gave significant responses during 1953. It is presumed that the lack of response to phosphate where one was obtained last year may be due to variation or that there was no carryover on this more phosphate deficient location.

The largest potash response was obtained at the Putnam location but it was not significant.