EFFECT OF N & P FERTILIZERS ON YIELD OF IRRIGATED PASTURE
Expressed as Pounds by Material Per Acre

Lewis - Sacramento County - 1958

Fertilizer Treatments 1956	1957	1958	1958 Yield of Grass	Ladino	Trefoil	1958 Total	Fertilizer Increase	Cost/Acre	Cost per Extra Ton
Check	Check	Check	4215	1875	258	6348	--	--	--
P_{80}	P_{160}	P_{320}	5275	4079*	28	9382*	3034	$ 32.00	$ 21.09
P_{160}	Carryover		4864	2372	107	7342	994 (5283 - 3 years)	16.00**	6.04*
N_{200} P_{80}	N_{160} P_{160}	N_{100}) P_{320})	7300*	2654	42	9996*	3648	45.30	24.78
N_{200}	N_{160}	N_{100}	6119*	1129	110	7358	1010	13.30	26.33
L.S.D. - .05			1317	959	n.s.	1365			

* Significantly more than the check.

** Cost on 3-year basis from P_{160} in 1956.

EFFECT OF N & P FERTILIZERS ON YIELD OF IRRIGATED PASTURE
Total Production - Lbs./Acre - in 3 Years

Lewis, Sacramento County - San Joaquin Loam

Fertilizer Treatments 1956	1957	1958	Total* Cost/Acre	Increase Yield Due to Treatment 1956	1957	1958	Total	Cost per Extra Ton
none	none	none	---- Base	5804	5963	6345	18112	---
P_{80}	P_{160}	P_{320}	$ 56.00	2008	2775	3035	7818	$14.33
P_{160}	--	--	16.00	2859	1431	998	5288	6.04
N_{200} P_{80}	N_{180} P_{160}	N_{100} P_{320})	115.00	3804	4424	3648	11876	19.92
N_{200}	N_{180}	N_{100}	59.00	1965	1180	1015	4160	29.64
L.S.D. - Between Treatments				1428	1196	1365	--	--

* With N @ 12.3¢/lb. & P (P_2O_5) @ 10¢/lb.

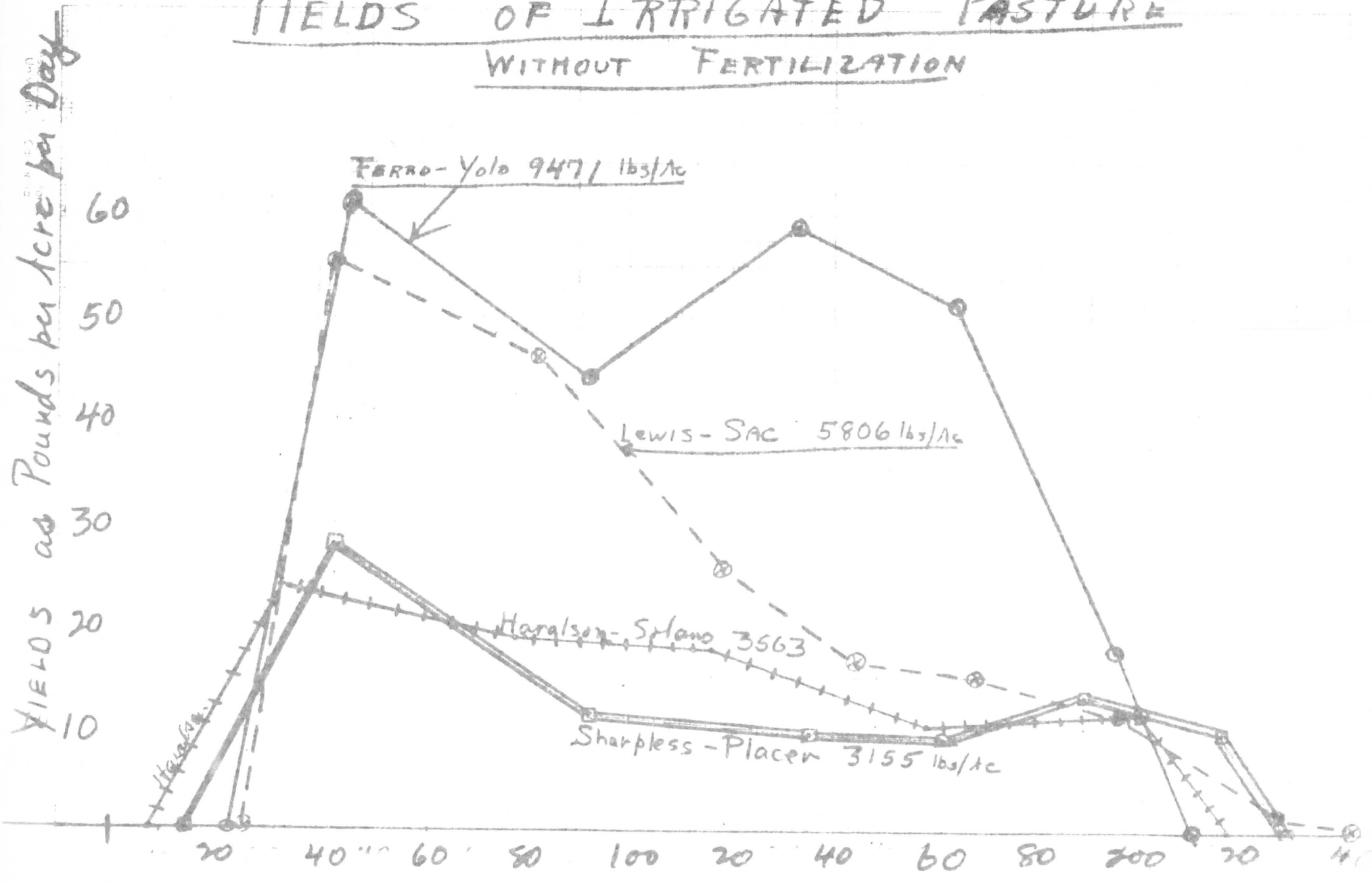
5-YEAR SUMMARY OF EFFECTS OF N AND NP FERTILIZERS ON BEEF PRODUCTION

	1953-54	1954-55	1955-56	1956-57	1957-58	45 Tests In 5 Yrs.
Number of trials.	4	9	13	10	9	
Number acres in all trials. . .	1118	1754	2543	4197	4088	13,700 Ac.
Grazing Days per acre						Av. Values
Control.	34 days	40 days	37 days	34 days	43 days	37.6
"Best" Treatment	76 days	90 days	90 days	79 days	111 days	109.2
Meat produced/acre						
Control.	55.8 lbs.	64.0 lbs.	64.8 lbs.	47.2 lbs.	65.6 lbs.	59.5 lbs.
Fertilized	158.6 lbs.	188.0 lbs.	162.1 lbs.	144.2 lbs.	172.1 lbs.	165.0 lbs.
Increase/acre	102.8 lbs.	124.0 lbs.	97.3 lbs.	97.0 lbs.	106.5 lbs.	105.5 lbs.
Average fertilizer cost/acre (Incl. application)	$13.09	$15.69	$15.93	$10.96	$11.53	$13.44
Fertilizer cost/lb. Extra Beef/acre.	12.7¢	12.6¢	16.4¢	11.3¢	10.8¢	12.73¢

(1)

YIELDS OF IRRIGATED PASTURE

WITHOUT FERTILIZATION

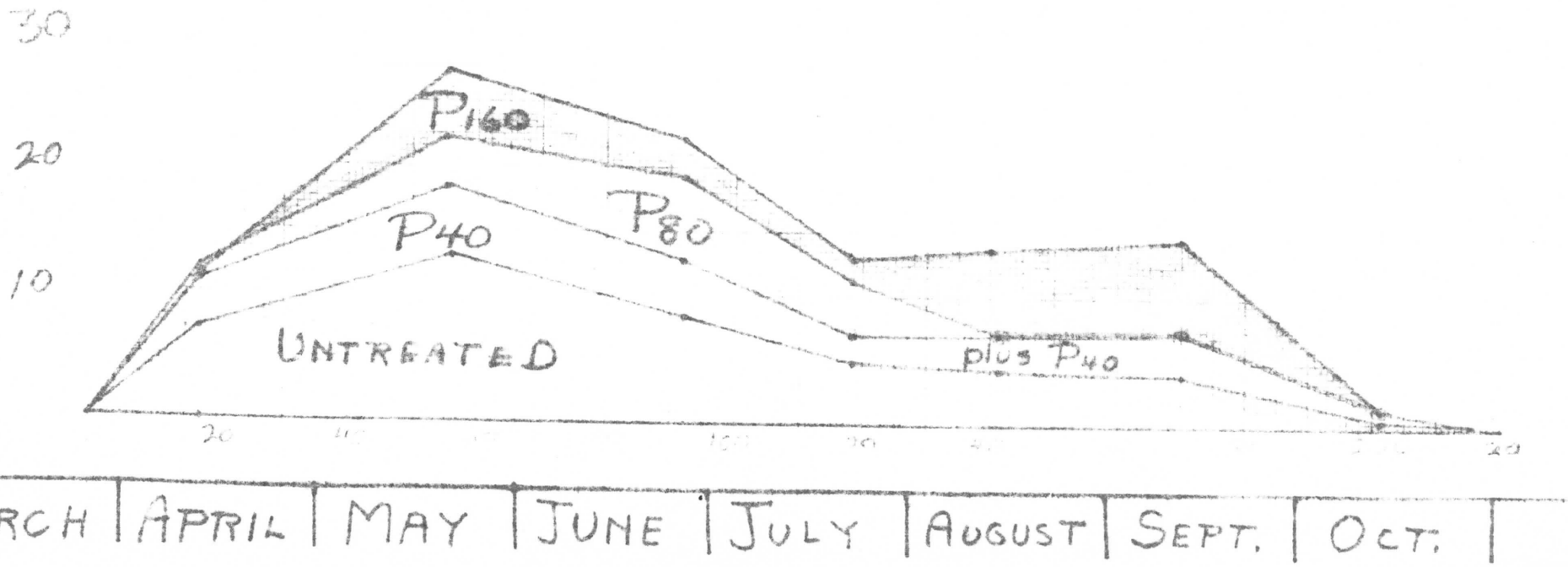


	MARCH	APRIL	MAY	JUNE	JULY	AUGUST	SEPT	OCT.

Effect of P on Yield of Ladino Clover

Lewis - Sacramento Co 1956

	Total Yield	lbs/Ac Increase
check	1366	
P_{40+40}	2095	+729
P_{80}	2577	+1211
P_{160}	3282	+1916



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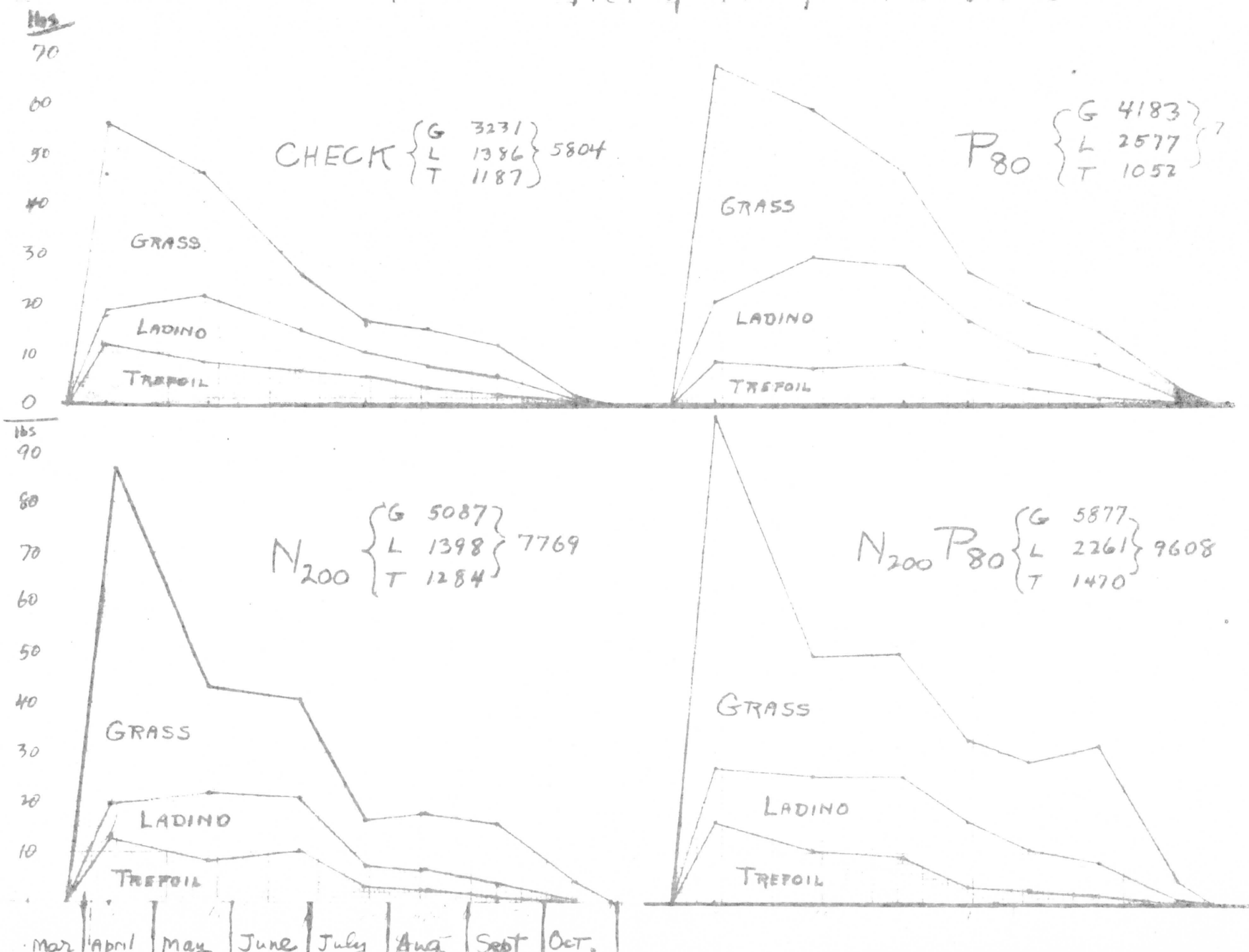
Lewis - Soc 1956 Yield of Irrigated Pasture

Yields = as Pounds Dry Matter per Acre per day



EFFECT OF N & P FERTILIZERS ON TOTAL YIELD & YIELD OF SEPARATE PASTURE SPECIES

LEWIS - SACRAMENTO COUNTY - 1956

Total Yield of Forage as lbs. dry weight per acre

Fertilizer Treatments	Pounds of Material Harvested at Each Cutting							Total for Season
	Apr.30	June 11	July 9	Aug. 2	Aug.27	Sept.27	Oct.26	
Check	1943	1937	746	399	378	352	49	5804
P_{40+40}	2121	2478	1133*	498	544	515	94	7383*
P_{80}	2367	2458*	1333*	632*	500	427	95	7812*
P_{160}	2433	2581*	1398*	702*	683*	780*	86	8663*
N_{200}	3045*	1804	1182*	392	566+	647+	133*	7769*
$N_{200}P_{80}$	3468*	2076	1448*	782*	712*	984*	138*	9608*
L.S.D. 5%	1030	500	337	221	200	310	77	1428

Yield of Grasses as lbs. dry weight per acre

Fertilizer Treatments	Pounds of Material Harvested at Each Cutting							Total for Season
	Apr.30	June 11	July 9	Aug. 2	Aug.27	Sept.27	Oct.26	
Check	1289	1047	312	155	196	186	37	3231
P_{40+40}	1356	1042	456	242	303	264	61	3724
P_{80}	1664	1243	544*	241	242	185	64	4183
P_{160}	1388	940	475	230	277	293	54	3657
N_{200}	2353*	888	571*	217	405*	536*	117*	5087 *
$N_{200}P_{80}$	2462*	1010	718*	393*	450*	731*	114+	5877 *
L.S.D. 5%	761	n.s.	208	121	146	219	70	1284

Yield of Ladino Clover as lbs. dry weight per acre

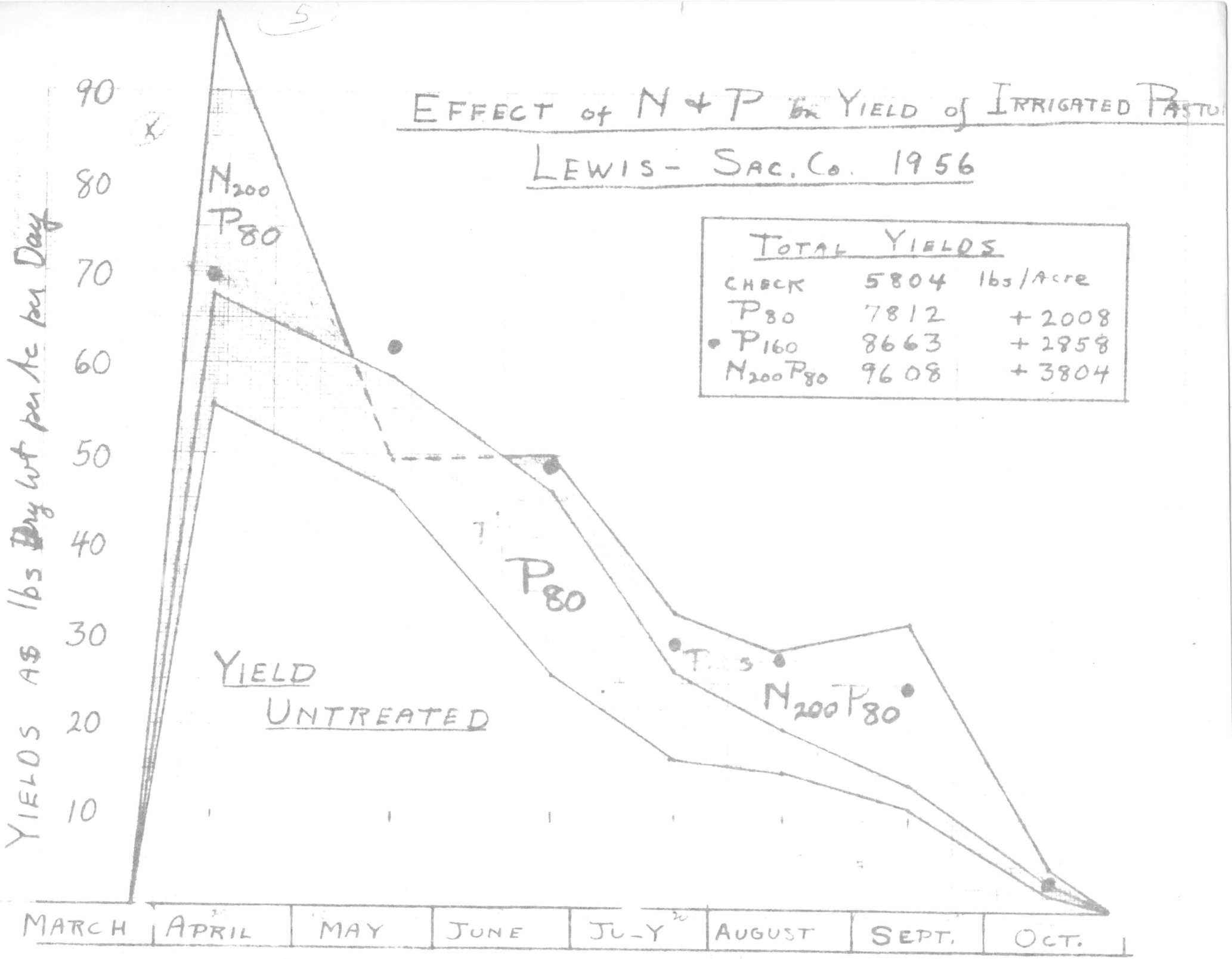
Fertilizer Treatments	Pounds of Material Harvested at Each Cutting							Total for Season
	Apr.30	June 11	July 9	Aug. 2	Aug.27	Sept.27	Oct.26	
Check	247	542	242	116	106	122	11	1386
P_{40+40}	377	764	366	163	175+	219	31	2095*
P_{80}	410	924*	566*	270*	175+	213	28	2577*
P_{160}	380	1144*	641*	304*	339*	445*	31	3284*
N_{200}	232	559	309	104	99	81	14	1398
$N_{200}P_{80}$	441	632	458	315*	197*	196	22	2261*
L.S.D. 5%	n.s.(P's*)		317	261	151	74	134	n.s. 615

Yield of Trefoil as lbs. dry weight per acre

Fertilizer Treatments	Pounds of Material Harvested at Each Cutting							Total for Season
	Apr.30	June 11	July 9	Aug. 2	Aug.27	Sept.27	Oct.26	
Check	407	348	183	128	76	44	1	1187
P_{40+40}	388	672	311	93	66	32	2	1564
P_{80}	293	291	232	121	83	29	3	1052
P_{160}	665	497	282	168	67	42	1	1722
N_{200}	460	357	302	71	62	30	2	1284
$N_{200}P_{80}$	565	434	272	75	65	57	2	1470
L.S.D. 5%	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.

* Treatments significantly better than control

\+ Not quite significant


EFFECT of N + P on YIELD of IRRIGATED PASTURE
LEWIS - SAC. Co. 1956
TOTAL YIELDS
CHECK 5804 lbs/Acre
P80 7812 +2008
P160 8663 +2958
N200P80 9608 +3804
YIELDS AS lbs Dry wt per Ac per Day
90
80
70
60
50
40
30
20
10
N200 P80
P80
YIELD UNTREATED
MARCH
APRIL
MAY
JUNE
JULY
AUGUST
SEPT.
OCT.

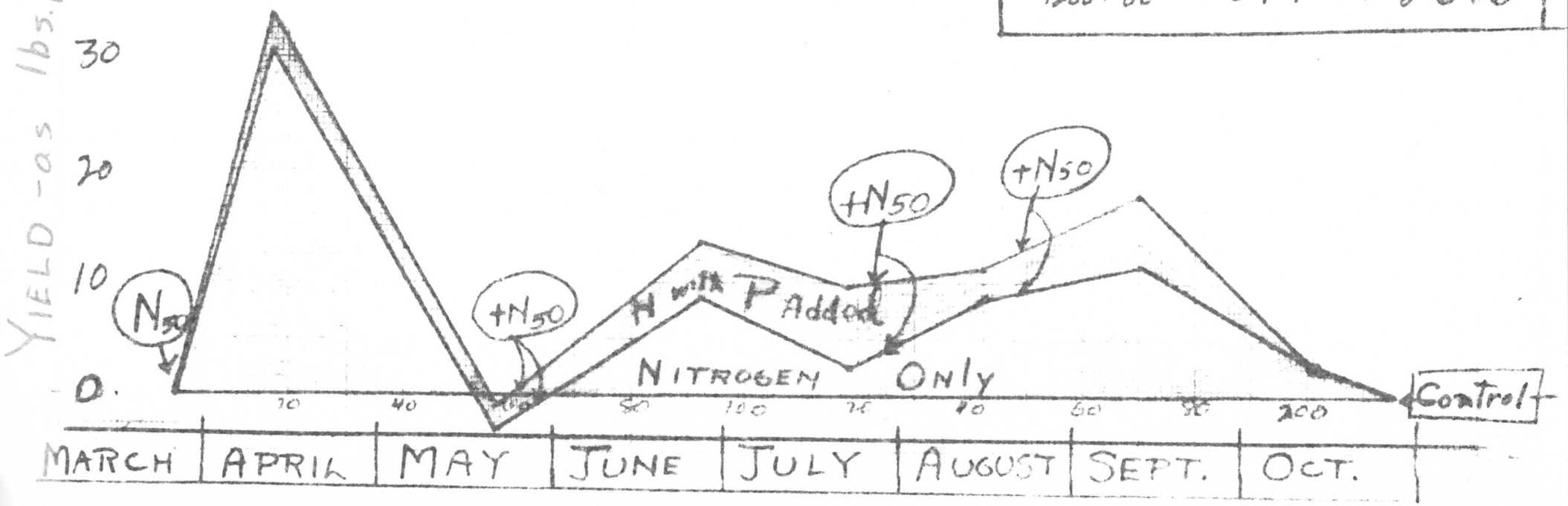
How Long Does an "N" Application Last?

Increase Yield of Grass due to N Applied

(0 base = yield of control)

Lewis – Sac. Co 1956

Season Totals lbs/acre		
	3231	Increase
N_{200}	5087	+ 1856
$N_{200}P_{80}$	5877	+ 2646



Lewis Sacramento

Grand Summary

for 1957

green matter/acre

Harvest	A Check	B P_{320}	C P_{160}	D P_{160} carryover	E NP_{160}	F N	Harvest dates
							Fert app. March 14
I	2,271	3,125	3.417	3,944	4.005	2,322	April 5
II	2,690	4141	4073	4.141	6.324	3,743	April 27
III	10,980	16,555	16,792	13,695	17,905	12,434	June 4
IV	5,490	8,330	7.569	6976	7.597	5,875	July 12
V	4.573	7.099	6.743	5,630	8.527	5,202	Aug 19
Total	26,004	39,250	38,594	34,386	44,358	29,576	
		13,246	12,590	8,382	18,354	3,572	

dry matter – Lbs/acre

dry matter/acre

I	447	595	632	743	749	453	
II	509	677	698	684	1039	678	
III	2,015	2,858	2.916	2,532	3.499	2.603	
IV	1.086	1.516	1,485	1.412	1,562	1,158	
V	977	1.370	1,376	1,207	1,826	1,184	
Total	5.034	7.016	7,107	6,578	8,625	6,076	
		1.982	2,073	1,544	3,591	1,042	
@ 10% moist.	5,537	7,717	7,817	7,235	9,487	6,683	
increase		2,180	2.280	1,698	3,950	1,146	

Lewis – Sacramento
Cost of Fertilized Pasture

1956 – Season

TREATMENT	Check	$P_{40}+P_{40}$	P_{80}	P_{160}	$N_{150}P_{80}$	N_{150}	N 50 # op
Total yield	5,804	7,383	7,812	8,663	9,608	7,769	
Increase	——	1,579	2008	2.859	3.804	1,965	
COST							
application		1.50	0.75	0.75	3.00	3.00	
fertilizer		7.25	7.25	15.25	35.00	27.00	
Total		8.75	8.00	16.00	38.00	30.00	
Cost/extra ton		11.08	7.97	11.19	19.98	30.53	

1957 Season to date

TREATMENT	Check	P_{320}	P_{160}	P_{160} carryover	$N_{180}P_{160}$	N_{180}
Total Yield	5,034	7,016	7,107	6,578	8,615	6,076
Increase	——	1.982	2.073	1,544	3,591	1.045
COST						
application		0.75	0.75	——	3.75	3.75
fertilizer		35.84	17.92		44.65	26.73
Total		36.59	18.69		48.40	30.48
Cost/extra ton		36.92	18.03	8.13*	26.96	58.33

* includes both seasons.

Total 1956 +57	10,838	M,399	14,919	15,241	18,223	13.845	
		3,561	4,081	4,408	7.359	3.010	
Cost/extra ton for both seasons		48.00	26.00		46.94	88.86	

Lewis - Sacramento Co.

Comparison of seasonal yield through August, 1

1956	Check	P_{40+40}	P_{80}	P_{160}	$N_{150}P_{80}$	N_{150}
	5403	6,774	7,290	7,797	8,486	6,989
		1,371	1,887	2,394	3,083	1,586
1957	Check	P_{320}	P_{160}	P_{160} corryover	$N_{180}P_{160}$	N_{180}
	5,034	7,016	7,107	6,578	8,615	6,076
		1,982	2,073	1,544	3,591	1,045

F

Harvest & fertilizing dates for Lewis during 1956 Season

Harvest dates		Fertilized	
I	April 30, 1956	March 16	N, NP_{80}, $P_{40}P_{80}$
II	June 11, 1956	June 14	N_{50}
III	July 9, 1956	July 26	P_{40}
IV	Aug 2, 1956	Aug 6	N_{50}
V	Aug 27, 1956	Aug 30	N_{50}
VI	Sept 27, 1956		

CO-OPERATIVE EXTENSION WORK
IN
AGRICULTURE AND HOME ECONOMICS
State of California

University of California
and United States Department
of Agriculture, cooperating

University of California
Agricultural Extension Service

140 GIANNINI HALL
BERKELEY 4, CALIFORNIA

August 5, 1957

Mr. Glenn S. Goble
310 Old P. O. Building
7th and K Streets
Sacramento 2, California

Dear Glenn:

I am finally forwarding to you the chemical data obtained by the analysis of samples taken from the Lewis plots last year. We have analyzed the grass, Ladino and Trefoil for nitrogen and total phosphorus and then "put the forage back together" to show the changes in nitrogen and phosphorus content of the whole forage.

On page 1 are listed the values in percent total nitrogen of these three species at each cutting. If you wish a crude protein value any of these figures may be multiplied by 6.25 to give you the percent crude protein in the dried forage. You will notice that the Ladino and Trefoil contained considerably higher percent total nitrogen at every cutting date than did the grass. You will also notice that the grass had the lowest protein content at the first and second cuttings. You will recall that the grass was quite mature when harvested at the first cutting. The fertilizer treatment affected the nitrogen (or protein) content as follows: At the first cutting the two nitrogen treatments increased the percent nitrogen slightly. Again this same effect was observed on the fourth and fifth cuttings. There is evidence that the P_{160} treatment also increased the protein content slightly.

Neither Ladino or Trefoil were appreciably affected in nitrogen content by application of any fertilizer. The whole forage, which is what the animal would eat, was not significantly affected at any time by any fertilizer treatment. Actually the values where nitrogen was applied often tended to be a little less than in the non-nitrogen treatments.

While the nitrogen content of the grass was increased, particularly at the first cutting, by the nitrogen fertilization, it was still so much less than the normal nitrogen content of the Ladino and Trefoil that an increase in amount of grass did not appreciably affect the protein content of the total forage. We could easily have a situation where lots of extra grass was stimulated, its protein content increased, and yet the protein content of the whole forage be decreased because of the larger proportion of low protein grass in the mixture.

The phosphorus content expressed as total percent phosphorus is shown on the second table. Here the phosphorus content of grass, Ladino and Trefoil were all clearly increased by added phosphorus. The increases from the P_{160} rate were particularly striking. The application of straight nitrogen had no effect one way or another that amounted to anything upon the phosphorus content of the forage. Where both nitrogen and phosphorus were applied the phosphorus content of the forage was just about the same as the phosphorus content

of the corresponding straight phosphorus treatment. I think it is significant, Glenn, that the percent phosphorus in all species, including grass, was clearly increased by the addition of phosphorus.

If you wish to prepare a simple table showing how the phosphorus and nitrogen content of the forage was affected by the treatment, the bottom tables on pages 1 and 2 could be put together to do the job.

On page 3 we have calculated the amount of nitrogen harvested off in the forage removed at each cutting date and have added up the harvest for the six cuttings as a seasonal total. In the last column is shown the increase in nitrogen removal as a result of fertilization. You will notice that the grass removed 67 pounds of nitrogen per acre without any fertilization. Where 80 pounds P_2O_5 was applied 21 additional pounds of nitrogen was removed. We cannot say with assurance whether this was because the phosphorus made the grass grow more or because it was associating with happy Ladino clover. Where 200 pounds of nitrogen was applied throughout the year, 60 additional pounds of nitrogen was harvested off, or a recovery of somewhat less than 30 percent. I think it is interesting that the nitrogen-phosphorus treatment which showed an increase of 83 pounds of nitrogen per acre, is almost exactly the sum of the N_{200} and P_{80} separate treatments. On the Ladino and Trefoil you will note that the application of nitrogen had no appreciable effect on the uptake of nitrogen by these species and that the greatest uptake of nitrogen by the Ladino was where it was stimulated by the application of the highest rate of phosphorus. On the whole forage you will notice that if you add up the nitrogen removal in the P_{80} and N_{200} treatments you will get almost exactly the same nitrogen value as shown from the combined treatment.

We have also calculated the removal of phosphorus in the forage of each of the species and calculated the removal for the whole forage. There are several very interesting things shown here. First, the grass fertilized with straight nitorgen made enough extra growth to remove considerably more phosphorus from the soil than the non-fertilized grass. You will also see that the application of phosphorus, which had little effect upon the growth of the grass, had a big effect upon the removal of phosphorus. In other words, we have applied phosphorus primarily to make our legumes grow. At this location at least half of the phosphorus was taken up by the grass. If you wish to add the phosphorus removal by the grass with P_{80} to the phosphorus removal in the N_{200} treatment you will again come up with almost exactly the same total phosphorus removal as we obtained from the combined treatment. This you may again do with the whole forage.

I have also prepared two small tables on sheets 5 and 6 which summarize the uptake of nitrogen and phosphorus in the pasture forage for the entire season. Sheet 6 I think is particularly interesting, since it shows where the added phosphorus went and by what species it was removed. The P_{160} treatment, for instance, which contained 70 pounds of actual phosphorus, contained 16 pounds more phosphorus per acre than the control. This was a recovery of only 23 percent of the added fertilizer. Of this 16 pounds you will notice if you follow the line across that the grass removed nearly 7 pounds while the Ladino and Trefoil removed about $9\frac{1}{2}$ pounds together.

You may wish to digest these figures. Art and I will endeavor to get together with you and decide how best to use them in a state publication. I think one important factor which you may wish to consider is the summary data on page 5 which shows the total nitrogen removal by various species fertilized with different materials. On the control 115 pounds of nitrogen was harvested throughout the year. This amounted to 969 pounds of crude protein

August 5, 1957

while with the P80 treatment 1372 pounds of crude protein was harvested.

I hope the data we get from the second year's results will be as nice as we have on these. I am sorry it has taken so long to work them up - in fact there is considerably more statistical testing to be done. I have indicated the L.S.D. on a number of the treatments. Where the values are not written in they have not yet been determined, but will be when we can get the time to do so.

Sincerely yours,

WE Martin

W. E. Martin
Extension Soils Specialist

cc: L. J. Berry
Arthur D. Haig

Berry (1)

EFFECT OF TREATMENT ON % NITROGEN OF IRRIGATED PASTURE FORAGE

Lewis - Sacramento County - 1956

Grass - Percent Total Nitrogen at Each Cutting

Treatment	1	2	3	4	5	6
A Check	1.80	2.00	2.44	2.77	3.49	3.16
B P40 + 40	1.82	2.08	2.63	2.76	3.21	3.40
C P80	1.77	2.12	2.47	3.01	3.02	3.09
D P160	2.08	2.43	2.75	2.96	3.52	3.07
E N200 P80	2.13	2.19	3.05	2.90	3.91	3.52
F N200	2.15	2.30	3.06	2.87	3.78	3.46
L.S.D.	.25	n.s.	.44	n.s.	.50	n.s.

Ladino - Percent Total Nitrogen at Each Cutting

Treatment	1	2	3	4	5	6
A Check	3.93	3.04	3.34	3.57	4.11	4.27
B P40+40	4.59	3.19	3.37	3.74	4.35	4.45
C P80	4.03	3.28	3.43	3.79	4.19	4.42
D P160	4.05	3.42	3.43	3.94	4.13	4.46
E N200 P80	3.97	3.32	3.35	3.79	4.33	4.50
F N200	3.68	3.37	3.51	3.62	4.15	4.19
L.S.D.			n.s.			

Trefoil - Percent Total Nitrogen at Each Cutting

Treatment	1	2	3	4	5	6
A Check	3.66	2.74	3.12	3.87	4.05	3.88
B P40 + 40	3.91	3.41	3.40	3.80	4.05	4.40
C P80	3.75	3.26	3.34	3.84	4.15	4.27
D P160	3.83	3.31	3.48	3.94	3.93	4.34
E N200P80	3.57	3.19	3.41	3.78	4.09	4.15
F N200	3.57	3.10	3.37	3.75	4.01	4.11
L.S.D.			n.s.			

Whole Forage - Percent Total Nitrogen at Each Cutting

Treatment	1	2	3	4	5	6
A Check	2.46	2.39	2.86	3.26	3.76	3.62
B P40 + 40	2.72	2.76	3.07	3.30	3.71	3.94
C P80	2.42	2.68	3.02	3.49	3.61	3.80
D P160	2.99	3.06	3.21	3.61	3.86	3.93
E N200 P80	2.58	2.73	3.13	3.34	4.04	3.75
F N200	2.48	2.79	3.26	3.21	3.86	3.61
L.S.D.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.

Berry (2)

EFFECT OF TREATMENT ON % PHOSPHORUS OF IRRIGATED PASTURE FORAGE
Lewis - Sacramento County - 1956

Grass - Percent Total Phosphorus at Each Cutting

Treatment	1	2	3	4	5	6
A Check	.242	.201	.204	.279	.305	.293
B P40 + 40	.320	.222	.283	.356	.455	.403
C P80	.341	.282	.259	.357	.387	.356
D P160	.395	.370	.394	.406	.453	.403
E N200 P80	.335	.293	.267	.305	.327	.280
F N200	.226	.226	.213	.261	.303	.271
L.S.D.						

Ladino - Percent Total Phosphorus at Each Cutting

Treatment	1	2	3	4	5	6
A Check	.227	.212	.249	.262	.310	.253
B P40 + 40	.307	.233	.276	.351	.321	.276
C P80	.333	.251	.291	.325	.305	.253
D P160	.366	.302	.331	.345	.334	.275
E N200 P80	.312	.265	.370	.334	.330	.272
F N200	.248	.220	.253	.282	.287	.264
L.S.D.						

Trefoil - Percent Total Phosphorus at Each Cutting

Treatment	1	2	3	4	5	6
A Check	.181	.206	.217	.251	.260	.246
B P40 + 40	.291	.217	.260	.301	.276	.279
C P80	.271	.242	.246	.265	.293	.258
D P160	.299	.300	.288	.290	.339	.284
E N200 P80	.251	.223	.245	.281	.293	.254
F N200	.275	.204	.216	.266	.255	.217
L.S.D.						

Whole Forage - Percent Total Phosphorus at Each Cutting

Treatment	1	2	3	4	5	6
A Check	.228	.206	.227	.265	.288	.272
B P40 + 40	.308	.226	.275	.348	.386	.338
C P80	.332	.267	.270	.327	.342	.300
D P160	.367	.325	.349	.351	.381	.323
E N200 P80	.318	.272	.264	.315	.326	.277
F N200	.228	.221	.226	.274	.295	.269
L.S.D.	.058	.035	.040	.022	.040	.021

EFFECT OF TREATMENT ON UPTAKE OF NITROGEN BY PASTURE FORAGE

Berg

Lewis - Irrigated Pasture - 1956

Grass - Pounds Nitrogen/Acre at Each Cutting Date

Treatment	1	2	3	4	5	6	Season Total	Gain
A Check	23.06	19.93	7.63	4.28	6.68	5.73	67.31	--
B P40+40	24.39	21.30	11.89	6.62	9.42	8.87	82.49	15.18
C P80	29.49	25.77	13.44	7.23	7.09	5.76	88.78	21.47
D P160	28.82	23.28	13.05	6.80	9.75	8.83	90.53	23.22
E N200P80	52.55	21.70	22.18	11.29	17.53	25.81	151.06	83.75
F N200	50.19	20.38	17.52	6.23	15.33	18.42	128.07	60.76
L.S.D.			6.34	2.97				

Ladino - Pounds Nitrogen/Acre at Each Cutting Date

Treatment	1	2	3	4	5	6	Season Total	Gain
A Check	9.67	16.63	8.18	4.14	4.36	5.21	48.19	--
B P40+40	17.29	23.82	12.27	6.11	7.56	9.72	76.77	28.58
C P80	16.58	30.21	19.09	10.21	7.27	9.54	92.90	44.71
D P160	15.08	39.23	22.01	12.00	14.04	19.86	122.22	74.03
E N200P80	17.51	21.04	15.50	11.97	8.47	8.82	83.31	38.12
F N200	8.43	18.77	11.00	3.70	4.07	3.45	49.42	1.23
L.S.D.			9.19					

Trefoil - Pounds Nitrogen/Acre at Each Cutting Date

Treatment	1	2	3	4	5	6	Season Total	Gain
A Check	14.87	9.56	5.50	4.53	3.09	1.66	39.21	--
B P40+40	14.95	22.79	10.60	3.58	2.70	1.41	56.03	16.82
C P80	10.95	9.49	7.75	4.67	3.46	1.24	37.56	- 1.65
D P160	27.76	16.62	9.69	6.59	2.63	1.80	65.09	25.88
E N200P80	19.83	13.79	9.23	2.90	2.67	2.35	50.77	10.56
F N200	16.39	11.04	10.08	2.71	2.46	1.23	43.91	4.70
L.S.D.			n.s.					

Whole Forage - Pounds Nitrogen/Acre at Each Cutting Date

Treatment	1	2	3	4	5	6	Season Total	Gain
A Check	47.60	46.12	21.32	12.95	14.13	12.60	154.71	--
B P40+40	56.50	67.92	34.68	16.31	19.68	20.00	215.09	60.37
C P80	57.03	65.48	40.28	22.11	17.82	16.53	219.25	64.53
D P160	71.66	79.13	44.75	25.40	2 6.42	30.50	277.86	123.14
E N200P80	89.89	56.53	46.91	26.16	28.67	36.97	285.13	130.42
F N200	75.02	50.20	38.60	12.64	21.86	23.10	221.42	66.70
L.S.D			12.10					

Berry (4)

EFFECT OF TREATMENT ON UPTAKE OF PHOSPHORUS BY PASTURE FORAGE

Lewis - Irrigated Pasture - 1956

Grass - Phosphorus Uptake at Each Cutting Date

Treatment	1	2	3	4	5	6	Season Total	Gain
A Check	3.16	2.09	.70	.43	.56	.55	7.49	--
B P40+40	4.12	2.36	1.27	.86	1.39	1.07	11.07	3.58
C P80	5.68	3.56	1.41	.86	.93	.65	13.09	5.60
D P160	5.47	3.47	1.88	.94	1.27	1.17	14.20	6.71
E N200P80	8.26	2.98	1.94	1.20	1.47	2.06	17.91	10.42
F N200	5.43	2.02	1.24	.59	1.23	1.46	11.97	4.48
L.S.D.	2.12	1.23	.54	.50	.60	.71	3.23	--

Ladino - Phosphorus Uptake at Each Cutting Date

Treatment	1	2	3	4	5	6	Season Total	Gain
A Check	.55	1.17	.61	.30	.34	.31	3.28	--
B P40+40	1.14	1.79	1.02	.58	.56	.61	5.70	2.42
C P80	1.36	2.32	1.63	.88	.54	.53	7.26	3.98
D P160	1.35	3.47	2.11	1.05	1.13	1.22	10.33	7.05
E N200P80	1.38	1.74	1.27	1.06	.65	.52	6.62	3.34
F N200	.59	1.26	.81	.29	.28	.22	3.45	.17
L.S.D.	.61	.96	.85	.54	.27	.31	1.97	

Trefoil - Phosphorus Uptake at Each Cutting Date

Treatment	1	2	3	4	5	6	Season Total	Gain
A Check	.74	.74	.39	.32	.20	.11	2.50	--
B P40+40	1.11	1.43	.78	.28	.18	.09	3.87	1.37
C P80	.80	.71	.56	.32	.24	.08	2.71	.21
D P160	1.93	1.45	.82	.48	.23	.12	5.03	2.53
E N200P80	1.44	.95	.64	.21	.19	.14	3.57	1.07
F N200	1.01	.75	.65	.19	.16	.07	2.83	.33
L.S.D.							1.28	

Whole Forage - Phosphorus Uptake at Each Cutting Date

Treatment	1	2	3	4	5	6	Season Total	Gain
A Check	4.45	3.99	1.70	1.05	1.10	.97	13.26	--
B P40+40	6.37	5.57	3.07	1.72	2.13	1.77	20.63	7.37
C P80	7.84	6.60	3.60	2.06	1.71	1.26	23.07	9.81
D P160	8.76	8.39	4.81	2.47	2.63	2.51	29.57	16.31
E N200P80	11.09	5.67	3.87	2.47	2.31	2.72	28.13	14.87
F N200	7.03	4.04	2.70	1.07	1.67	1.75	18.26	5.00
L.S.D.	2.80	1.37	.96	.82	.74	.91	4.14	--

Berg (5)

TOTAL NITROGEN UPTAKE IN HARVESTED IRRIGATED PASTURE FORAGE

Lewis - Sacramento County - 1956 Season Totals

Treatment	Uptake of N* in Harvested Forage				Increase due to Treatment			
	Grass	Ladino	Trefoil	Total	Total	Grass	Ladino	Trefoil
Check	67.31	48.19	39.21	154.71	--	--	--	--
P40 + 40	82.49	76.77	56.03	215.09	60.37	15.18	28.58	16.82
P80	88.78	92.90	37.56	219.25	64.53	21.47	44.71	- 1.65
P160	90.53	122.22	65.09	277.86	123.14	23.22	74.03	25.88
N200 P80	151.06	83.31	50.77	285.13	130.42	83.75	38.12	10.56
N200	128.07	49.42	43.91	221.42	66.70	60.76	1.23	4.70

* As pounds nitrogen/acre

Berry (6)

TOTAL PHOSPHORUS UPTAKE IN HARVESTED IRRIGATED PASTURE FORAGE

Lewis - Sacramento County. 1956 Season Totals*

Treatment**	Uptake ~~P_2O_5~~ P in Harvested Forage				Increase due to Treatment			
	Grass	Ladino	Trefoil	Total	Total	Grass	Ladino	Trefoil
Check	7.49	3.28	2.50	13.27	--	--	--	--
P40 + 40 (35)	11.07	5.70	3.87	20.63	7.37 (21.0 % Recovery)	3.58	2.42	1.37
P80 (35)	13.09	7.26	2.71	23.07	9.81 (28.0 % Recovery)	5.60	3.98	.21
P160 (70)	14.20	10.33	5.03	29.57	16.31 (23.3 % Recovery)	6.71	7.05	2.53
N200 P80 (~~140~~ 35)	17.91	6.62	3.57	28.13	14.87 (28.0 % Recovery)	10.42	3.34	1.07
N200	11.97	3.45	2.83	18.26	5.00	4.48	.17	.33
L.S.D. - 5%	3.23	1.97	1.28	4.14		3.23	1.97	1.28

* As pounds phosphorus/acre

** Nitrogen and phosphorus refer to pounds nitrogen + P_2O_5 applied/acre. Bracketed figures (35) are actual phosphorus per acre applied in fertilizers.

#183
AGR. NOTES
DEC. 1959

FERTILIZATION TRIALS

The Lewis trial was continued by Art Haig, Glenn Goble, and Dr. W. E. Martin during the 1959 season to determine if there was carryover from the previously applied fertilizer treatments. As we were unable to get all the clipping from this trial, the seasonal totals are not computed.

The B and C treatments had received a total of 560 pounds per acre of P_2O_5 during the last three years. The previous years results indicated that 120 pounds of P_2O_5 per acre per year would be more than adequate for maximum clover growth on this pasture. However, only the C treatment showed a significant effect of applied phosphorus on clover yields, as one of the B treatment plots showed a severe moisture stress during the season.

Phosphorus response on Lewis Irrigated Pasture Trial in Sacramento County, July 1959. Phosphorus (560 lb. P_2O_5 per acre) on right, check plot on left side.

The grass fraction showed a significant increase in yield from the E treatment. This was a result of the increased grass growth during the previous three years from the heavy nitrogen phosphorus applications. However, nitrogen alone did not increase the amount of grass as the lack of available phosphorus did not allow maximum production grass production. If a pasture soil is deficient in phosphorus, we can increase the grass yields with nitrogen, but to maximize grass production it is necessary to supply phosphorus with the nitrogen. Also the use of nitrogen on grass means that more careful grazing management is necessary to prevent the grass from becoming too rank.

LEWIS--1959
Yields--Lbs. of Dry Matter Per Acre

	Treatments			Ladino			Grass			Total		
	1956	1957	1958	5/15 1	6/22 2	8/5 3	1	2	3	1	2	3
A		Check		664	397	368	2423	806	816	3007	1253	1219
B	P_{80}	P_{320}	P_{160}	856	457	448	2418	654	887	3275	1115	1341
C	P_{80}	P_{160}	P_{320}	1186	697+	779+	2267	887	686	3453	1591	1465
D	P_{160}	----	----	379	220	344	2783	661+	912	3163	904	1291
E	N_{200}	$N_{180}P_{160}$	$N_{100}P_{320}$	776	712+	529	3514[a]	1165[a]	1125[a]	4292+	1877+	1649[a]
F	N_{200}	N_{180}	N_{100}	347	191	305	2362	627	956	2497	925	1262
LSD (19:1)				425	256	238	n.s.	n.s.	n.s.	900	600	n.s.

(a) This treatment is better than others at 19:1 odds when individual degree of freedoms are checked, i.e. (E vs. others).

Furthermore, it should be noted that use of nitrogen to increase grass growth is quite different than the use of phosphorus to increase clover growth. Withholding phosphorus will decrease clover stands, while withholding nitrogen will not reduce grass stand as much, so that pasture will contain proportionally greater amount of grass, even though no further nitrogen is added.

The results from this trial indicate that to measure phosphorus response, it is necessary to determine the effect of fertilization on clover yields rather than on total yields.

#168
AGR. NOTES
DEC. 1958

IRRIGATED PASTURE

Irrigated pasture, with more than 700,000 acres devoted to its use, continues to be one of California's major crops. Operating costs continue to rise and the number of calls from pasture operators to farm advisors for advice in pasture management has increased.

Farm advisors are placing greater emphasis upon proper planning prior to pasture establishment in order to provide for improved management practices during its use. Stressed as one of the most important items is the irrigation and drainage system. Increased emphasis is being placed upon the value of the practice of reworking irrigated pastures after they have deteriorated from several years use by incorporating them into the crop rotation system and periodically replacing them with a cultivated low water use crop. This is done for a long enough period of time to provide for the correction of water penetration problems and to allow for regrading, releveling and redesign of the irrigation and drainage systems if necessary prior to reestablishment of irrigated pasture.

Fertilization appears to be one of the management factors which can markedly influence the production and profitableness of irrigated pastures. County farm advisors have continued the encouragement of field research on the fertilization of irrigated pastures and have cooperated with Dr. Arthur Haig, Extension Field Technologist, and Dr. William E. Martin, Extension Soils Specialist, in conducting further fertilization trials.

Sacramento County continued its work on irrigated pasture on San Joaquin loam. The table on page 31 shows the treatments used and results obtained this third year of work.

The initial P160 treatment established in 1956 was allowed to carry over with no further treatment again this year. All other plots receiving phosphorus were treated with either 160 or 320 pounds P_2O_5 to bring them all to the same level of phosphorus over a three year period.

The plots receiving nitrogen in previous years continued to receive a nitrogen application except that 20 pound increments of nitrogen were added after each harvest rather than the 30 pound applications used in the second year. One high phosphorus plot received a heavy nitrogen application following the July harvest to see if the grass to clover ratio could be increased.

The P160 carry over plots continued to show an increased yield over the control. However, all other phosphorus treatments outyielded the P160 carry over indicating that while an initial application of 160 pounds of P_2O_5 is adequate to provide nearly maximum yields over a two year period, it will not provide sufficient phosphorus to produce maximum yields over a three year period on San Joaquin loam. Nitrogen alone produced only very little additional forage over the check but when used in combination with phosphorus produced the greatest forage yield. The single high summer application of nitrogen to phosphorus treated areas produced no more forage than did the straight phosphorus treatment.

THE EFFECT OF N AND P ON YIELD OF IRRIGATED PASTURE
J. Lewis Ranch--San Joaquin Loam--Sacramento County
Expressed as Pounds of Dry Forage per Acre

Fertilizer Treatments (Pounds of P_2O_5/Acre)			Seasonal Yields			Fertilizer Increase			Fertilizer Cost/Acre ($)			Cost Per Extra Ton ($)		
1956	1957	1958	1956	1957	1958	1956	1957	1958	1956	1957	1958	1956	1957	1958
Check	Check	Check	5,804	5,963	6,347	--	--	--	--	--	--	--	--	--
$P_{40}+P_{40}$	P_{320}	$N_{60}P_{160}$	7,383	8,629	8,843	1,579	2,666	2,496	8.00	32.00	25.00	10.13	24.00	32.05*
P_{80}	P_{160}	P_{320}	7,812	8,738	9,382	2,008	2,775	3,035	8.00	16.00	32.00	7.97	11.53	21.00*
P_{160}	carryover		8,663	7,394	7,342	2,859	1,441	995	16.00	--	--	11.19	7.44	6.04**
$N_{200}P_{80}$	$N_{180}P_{160}$	$N_{80}P_{320}$	9,608	10,387	9,926	3,804	4,424	3,579	38.00	41.38	44.00	19.98	41.38	24.58
N_{200}	N_{180}	N_{80}	7,769	7,143	7,358	1,965	1,180	1,011	30.00	25.38	12.00	30.00	25.38	23.73
LSD at the 0.05% level			1,428	1,197	1,412	1,428	1,197	1,412						

The cost of P_2O_5 was computed at 10¢ a pound and N at 15¢ a pound.

* From the results already obtained, it is expected that these costs will be reduced in succeeding years by the carry over effect. This effect should last for at least three years.

** The value shown for 1958 was obtained by using the three years' yields for calculating cost per extra ton. Although no significant carry over effect was obtained for the 1958 season, there was a significant increase obtained for two harvests and the ladino petioles still showed a higher phosphorus level than those of the control.

Striking effects of fertilization on the botanical composition of pastures was noted in this third year of operation. The reduction of trefoil was continued by all treatments and only in the check plots was there any appreciable trefoil. Nigrogen reduced the percentage of clover wherever it was used. The greatest reduction occurred on the straight nitrogen treatments. Only on the straight phosphorus treatments was the stand of ladino clover sustained or increased.

A phosphorus rate trial established on trefoil sheep pasture on Lindsey clay loam in Solano County likewise resulted in a striking reduction in the per cent of trefoil present and its replacement with ladino clover. Phosphorus was applied as treble super phosphate at the rate of 0, 45, 90, 180 and 360 pounds of P_2O_5 per acre in the spring of 1958. A single phosphorus rate of 90 pounds P_2O_5 per acre was applied in the fall of 1957. On the fall application plot there was a visible grass response apparent on the first of February and it was not until after the first of March that growth stimulation on the legumes was evident.

The table on page 33 indicates the treatments used and results secured on the Solano County trefoil plots.

The spring applications of P45 and P90 produced about the same amount of increased growth over the control and were less effective than the applications of P180 and P360 which were about equal. None of the spring treatments produced as much total forage as the fall application of P90. This may well indicate that there are production as well as application advantages to the use of phosphorus on irrigated pastures in the fall.