Agricultural Extension Service University of California Shasta County

Ranch Review

Livestock and Range

October 8, 1975

RANGE CLOVERS, LIME, AND PHOSPHORUS

All of these can increase range feed production in the right locations. All of these cost money. Cattle money is in short supply, and any that is available for range seeding or fertilization must be stretched as far as possible.

A few trials with Glenn Hawes over the past several years give some answers to the perennial questions of what methods to use. All of these trials have been on Red Bluff soil, a soil that is quite acid and very deficient in phosphorus. The results may not apply to your place, but these results can give you some ideas to try.

The source of phosphorus was first tested. We used single superphosphate, the common treble superphosphate, and a special treble superphosphate containing added sulfur. The three fertilizers were used in combination with a ton and a half of lime per acre worked in, and also where no lime was applied. Single super was the most useful material, with one exception. The exception was that treble super outperformed single super at the same rate of actual phosphorus where there was no lime added.

1974 Records

Regardless of phosphorus treatment, lime was always beneficial. The figures in the table below show the yield records from 1974, the sixth growing season after the fertilizer and lime were applied. Figures from the special treble material are not shown since that material did not look too good.

YIELD MAY 1974

Fertilizer, pounds per acre applied October 1968	Pounds dry matter per acre		
	Without Lime	With Lime	Increase From Lime
None	1,812	3,113	1,301
253 lbs. treble superphosphate	2,889	4,339	1,450
604 lbs. single superphosphate	2,089	4,637	2,548
1208 lbs. single superphosphate	3,443	4,626	1,183
2416 lbs. single superphosphate	4,189	5,586	1,397
Average for all treatments	2,884	4,460	1,576

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Lime increased yield on all fertilizer treatments and also increased yield by about 70% where no phosphorus was applied.

The 600-pound rate of super had pretty much lost its effect by the sixth year as shown in the above table, and actually didn't do too much in the fifth year either. However, where the 600 pound rate was used with lime it still produced a significant response in the sixth year.

The higher rates of super (1200 and 2400) were still effective in the sixth year without lime, but produced much higher yields in combination with lime.

Six Year Records

The six year record is similar to the single year 1974. The higher rates of phosphorus produced the higher yields, and the addition of lime increased yields of all phosphorus treatments.

The relative yields of the different treatments are shown below:

YIELD FOR SIX YEAR PERIOD 1969-1974
(No yields measured in 1970)

Fertilizer treatment Oct. '68	Yield in % compared to no fertilizer-no lime = 100%	
	Without Lime	With Lime
None	100%	163%
253 lbs. treble superphosphate	151	220
604 lbs. single superphosphate	116	250
1208 lbs. single superphosphate	180	274
2416 lbs. single superphosphate	191	279

The yield for the treble application without lime shows considerably better than the 600 pound single super rate without lime. This is unexpected and we are unable to explain it. Where lime was applied the 600# super was better than the treble; this was expected since the plants there respond some to the sulfur in single super as well as the phosphorus.

Lime with no phosphorus caused an increase of 63% in yield, almost as much as the 80% increase from 1200 pounds of super. Where lime was added to phosphorus applications the increased yield compared to the no treatment was more than double the increase from phosphorus alone.

So What?

Lime should be the first priority if you are seeding annual clovers in the Red Bluff soils that are located on the Stillwater Plains, and near Redding, Enterprise, and Olinda. Lime will help get a thicker stand sooner, will cause a consistent increase in yield over a period of years, and should produce feed more economically than phosphorus fertilizer by itself. Of course, a combination of lime and phosphorus will provide the greatest total feed.

Use a minimum of one ton of lime per acre and work it in. 3,000 pounds per acre may be better. The sugar beet lime available at Hamilton City is O.K., and it may contain as much phosphorus as 100 pounds of super per ton of lime.

Two hundred pounds per acre would be a minimum superphosphate rate if you are using lime. If you don't use lime you should use 500 pounds per acre on that kind of soil.

Lime may cost $8-$10/ton delivered and spread. Single super is currently around $100 a ton.

We do not recommend lime on the other red acid soils of the county, since we don't have the evidence to show it would be worthwhile. But it would be worthwhile to run trials on different soils where there are plants like rose and sub clover that may respond to lime.

LIME and INOCULATION

Some people thought the only reason we got increased production from lime was because we did a poor job of inoculating the clover seed and the lime compensated for that poor job. The theory was that if we did a first class job of inoculation with the best methods available we would see no increase in the yield from lime application.

As a result we put out a plot testing different methods of inoculation with and without 3000 pounds of lime per acre worked into the soil. One treatment was no inoculation and the other three treatments were the most advanced inoculation methods we had available. The entire plot was treated with 500 pounds of single superphosphate per acre to make sure there was no phosphorus deficiency that would influence results.

The results of the two years of harvest are shown in the tables below. In 1974 lime application produced as much as anything regardless of inoculation treatment. Plots treated with lime yielded about twice as much as those without lime. In 1975 plots treated with lime increased yields by 55%. Regardless of inoculation treatment the addition of lime always increased yield.

Again, we cannot make this recommendation on all soils in the county, but we can see the need for testing this on our soils.

YIELD MAY 1974

Inoculation Treatment	Pounds Dry Matter Per Acre Without Lime	With Lime
None	1,128	3,143
Method 1	1,523	2,836
Method 2	1,715	2,699
Method 3	1,421	2,573
Average	1,447	2,813

YIELD MAY 1975

Inoculation Treatment	Pounds Dry Matter Per Acre Without Lime	With Lime
None	3,137	4,720
Method 1	3,521	5,956
Method 2	4,054	5,974
Method 3	3,461	5,386
Average	3,543	5,509

Walter H. Johnson
Farm Advisor

EFFECT OF P + S RATE & SOURCE ON FORAGE YIELD

Meyer Plot - Shasta County - 4th Season Results

Treatments in 1967			1971 Yields - (April 30, 1971)				
Material/Acre	Nutrients/Ac		Fresh Weight lbs/Ac	Dry Weight lbs/Ac		Dry Yield of	
	P_2O_5	S			%	Grass	Clover
Check	---	---	11773	1738	100	438	1297
430 Treble	224	---	22332	3334	191	802	2532
220 CSPS (0-40-0-20-S)	88	44	15228	2188	126	641	1547
433 Super (0-20-0-12)	87	52	15281	2185	126	600	1585
440 CSPS	176	88	21048	2935	169	917	2018
866 Super	173	104	20560	2812	162	835	1977
880 CSPS	352	176	25102	3267	188	1043	2224
1732 Super	346	208	24102	3242	187	945	2296
r value - linear response to P			.968	.917		.926	.860
C.V.				25.5		30.4	26.5

No difference between CSPS & Superphosphate

RESIDUAL EFFECTS OF PREVIOUS FERTILIZATION WITH P & S ON 1971 YIELDS OF TOTAL FORAGE---LBS/ACRE

Original Treatment			4th Year Shasta Meyer	4th Year Stanislaus Grove		3rd Year Shasta Haws		3rd Year Marin Furlong	3rd Year Butte Ahart		3rd Year Mendocino Hargus
Material	Nutrients										
	P_2O_5	S/Ac	lbs/Ac	no	+lime	No	+lime		No K	+K	lbs/Ac
Check	---	---	1738	1860	1583	259	879	1151	220	266	392
430 Treble	200	---	3334	----	----	677	1111	1486	2126	1945	405
250 CSPS	100	50	2188	1860	1703	305	1606	1169	2375	2488	1518
500 Super	100	50	2185	2086	1844	401	1802	1744	1605	1860	587
500 CSPS	200	100	2935	2009	1900	469	1802	1440	3232	3562	1949
1000 Super	200	100	2812	2050	2078	970	2069	1971	2387	2979	1076
1000 CSPS	400	200	3267	2010	2217	487	1767	1777	3006	3674	2025
2000 Super	400	200	3242	2186	2193	656	1671	2232	2850	3377	1638
						4224	12,707				
CV			25.5	11.2		20.7		15.2%	14.5		25.2
LSD			917	290		318	454	362	623		213

$\frac{12,707}{4224} = 302\%$

(2)

SUMMARY OF FORAGE YIELDS - 3RD SEASON EFFECTS--HAWS SHASTA 1971

Fertilizer Treatments Oct. 23 '68			Fresh Wt. lbs/ac		Dry Matter lbs/ac				Grass lbs/ac		Clover lbs/ac			
Material/Acre	Nutrients/Acre		No Lime	+Lime	No Lime		+Lime		No Lime	+Lime	No Lime		+Lime	
	P_2O_5	S			%		%				%		%	
None	---	---	1026	3291	100	259	100	879	178	337	100	81	100	544
250 Treble	130	---	2904	4201	258	677	126	1111	230	331	550	445	143	779
271 CSPS	103	54	1200	6582	118	305	183	1606	114	523	236	191	199	1084
604 Super	120	60	1636	7444	155	401	206	1802	161	437	296	240	252	1368
542 CSPS	206	108	1878	7115	181	469	206	1802	176	594	362	293	222	1207
1208 Super	240	120	3969	8267	374	970	236	2069	275	529	859	695	284	1540
1084 CSPS	412	216	1994	6786	188	487	201	1767	170	529	392	317	234	1272
2416 Super	480	240	2672	6886	254	656	191	1671	219	429	541	438	229	1242
					4,224		12,707				2,703		9,036	
					302 %						334 %			

RESIDUAL EFFECTS OF PREVIOUS FERTILIZATION WITH P & S ON 1971 YIELDS OF RANGE CLOVERS---LBS/ACRE

Original Treatment			4th Year Shasta Meyer	4th Year Stanislaus Grove		3rd Year Shasta Haws		3rd Year Marin Furlong	3rd Year Butte Ahart		3rd Year Mendocino Hargus
Material	Nutrients P_2O_5/Ac.	S/Ac		No	+lime	No	+lime		No K	+K	
None	---	---	1297	912	936	81	544	86	34	41	43
370 Treble	200	---	2537	---	---	445	779	226	1297	1150	.27
250 CSPS	100	50	1547	939	1009	191	1084	111	1439	1512	440
500 Super	100	60	1585	1061	1172	240	1368	289	683	939	59
500 CSPS	200	100	2018	929	1309	293	1207	137	2395	2687	595
1000 Super	200	120	1977	965	1257	695	1540	705	1489	1906	129
1000 CSPS	400	200	2224	825	1300	317	1272	370	2093	2690	744
200#Super	400	240	2296	1090	1351	438	1242	1027	1911	2395	584
						2,700	9,036				
LSD			903	273		240	387	287	762		350
CV			26.5	15.1		---		53.	25.7%		72.5%
CSPS vs Super (S) (SO_4)			PSO_4=PS	PSO_4=PS		PSO_4>PS		PSO_4>PS	PS>PSO_4		PS>PSO_4

$\frac{9,036}{2,700} = 338\%$

SHASTA COUNTY

Glenn Haws

5/3/72

Lime		I	II	III	T	M
2412	Super	813	867	1344	3024	1008
1208	Super	831	1080	1429	3340	1113
604	Super	763	824	1276	2863	954
1084	CSPS	831	669	1618	3118	1039
542	CSPS	936	1120	1883	3939	1313
271	CSPS	681	1078	1593	3352	1117
253	Treble	829	608	697	2134	711
Check		570	354	532	1456	485
Main Plot Total		6254	6600	10372	23226	968
No Lime						
2412	Super	640	769	732	2141	714
1208	Super	693	518	659	1870	623
604	Super	524	361	455	1340	447
1084	CSPS	413	671	365	1449	483
542	CSPS	314	386	452	1152	384
271	CSPS	409	262	318	989	330
253	Treble	263	651	540	1454	485
Check		302	436	333	1071	357
Main Plot Total		3558	4054	3854	11466	478
		9812	10654	14226	34692	

	2412 Super	1208 Super	604 Super	1084 CSPS	542 CSPS	271 CSPS	253 Treble	Check
Total	5165	5210	4203	4567	5091	4341	3588	2527
Mean	861	868	701	761	849	724	598	421

Table of Means

	2412 Super	1208 Super	604 Super	1084 CSPS	542 CSPS	271 CSPS	253 Treble	Check	Lime Means
Lime	1008	1113	954	1039	1313	1117	711	485	968
No Lime	714	623	447	483	384	330	485	357	478
P & S Means	861	868	701	761	849	724	598	421	

$LSD_{.05}$ - Lime Means = 699; $LSD_{.05}$ - P & S Means for same Lime Treatment = 297; $LSD_{.05}$ - P & S Means = 210; $LSD_{.05}$ - P & S Means for Different Lime Treatment = 503.

Source	df	SS	MS	OF	RF 5%	RF 1%
Sub Plots	47	6,856,653				
Main Plots - Lime	5	4,201,169				
Blocks	2	686,490	343,245	1.08	19.16	99.00
Lime	1	2,881,200	2,881,200	9.10	18.51	98.49
Error (a)	2	633,479	316,740			
Fertilizer Treatments	7	987,367	141,052	4.48**	2.36	3.36
Fertilizer x Lime	7	786,707	112,387	3.57**	2.36	3.36
Error (b)	28	881,410	31,479			
P vs No P	1	858,438	858,438	27.27**	4.20	7.64
P S vs P	1	160,083	160,083	5.09*	4.20	7.64
Lime x (P vs No P)	1	482,517	482,517	15.32**	4.20	7.64
Lime x (P S vs P)	1	541,025	541,025	17.18**	4.20	7.64