MAR 2 1972

Date of writing
December 17, 1972

CEMIS Form 4

REPORT OF PLANNED WORK ACCOMPLISHED*

NAME(S) William J. van Riet LOCATION Stanislaus County

Period covered by this report:
From January 1971
To December 1971

PROJECT PLAN TITLE RANGE IRRIGATION

Project Number	CW5	Primary Subject	A60	Secondary Subject	A57	Commodity	A3
State Project Reference		Audience Type	10	Research Involved (Yes / No)	X	Status: Continuing / Terminated	X

Copies to L. Berry, L. Booher

INCLUDE IN THIS REPORT: Procedures used; results obtained (including specific changes brought about in knowledge, skills or attitudes, economic benefits or other results);** technical results where applicable (detailed technical results should be attached to this report and sent to appropriate specialist(s); evaluation of effectiveness of work done and degree to which goals were reached. (Attach additional pages if needed.)
** Cite specific examples including degree of acceptance or use of knowledge or practices taught.

PROCEDURES:

A trial was established in fall of 1970 to evaluate the economic feasibility of supplemental fall irrigation on annual legume pastures in Stanislaus County. About 75 acres were sprinkled with approximately 2 acre-inches of water with the Ames Company Turbo-rain demonstration unit pumping from the TID canal. A small plot was set aside to measure yield responses to no irrigation, 2 inches, and 4 inches of irrigation water as outlined in the project plan. The plot was mowed in November, February, and April.

RESULTS:

The sprinkler failed to perform efficiently, causing erratic water coverage patterns. While actual costs could not be obtained on borrowed equipment, we found that labor and power costs alone far exceeded any possible increase in yields.

Yield data indicate that fall irrigation of annual legumes increases the amount of early forage production, but in a good rainfall year such as this was, these increases do not hold up throughout the season. In fact, spring (April) yields of the irrigated plots were less than the spring (April) yields of the check plots. Fall irrigation did not extend plant life sufficiently to increase the yield. Perhaps in a short rainfall year, these results would have been different.

We conclude that under adequate seasonal rainfall, we cannot expect supplemental irrigation in the fall to economically increase yields of annual Rose and subclovers.

A short report of the trial results and conclusions has been distributed via newsletter to growers. A detailed report is attached to this one for specialists' information.

* See CEMIS Handbook for instructions on use of this form.

RANGE IRRIGATION (Supplement)

PROCEDURE USED:

Arrangements were made with the Ames Company for use of their Turbo-Rain demonstration unit with pump and hose to sprinkle up 160 acres of annual legume pasture. Cooperator Larry Hooker provided the pasture, operating labor and expenses. We had planned to sprinkle-irrigate 160 acres of annual legumes in September with 2 acre-inches of water, and measure cattle gains from the field, comparing gains obtained on nonirrigated adjacent fields. The sprinkler failed to perform up to expectations and, as a result, only about 75 acres were sprinkled. Since Mr. Hooker could not cross-fence the entire field to obtain gain data, a small corner was fenced and yields were measured by mowing November 17, February 4, and April 22.

Four inches, two inches and no irrigation water were compared. Water was applied between September 20 and October 10, 1970.

RESULTS OBTAINED:

1. The sprinkler performance was poor. Breakdowns caused a great loss of time. Consequently, only about one-half of planned acreage (75 acres) was irrigated in a three-week period from September 12 to October 10. Coverage was not uniform. The sprinkler traveled uphill slower than it traveled downhill. The water-powered boom turned faster downhill than uphill while the unit traveled up or down the slopes of the field. This resulted in erratic water coverage, varying between 1/2 and 4 acre-inches.

2. The length of time soil moisture persisted was estimated. On October 19, 1970, the top four inches of soil were quite dry by visual inspection where sprinkling was done on September 20 - 25. The young clover seedlings were wilted at 2 p.m. Clover had germinated well in all irrigated areas. Good growth had occurred where four inches of water were applied, with vetch 6 to 8 inches tall. Mean temperature was 70° F. and no rain fell during this time.

October 20 brought .2 inches of rain with .3 inches more on October 22.

3. By November 17 when the first cutting was made, very heavy wild radish growth had occurred in the irrigated area. There was no measurable growth of any kind on nonirrigated plot areas at that time. On February 4 when the second cutting was made, radish growth was quite rank and in bloom. The nonirrigated block had virtually no radish growth. Within our fenced plot the clovers were small and immature, apparently being shaded out by the tall radish and volunteer barley. Across the plot fence, in the irrigated portion of the pasture, cattle had grazed the radish down about 80 percent, so the clovers were dense and vigorous. Proper grazing of the irrigated pasture tended to nullify the bad effects of the wild radish growth.

4. By March, no visual differences between the irrigated and nonirrigated areas could be seen. Naturally, germinated plants had caught up with the plants which were irrigated up.

5. Yield data are presented in table I. There were no significant differences ($P<.05$) in mean dry matter yield due to the supplemental irrigation (table II). There were, however, significant differences ($P<.01$) in yield, due to the harvest regime as shown in table III. Regardless of irrigation regime, the greatest yield was obtained by

making three cuttings. Duncan's multiple range test aided in determining which harvesttime means were significantly different from others. Dry matter yields were highest when three cuttings were made. Yields of nonirrigated plots were greater as the season progressed. Yields of the irrigated plots began earlier, peaked in midseason, and were less late in April.

6. Laboratory analyses of forage samples showed no difference in nutrient composition due to the early irrigation. Seasonal differences in nutrient composition occurred as would be expected. Average TDN and total protein percentages by cutting were:

November 17 cutting	21.8%	Protein	67.41% TDN
February 4 cutting	19.52%	Protein	68.92% TDN
April 22 cutting	15.9%	Protein	71.84% TDN

Table IV shows total protein and TDN yields per acre for each plot.

7. Cost data are incomplete, since the equipment was borrowed. It is expected, however, that very significant increased forage yields would be required to pay for the operational labor and electric costs and the cost of investment in equipment.

DISCUSSION AND SUMMARY

Results of this fall supplementary irrigation trial are for only one year and one type of sprinkler. Two acre-inches of irrigation water was enough to germinate and sustain plant life for 30 days, after which additional soil moisture was required. Irrigation costs are high.

Yield was not significantly increased by fall sprinkling. Forage production did begin earlier, however, with 928 pounds per acre of dry matter with 2 inches of water; and 1565 pounds per acre with 4 inches of water by November 17. Nonirrigated plants were just emerging from the soil at that time. By studying the yields obtained at different dates for each irrigation regime, it appears that fall irrigation increases the amount of early forage production, but in a good rainfall year such as this was, these increases do not hold up throughout the season. One can surmise that fall irrigation only moved the productive life of these plants to an earlier season, but did not extend the life sufficiently to increase total yield. Perhaps in a short rainfall year, the two or four inches of water in the fall will substantially increase yields.

It is safe to conclude that under adequate seasonal rainfall, we cannot expeet supplemental irrigation in the fall to economically increase yields of annual rose and subterranean clovers. Other species of pasture plants may respond differently.

SUPPLEMENTAL RANGE IRRIGATION--LARRY HOOKER RANCH 1970-71

Table I

3 IRRIGATIONS, 6 HARVEST MEASUREMENTS, 5 OBS./MEAS.
DRY MATTER--LBS. PER ACRE

ri- tion	Harvesttime	OBSERVATIONS 1	2	3	4	5	Totals	$\bar{X}$ Means
	1 Nov	0	0	0	0	0	0	0
	2 Nov Feb	1,141	1,057	867	1,213	1,350	5,628	1,125.6
0"	3 Feb	1,076	1,004	1,186	1,121	1,098	5,485	1,097.0
eck	4 Nov Feb Apr	3,848	4,015	3,850	3,858	4,256	19,827	3,965.4
	5 Feb Apr	4,181	3,711	3,590	3,881	3,784	19,147	3,829.4
	6 Apr	4,889	3,652	4,035	4,645	3,610	20,831	4,166.2
	1 Nov	1,028	1,231	1,102	814	467	4,642	928.4
	2 Nov Feb	1,882	1,770	1,629	1,702	1,366	8,349	1,669.8
2"	3 Feb	1,686	2,150	1,499	2,465	2,369	10,169	2,033.8
	4 Nov Feb Apr	3,293	3,909	4,085	3,824	3,990	19,101	3,820.2
	5 Feb Apr	3,254	3,634	3,182	3,960	3,599	17,629	3,525.8
	6 Apr	2,606	2,059	2,286	3,477	3,209	13,637	2,727.4
	1 Nov	1,706	1,880	1,487	1,405	1,350	7,828	1,565.6
	2 Nov Feb	2,377	2,727	2,099	2,025	1,936	11,164	2,232.8
4"	3 Feb	2,841	2,988	2,807	2,315	2,159	13,110	2,622.0
	4 Nov Feb Apr	4,509	5,389	4,005	4,603	4,716	23,222	4,644.4
	5 Feb Apr	3,907	4,929	4,964	4,409	4,267	22,476	4,495.2
	6 Apr	4,105	3,512	2,484	3,491	3,247	16,839	3,367.8
							ΣX = 239,084	2,656.4889

TOTAL SIZE = I x H x O = (3) (6) (5) = 90 observations

Treatment means: Check $\bar{X}$ = 2,363.93
2" $\bar{X}$ = 2,450.90
4" $\bar{X}$ = 3,154.63
— means do not differ significantly (P<.05)

ble II

ANALYSIS OF VARIANCE

URCE OF VARIATION	d.f.	S. S.	M. S.	F
mong Harvests	17	164,363,246.69	9,668,426.28	
rrigations	2	11,280,072.96	5,640,036.48	0.5526 n.s.
mong Harvests w/n Irrigation (experimental error)	15	153,083,173.73	10,205,544.92	76.6427**
mong Observations w/n Irrigation (sampling error)	72	9,587,333.80	133,157.41	
TAL	89	173,950,580.49		

means significantly different (P<.01)

Table III

Hooker Plot--1970-1971

EFFECT OF IRRIGATION WATER AND HARVEST TIMES ON RANGE FORAGE

YIELD EXPRESSED IN DRY MATTER PER ACRE

Harvest Time	Check	2 Inches	Difference	% of Check	4 Inches	Difference	% of Check
Nov	0	928.4 a	+928.4		1565.6 b,e,d	+1565.6	
Nov & Feb	1125.6 a,b,c	1669.8 c,d,e	+574.2	148%	2232.8 e,f	+1107.2	198%
Feb	1097.0 a,b	2033.8 d,e	+936.8	185%	2622.0 f,g	+1525.0	240%
Nov, Feb & Apr	3965.4 h,i	3820.2 h,i	-145.2	96%	4644.4 j	+ 679.0	117%
Feb & Apr	3829.4 h,i	3525.8 h	-293.6	92%	4495.2 j	+665.8	129%
Apr	4166.2 i,j	2727.4 f,g	-1438.8	65%	3367.8 g,h	+768.4	81%

a, b, c, d, e, f, g, h, i, j Means with the same superscripts do not differ significantly (P<.01)

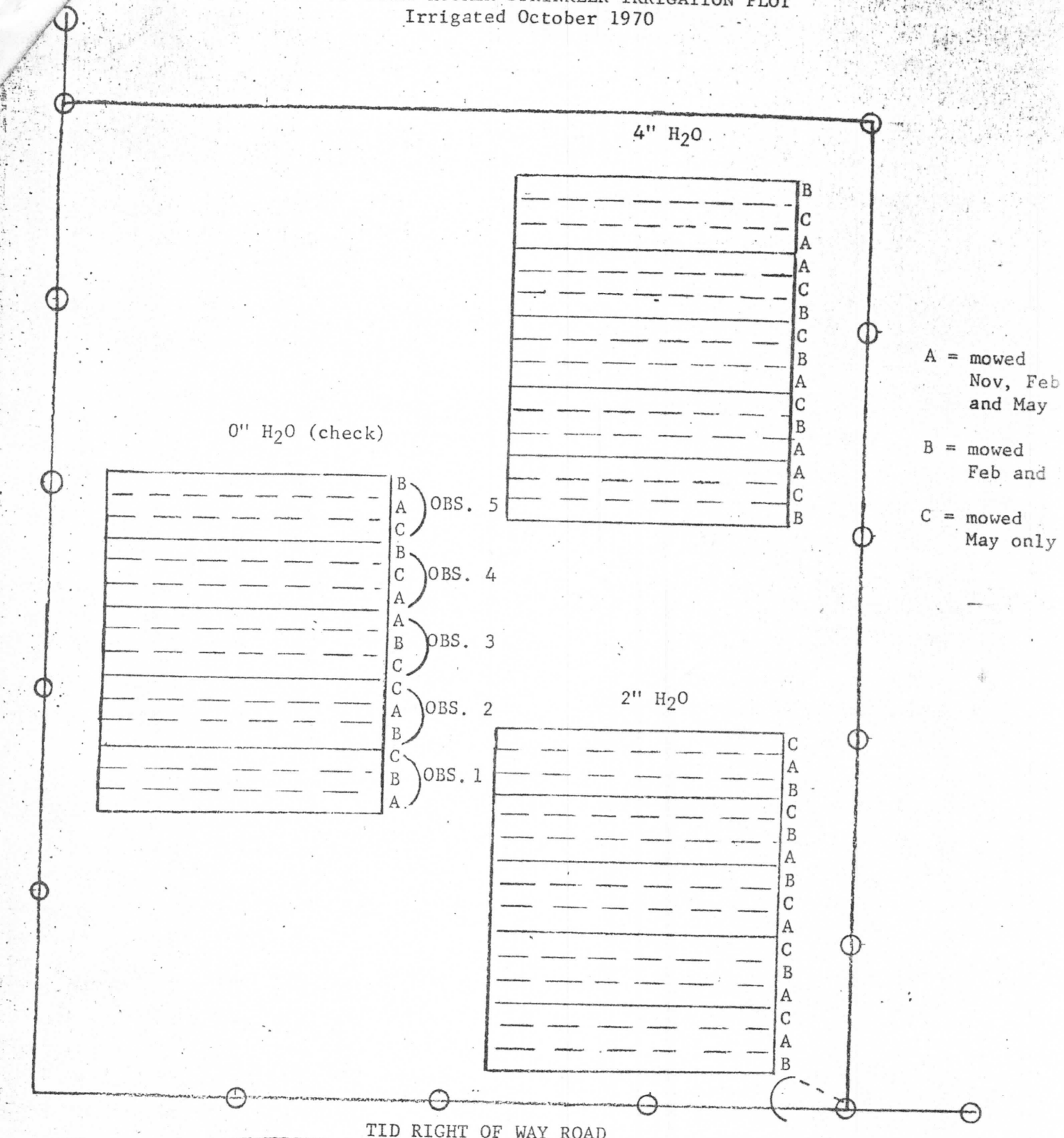
Table IV

YIELD OF DRY MATTER, PROTEIN AND TDN IN ANNUAL LEGUME SUPPLEMENTAL IRRIGATION TRIAL

Hooker Ranch--1970-1971

Irrigation	Harvest Time(s)	Dry Matter $\bar{X}$ Lb/A	Total Protein %			TDN %			Protein Lb/A	TDN Lb/A
			Nov	Feb	Apr	Nov	Feb	Apr		
0 inch Check	1 Nov		0			0			0	0
	2. Nov Feb	1125.6		25.7			67.67		289	762
	3. Feb	1097.0		25.7			67.67		282	742
	4. Nov Feb Apr	3965.4		(25.7)	(13.1)		(67.67)	(71.21)	661	2784
	5. Feb Apr	3829.4		(25.7)	(13.1)		(67.67)	(71.21)	641	2690
	6. Apr	4166.2			11.5			71.36	479	2973
	$\bar{X}$	2363.93		25.7	12.56		67.67	71.26	470.4	1990.2
2 inch	1. Nov	928.4	22.4			65.11			208	604
	2. Nov Feb	1669.8	(22.4)	(20.3)		(65.11)	(69.12)		358	1117
	3. Feb	2033.8		(17.7)			69.64		360	1416
	4. Nov Feb Apr	3820.2	(22.4)	(20.3)	(12.0)	(65.11)	(69.12)	(71.70)	617	2673
	5. Feb Apr	3525.8		(17.7)	(14.1)		(69.64)	(72.53)	570	2498
	6. Apr	2727.4			32.5			71.07	885	1938
	$\bar{X}$	2450.90	22.4	19.0	19.53	65.11	69.38	71.76	599.6	2049.2
4 inch	1. Nov	1565.6	21.2			69.70			332	1091
	2. Nov Feb	2232.8	(21.2)	(18.5)		(69.70)	(69.32)		456	1554
	3. Feb	2622.0		15.4			68.86		404	1806
	4. Nov Feb Apr	4644.4	(21.2)	(18.5)	(15.9)	(69.70)	(69.32)	(71.70)	840	3283
	5. Feb Apr	4495.2		(15.4)	(14.4)		(68.86)	(72.81)	674	3170
	6. Apr	3367.8			14.2			72.40	478	2438
	$\bar{X}$	3154.63	21.2	16.95	14.83	69.70	69.09	72.30	636.8	2668.4
$\bar{X}$		2656.49	(21.8)	(19.5)	(15.9)	(67.41)	(68.92)	(71.84)	568.93	2235.93

1970-71 LARRY HOOKER SPRINKLER IRRIGATION PLOT
Irrigated October 1970



West edge of Larry Hooker's property. SW corner of the field.