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Irrigation and Drainage Letter

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WATER PENETRATION PLOTS

Jewell Meyer, Stanislaus County, gives an evaluation of his 1963 plot work on water penetration. He reports that the work with detergents or surficants looks only fairly good. There are some indications that these new products will be of some benefit on soils such as the Ripperdan which seal in the top few inches, somewhat like a powdery road does.

The work with auger holes backfilled with sawdust in orchards have shown some outstandingly good results. One orchard in particular that dropped 5 to 7 tons of fruit last year as a result of poor penetration had a full crop this year with little or no fruit drop. The water only penetrated 18 inches deep in this orchard last year and we found moisture to five feet around the auger holes and extending laterally 10 feet out from the auger holes. This was enough to supply the trees with the needed water during the middle of the summer. The holes were dug 16-18 inches in diameter with a small tractor on a three point hitch and about 40 inches deep. Fifty to 100 holes per acre depending upon the seriousness of the problem has worked well. The cost of such an operation was found to be 50 cents a hole--including equipment, labor and materials.

NEW PUBLICATIONS

"Electrical Resistance Gypsum Blocks for Scheduling Irrigations", Oregon State University Extension Bulletin 810, by Marvin N. Shearer, Extension Irrigation Specialist, March, 1963.

"Saline Water Conversion Research", University of California Sea Water Conversion Laboratory, 1963, Progress Report, Water Resources Center Contribution No. 85.

"Linings for Irrigation Canals", by U.S. Bureau of Reclamation. Available from Superintendent of Documents, Washington 25, D.C., at a price.

"Use of Ground-Water Reservoirs - San Joaquin Valley - California", U.S.G.S. Water Supply Paper 1618. Available from Superintendent of Documents, Washington 25, D.C.

"Vegetative Water Use Studies, 1954-1960", Bulletin No. 113, State Department of Water Resources, Interim Report, August, 1963.

COMING EVENTS

June 22-26 - 45th Annual Meeting Pacific Division AAAS, and Western Society of Soil Science, University of British Columbia, Vancouver, B.C.

July 14, 15, 16 - Irrigation Field Training Conference for farm advisors at Davis.

Booher - Houston - Marsh - Werenfels

IRRIGATION OF ALFALFA

Studies of irrigation practices and efficiencies in growing alfalfa were started by J. R. Davis, A. W. Fry and L. G. Jones at Davis in 1962. The results and analyses of the 1962 yields were reported in the April, 1963, issue of California Agriculture. These studies were continued during 1963 by Paul E. Martin, Luther G. Jones and R. M. Hagan. The following is a review of the plot layout and a summary of the results of the 1963 work:

Lahontan alfalfa was planted on Yolo loam soil in 1961. A randomized plot design with six replications of each irrigation treatment was used. Each plot was 20 feet by 50 feet and was surrounded by earth levees with a plastic film core extending about 2 feet below the soil surface. Water was metered onto the plots at each irrigation according to the treatments as described below:

Treatment

A	Depth of water applied = 25% of treatment D
B	Depth of water applied = 50% of treatment D
C	Depth of water applied = 75% of treatment D
D	Depth of water applied sufficient to restore moisture level approximately to field capacity to ten feet.*
E	Depth of water applied = 150% of treatment D
F	200% of water applied to D for first two irrigation and none thereafter
G	Same as D with no winter irrigation
H	Same as C with no winter irrigation.

The 1963 growing season started out with above average rainfall in early spring, and temperatures throughout the summer were generally moderate. The soil moisture was replenished by winter rainfall to the depth of rooting. No winter irrigations were required. Treatment G was, therefore, similar to treatment D, and treatment H was similar to treatment C.

Table 1 shows the depth of water applied to each treatment throughout the season.

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* As determined with a neutron meter.

Table 1
Water Applied - 1963
Depth in inches

Treatment	June 19	July 15	Aug. 9	Sept. 11	Total
A	2.00	1.68	1.56	1.74	6.98
B	4.00	3.36	3.12	3.48	13.96
C	6.00	5.04	4.68	5.22	20.94
D	8.00	6.72	6.24	6.96	27.92
E	12.00	10.08	9.36	10.44	41.88
F	16.00	13.44	- -	- -	29.44
G	8.00	6.72	6.24	6.96	27.92
H	6.00	5.04	4.68	5.22	20.94

All 48 plots were harvested on the same morning using a 3-foot wide swather to cut a 3 foot by 20 foot area in the center of each plot. The cut hay was immediately weighed and samples taken for moisture content and hay quality. Average dry weight yields for each treatment are given in Table 2.

Table 2
Average Treatment Yields for Each Cutting - 1963
tons/acre - dry weight

Treatment	May 10	June 7	July 5	Aug. 2	Aug. 30	Oct. 1	Total
A - 1/4	2.00	1.52	1.39	1.02	0.73	0.49	7.15
B - 1/2	1.86	1.53	1.42	1.19	0.96	0.77	7.73
C - 3/4	1.86	1.44	1.53	1.45	1.17	0.91	8.36
D - 1	1.83	1.43	1.52	1.47	1.22	0.90	8.37
E - 1 1/2	1.85	1.44	1.54	1.57	1.22	0.90	8.52
F - 2	2.13	1.57	1.62	1.57	1.25	0.74	8.88
G - 1	1.86	1.36	1.52	1.44	1.20	0.91	8.29
H - 3/4	1.81	1.48	1.55	1.41	1.21	0.88	8.34

Yield differences were somewhat similar to those in 1962 which was also a year of heavy winter rainfall. A decline in yield of treatments A and B occurred with the third cutting. The greatest yield resulted from treatment F instead of treatment E which gave the highest yield in 1962. A severe soil moisture deficit occurred in treatment F near the end of the season which reduced the yield of the last cutting. (In 1964 the two irrigations of treatment F will be spaced further apart.) The first cuttings of treatments A and F gave the highest yields. This was probably due to drought and partial dormancy at the end of the 1962 season. High yields following dormancy are not uncommon and are assumed to be the result of increased root storage of carbohydrates during the period when top growth is inhibited.

The yields in relation to water use are given in Table 3. Where winter rainfall is sufficient to rewet the root zone, the highest duty* of irrigation water applied is obtained with treatment A. Where the amount of soil moisture depletion after the last crop is included, there is little difference in duty of water between treatments

*Duty is the quantity of water required to mature a given crop. A high duty indicates a high crop yield per unit of water. A low duty means less production per unit of water.

A, B, C, and D. Excessive water use, as in treatment E, appeared to depress the duty slightly. (It will be interesting to observe the yields during 1964 from treatments G and H when the soil moisture was not replenished by winter rainfall and no winter irrigations were applied to these treatments.)

Table 3
Yields in Relation to Water Use

Treatment	Hay yield in tons	Irrig. water applied - inches	Tons per ac.-ft. of irrig. water	Soil moist. deficit end of season - in.	Total water use - inches	Tons per acre-foot of total water use
A	7.15	6.98	12.29	16.73	23.71	3.61
B	7.73	13.96	6.65	12.01	25.97	3.57
C	8.36	20.94	4.79	5.24	26.18	3.83
D	8.37	27.92	3.60	5.59	33.51	3.00
E	8.52	41.88	2.44	3.72	45.60	2.24
F	8.88	29.44	3.62	13.28	42.72	2.49

The average per cent protein for each cutting from all plots is given in Table 4. Results for the various treatments are similar throughout the season.

Table 4
Average Per Cent Protein, Dry Basis - 1963

Treatment	May 10	June 7	July 5	Aug. 2	Aug. 30	Oct. 1	Average
A - 1/4	24.20	22.32	21.08	20.99	23.25	25.82	22.95
B - 1/2	25.26	22.17	21.97	20.69	22.24	25.33	22.94
C - 3/4	25.32	22.55	21.51	20.02	21.60	24.04	22.51
D - 1	24.93	22.39	21.28	19.71	22.09	23.71	22.35
E - 1 1/2	22.41	21.85	21.22	19.44	21.66	24.33	22.41
F - 2	22.62	22.23	21.42	19.59	21.56	24.96	22.62
G - 1	22.29	22.11	21.48	20.18	21.77	23.11	22.29
H - 3/4	22.49	22.09	20.69	20.00	21.59	24.71	22.49

Data obtained in 1963 support, in general, the results and conclusions formulated in 1962. Very small differences in yield occur between irrigation treatments early in the season when alfalfa is grown on a deep soil and the soil moisture reservoir is full in the spring. When irrigation water supplies are deficient it appears that a fairly good crop can be obtained with about seven inches of applied water under the conditions of the 1962 and the 1963 season. (Note, however, that in treatment A, which received a total of seven inches of irrigation water, about 70% of the total yield was produced during the first half of the summer.) When irrigation water supplies are adequate, there appears to be little difference between applying two deep irrigations or applying the same total amount of water in several applications throughout the season on deep soils and under the conditions at Davis.