guidelines toward minimizing the spill of chemical residues into return-flow systems from rice fields. But these experimental results and techniques must be weighed against other rice-culture operations and practices—for example, fertilizer practice, insecticide control, water flow, and water deliveries.

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TABLE 2. MOLINATE PERSISTENCE IN FLOOD WATERS, 1971, PREFLOOD PREPLANT APPLICATION, ORDRAM 5GS AT 80 lb/acre

Water management system	Down-stream station*	Molinate concentration			
		May 18	May 20	May 21	May 25
	ft	ppm	ppm	ppm	ppm
Flow-through	20	0.08	0.06	0.06	< 0.01
	100	0.16	0.10	0.11	< 0.01
	180	0.78	0.23	0.06	< 0.01
Static	20	< 0.01	< 0.01	< 0.01	< 0.01
	100	0.35	0.29	0.10	< 0.01
	180	0.90	0.60	0.08	< 0.01
Recycled	20	0.48	0.25	0.15	< 0.01
	100	...†	0.28	0.18	< 0.01
	180	1.02	0.69	0.19	< 0.01

* Downstream from water-inflow end.
†Sample lost.

TABLE 3. MOLINATE PERSISTENCE IN FLOOD WATERS, 1970, POSTFLOOD APPLICATION OF ORDRAM 6E AT ½ gal/ac IN A STATIC SYSTEM

Date	Molinate concentrations (ppm) at downstream sampling stations				
	20 ft	60 ft	100 ft	140 ft	180 ft
September 23*	1.82	0.95	1.15	1.13	1.14
September 25	0.79	1.00	0.57	0.75	0.71
September 28	0.45	0.46	0.61	0.78	0.65
October 3	0.44	0.34	0.34	0.37	0.24

* 2 hrs after spraying.

TABLE 4. MOLINATE CONTENTS IN SEEPAGE WATERS, 1970, POSTFLOOD APPLICATION OF ORDRAM 6E AT ½ gal/ac IN A STATIC SYSTEM

Date	Molinate concentrations* (ppm) in seepage waters of submerged soils		
	5-cm depth	15-cm depth	25-cm depth
September 23†	<0.01	<0.01	<0.01
September 25	0.35	0.07	<0.01
September 28	0.38	0.26	<0.01
October 3	0.43	0.32	0.04

* Average from stations 20, 60, 100, 140, and 180 ft downstream.
† 4 hours after application.

Wetting agents for eros on burned water

N. VALORAS · J. F. OSBORNE

Photo 1. Checkerboard pattern (center) representing surfactant treated areas in the study. The fan-shaped wetted areas to the left and right indicate areas irrigated by the Forest and Range Experiment Station.

THE MANY ACRES of watershed in Southern California that burn each year constitute a serious potential for erosion, because the removal of protective vegetation and fire causes the land to become water repellent—instead of being absorbed, water tends to run off.

To decrease erosion, the burned watersheds are commonly seeded with annual ryegrass (*Lolium* spp.), but seed germination depends on characteristics of the first seasonal rainfalls, which also determine severity of erosion prior to vegetative establishment.

To overcome these problems, wetting agents have been used to treat water repellent soils. Addition of a wetting agent to water allows the water to penetrate the soil rather than run off. Furthermore, a water-repellent soil which has been treated with wetting agent solution is wettable after redrying, since the wetting agent molecules are absorbed by soil particles. If only a small amount of wetting agent is applied, it all can be adsorbed near the soil surface, leaving lower layers of soil unaffected.

Demonstration plots

Demonstration plots for testing the use of a wetting agent were established in the winter of 1970–71 near the mouth of the San Antonio Canyon in the San Gabriel Mountains north of Upland, California. The area had been burned during the summer. The plots were watered with approximately one-half inch of 5000 ppm wetting agent solution. Water was pumped through a fire hose and sprayed on demonstration plots using a chemical injection pump to mix the wetting agent with water as it was applied.

Three sites were selected for treatment. One was the checkerboard area in photo 1, taken immediately following treatment. The fan-shaped dark areas which contain subplots of wetting agent treat-

sion control

sheds

J. LETEY

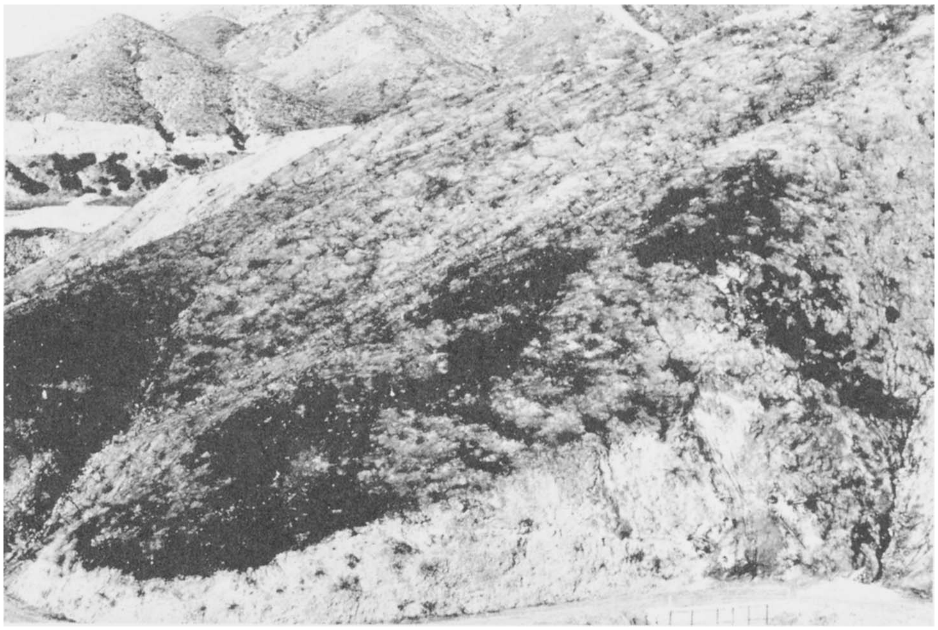

Photo 2. Photograph taken after some rains, illustrating grass growth in the checkerboard treated areas. The dark area with grass growth to the left was also one of the U.C. treated areas.

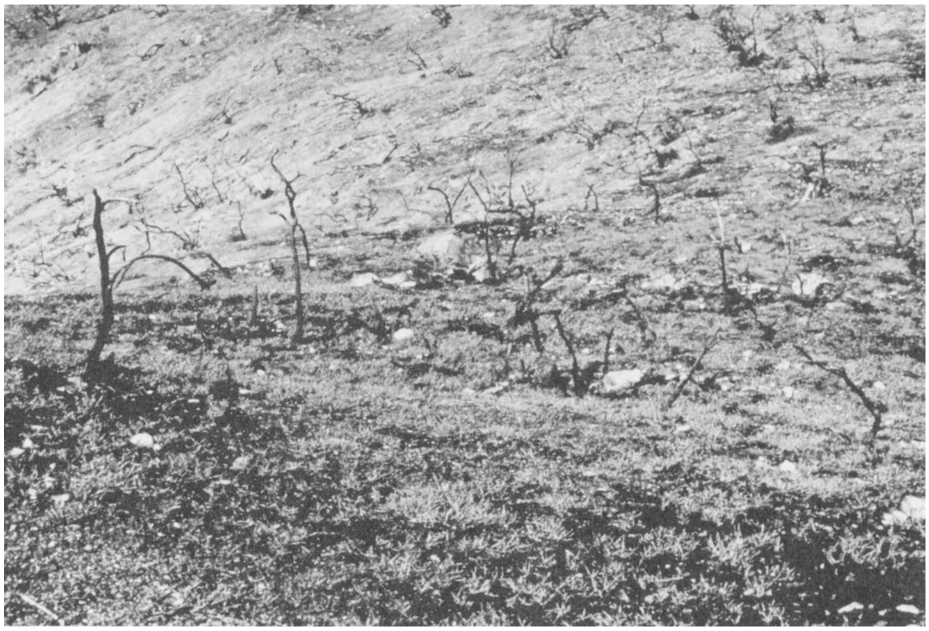

Photo 3. Closeup photograph of treated area (foreground) and untreated area (background) illustrating difference in grass growth and erosion.

ments were established by the Forest and Range Experiment Station.

All of the U. C. treated plots dried before the first rainfall and the water applied as part of the treatment was considered to be an insignificant factor in the final results. The plots were observed periodically for vegetative establishment and visible signs of erosion. First observations were made on December 14 following some low intensity rainfalls. No vegetative growth was observed. There were visible signs of slight erosion on untreated areas but no visible signs of erosion on the treated areas.

More grass

On December 23 more grass was observed on the treated area than on the untreated areas. Differences in erosion between the treated and untreated areas were visible. Similar observations were made on December 28.

Color slides were taken on January 15 and two of these slides are presented here as black and white photos 1 and 2. The checkerboard treatment pattern was readily observable on January 15 by the presence of grass growth on the treated areas (the contrast in colors on checkerboard was caused by a darker color related to grass growth on the treated area and the lighter color related to soil particle displacement and redeposition on untreated areas). Note the grass growth on the steep slope which had been treated with the wetting agent adjacent to the top checkerboard. The dark area on the left side of photo 1 also represents a treated area on which grass was growing. Plant counts by the Forest and Range Experiment Station on the checkerboard area showed an average of 69 grass plants per square meter on the treated plots and 27 on the untreated plots.

The third photograph is a closeup showing both treated and untreated areas. Note the grass growth on the treated plot and very little growth on the untreated plot. Also note visible signs of erosion (rilling and reflective surface caused by soil particle redeposition) on the untreated area with no visible signs of erosion on the treated area.

The rains were generally light and were not considered to be heavy erosion types. Even so, erosion was visible on the untreated plots. The effectiveness of a wetting agent in causing more rapid vegetative establishment and decreased erosion, as compared with no treatment, was clearly established for the water repellent area studied, considering the precipitation during the study period. The treatment cost was prohibitive, however, for large-scale use on a burned-over watershed. Laboratory studies are being planned to try reducing costs by spot treating certain areas instead of complete overall chemical applications. The laboratory study will also be conducted under a variety of rainfall characteristics.

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