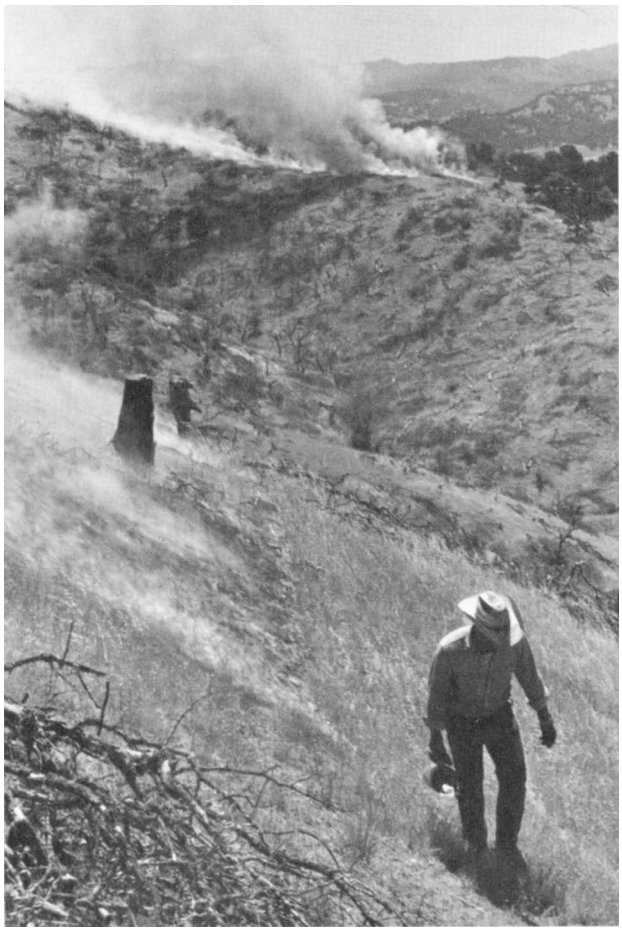
RANGE PASTURE BENEFITS



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At Hopland during the 11 years of range improvement study, the total increase in ranch income through livestock use was $133.60 per acre. This value takes into account $57.09 per acre production value without improvement and treatment costs of $34.87. Thus, by reducing the woody plant component of the watershed and replacing it with herbage that livestock could use, the product values were increased fourfold. It should be noted that no fertilizer was applied in this improvement study —and that its use would probably have given a greater magnitude of production increase. It is also expected that this higher level of production can be sustained with a minimum of maintenance costs.

ONE FACTOR in sustaining a profitable livestock operation is the use of range improvement practices that will contribute to the efficiency of feed production. Most range operators have opportunities to improve forage productivity by replacing unproductive vegetation, seeding to improved forage species, and managing livestock use to maximize feed benefits.

Oak trees grow in dense stands on many California foothill range areas and substantially reduce the quantity and quality of forage growing beneath. These trees can be removed economically by the use of the cut-surface method where 2,4-D is applied to cuts made around the trunk of the tree. The application technique is simple and can result in large increases in forage production the year after treatment. Several studies on foothill ranges show forage increases 4 to 5 times more than produced under trees.

Plant changes

Improvement of range forage production is illustrated in a 17-year Hopland Field Station study in the north coast area of Mendocino County where the vegetative composition of an area was changed from a predominant stand of trees to one of herbaceous forage plants. This study was coordinated with one involving the hydrology of a watershed as influenced by vegetative cover. The 210-acre area was composed of 6% open graslands, 83% mixed grass and dense trees, and 11% brush at the start of the study. The topography was characterized by steep slopes, bisected with a stream channel and varied in elevation from 600 to 1300 ft.

A six-year calibration study was conducted to determine sheep production before any alteration. The use was depictive of grazing in spring from March to June then again in the fall during September and October. In this period average grazing use per year was 40.2 sheep days per acre. A more meaningful evaluation was determined by assigning a cost to the grazing and livestock products with the following values: sheep grazing days at 6¢ per head per day, lamb at 20¢ per pound, and wool at 60¢ per pound. When these values were assigned to the six pretreatment years an income value of $5.19 per acre per year resulted.

In December 1959 through April 1960, all of the trees in the area were

THROUGH TREE REMOVAL

Hopland Field Station photo sequence of range pasture benefits through tree removal: (1) Before treatment showing many oak trees, and sparse ground cover, December, 1959. (2) Three years after chemical treatment of trees showing some broken branches on the ground, January, 1963. (3) (4) After burning, showing good removal of debris, July, 1965; and (5) Good stand of forage grasses in the spring following the burn, April, 1966.

INFLUENCE OF TREE REMOVAL AND SEEDING ON SHEEP PRODUCTION, WATERSHED II (210 ACRES), HOPLAND FIELD STATION

	Sheep days* /acre/yr.	Lamb/† acre/yr.	Wool/‡ acre/yr.	Income/ acre/yr.	Treatment cost/acre
Pre-treatment	40.2 days	11.4 lbs	.83 lbs		
6 yrs. 1955–60	$ 2.41	$ 2.28	$ .50	$ 5.10	
Treatment					
5-yr period	117.6 days	21.5 lbs	2.33 lbs		
1961–65	$ 7.06	$ 4.30	$1.40	$12.76	$34.87
Post-treatment					
6-yrs. 1966–71	218.0 days	52.3 lbs	5.70 lbs		
	$ 13.08	$10.46	$3.42	$26.96	

* Sheep days @ 6¢/hd/day.
† Lamb @ 20¢/lb.
‡ Wool @ 60¢/lb.

chemically treated by the cut-surface method. During the spring, the trees started to show effects of the treatment and by fall a greater portion were dead or dying; however, no noticeable influence on herbaceous vegetation was noted during this growing year. Starting in 1961, responses were observed, with increased forage production resulting from the removal of tree competition with herbaceous vegetation. The five years, 1961 through 1965, represented the treatment period during which trees were killed. The area was later cleared with fire and seeded. During the treatment period, the increase over pretreatment values on a yearly per acre basis was 77.4 sheep days, 10.1 lbs of lamb, and 1.5 lbs of wool. Assigning these sheep product values per acre, per year, to this period the total was $12.76 or an increase of $7.57. Treatment of the trees involved cost of labor and chemicals, and averaged $19.49 per acre. Tree density varied from about 150 stems per acre to over 700. Cost to treat trees varied depending on species, trunk diameter, density per acre, and slope of ground.

Burning

The second part of the treatment involved removing the dead tree debris by fire, and seeding with grasses and legumes. By the summer of 1965, five years after the trees were treated, they were sufficiently dry for burning to be an efficient cleanup method. Grazing in the spring of 1965 was reduced to allow a residue of grass to accumulate to help spread the fire. In July a controlled burn was initiated resulting in a clean burn with considerable ash deposited on the ground for a good seedbed. Later (in September) a mixture of adaptable grasses and legumes was seeded; these burning and seeding costs were $15.38 per acre. Grazing was also reduced in the growing season of 1965–66 to allow the seeded species to become established.

The third period (post-treatment) started in 1966 where the increased income due to improvement would be measured by sheep production. During this six-year period, ending in 1971, sheep days per acre per year increased over the pre-treatment period by 177.8, lamb production by 40.9 lbs, and wool by 4.87 lbs.

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Effects of nitrogen on yields

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The economically optimum yield for INIA 66 wheat was obtained by using 150 lbs of nitrogen and 30 lbs of phosphorus per acre in these tests. Nitrogen had greater effect on yields than phosphorus, however, maximum yields were realized by using a combination of nitrogen and phosphorus as a fertilizer. Darker green color intensity was obtained with higher rates of fertilizer. Higher rates of phosphorus have a tendency to suppress the bushel weight. The highest net dollar return was obtained by using 150 lbs of nitrogen and 30 lbs of phosphorus per acre.

TESTS IN 1971 showed yield responses to phosphorus in late planted INIA 66 wheat. A 1972 experiment (reported here), conducted at the West Side Field Station on a panoche clay loam soil, was designed to determine specifically the combined effects of phosphorus and nitrogen on INIA 66 wheat yields planted in early November 1971.

The test area was pre-irrigated with 15 inches of water in October 1971 with soil samples indicating a full profile to a depth of 6 feet. The following factorial design was chosen with four replications and 12 treatments: the amount of N and P applied are given in lbs per acre, and the source of nitrogen and phosphorus was from ammonium sulfate and treble super phosphate respectively T_1 ON-OP, T_2 ON-30P, T_3 ON-60P, T_4 ON-120P, T_5 75N-OP, T_6 75N-30P, T_7 75N-60P, T_8 75N-120P, T_9 150N-OP, T_{10} 150N-30P, T_{11} 150N-60P, T_{12} 150N-120P. All fertilizer treatments were drilled-in a few days prior to planting. INIA 66 was planted on November 10, 1971 at a seed rate of 125 lbs per acre.

Early in the season, foliar color differences were noted between the various fertilizer treatments. On February 8, 1972, a visual evaluation of color intensity was made for all treatments. A color rating scheme of 1 to 4 (light to dark green) was used; at the time of evaluation, plants were 4 to 8 inches in height.

A difference in value between nitrogen and phosphorus rates was observed. A comparison of color ratings indicated that a definite color change appears early in the season at low rates of nitrogen and phosphorus (table 1). The color variable may be difficult to differentiate without comparative treatment levels side by side, however.

Since color difference appears early it may be possible to apply the nitrogen in the irrigation water at the time of the first irrigation. Phosphorus probably should not be applied as a topical application due to possible foliar phytotoxicity.

Three irrigations

Three irrigations were applied during the season in all treatments. In the first irrigation, applied on February 28th at the jointing stage, all treatments were given 8.5 inches of water. The second and third irrigations were applied to all treatments at the flowering and milk stages, and received 7.6 inches and 7.3 inches of water respectively—for a combined season total of 23.4 inches of applied water. An additional 5.6 inches of water was depleted from the soil during the growing season which represented 29 inches of evapotranspiration for INIA 66 for the entire season.

Soil samples taken during the growing season and after harvest indicated that very little moisture was removed below the 4 ft depth. In previous barley irrigation experiments, barley extracted more moisture from the 4 to the 6 ft depth