EPTC

Pre-emergence herbicide aids establishment of clovers in dryland pastures

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EPTC can aid in the establishment of seeded annual clovers in dryland pastures where a weedy annual grass problem exists. Trials conducted in Mendocino, Mariposa, San Benito and Santa Barbara counties indicate that the pre-emergence herbicide will reduce competition from annual grasses but not from forbs such as mustard and filaree. Success is still dependent on climate, fertilizer treatment, grazing use and other related factors. EPTC application provides a method of altering species composition of a pasture. It can be applied in the late summer to prevent seed germination, in contrast to many herbicides that must be applied to living plants.

COMPETITION FROM annual grasses against planted clovers on dryland pasture can sometimes result in failure of the clover to become established. Use of a selective herbicide to reduce the density of annual grasses—with a limited effect on clovers—can aid in clover establishment. One such material, EPTC (ethyl N, N-di-n-propylthiolcarbamate) has been successfully used. EPTC is best applied during the dry months of July, August, September and October. The herbicide kills grass seeds before or as they germinate and is usually dissipated by the first rain to initiate germination. Studies with EPTC at Hopland Field Station in Mendocino County were the most detailed, and emphasis in this discussion is placed on data from this location.

The treated pasture at Hopland consisted of rolling grasslands that had been in cultivation for over ten years. Earlier use consisted of farming grain crops to be cut for hay or pastured by stock, principally sheep. During the past eight years the area has been in a seeded dryland pasture mixture and used by sheep for grazing. Of the planted species, hardinggrass (*Phalaris tuberosa* var. *stenoptera*) and Mt. Barker subclover (*Trifolium subterraneum*) are the main survivors. Growing in competition with the seeded species are many resident annual grasses, legumes, and broadleaf forbs.

Forage is harvested by grazing with mowing done only for control of weeds and reduction of coarse feed. The area is not irrigated and averages about 37 inches of rainfall during the period of October to May. Fertilizer is usually applied to the pasture each fall and includes nitrogen alone or in combination with phosphorus. A dense crop of early maturing annual grasses often develops when nitrogen is used alone, especially if grazing is not started early enough in the growing season. Aggressive annual grasses cause most of the competition for the successful establishment of seeded clovers and perennial grasses.

The test pasture at Hopland was approximately 30 acres in size. It had been seeded, except for the borders surrounding the field which were in resident annuals. The soils were mostly the Sutherlin series which have developed from hard sandstones and shale. Surface soils are brown, medium textured and slightly acid while the subsoils are moderately acid and of gravelly clays or clay loam. A small portion of the test area was of the Climax soil series which have developed from metamorphosed basaltic rock and are fine textured and moderately deep. Soil reaction at the surface of the Climax series is neutral and in the subsoils, slightly alkaline.

Treatments

A randomized block designed with four treatments replicated four times was used. Three of the replications had acre-size plots and the fourth replication had plots of half-acre size. The EPTC was applied to the soil surface and accumulated plant litter in granular form using a tractor-drawn Ezee-Flow fertilizer spreader. The usual practice in application to cultivated crops is by soil incorporation to increase the efficiency of the material. Soil incorporation was impractical in this test because the ground was very hard and dry, and the soil disturbance would have been detrimental to the resident plants. Treatments were applied at two, four, and six pounds per acre using five per cent granular material. The chemical was applied the first part of October and 10 days elapsed before the first precipitation of 0.24 inch occurred, It was more than 30 days before one inch of rainfall was recorded or any germination was observed.

The pasture was overseeded in September with crimson, rose, and subterranean clovers. Planting was done with a rangeland drill using 10 pounds of the mixture per acre. Single superphosphate fertilizer was also applied (by aircraft) at 210 pounds per acre.

Sheep grazed the treated areas at various times during and after the chemical application. In October, 200 head of sheep were on the area for two weeks. In March, 181 ewes with their lambs grazed the 30 acres for 10 days, followed by two weeks of grazing in late June by 400 head of lambs. During the next two growing seasons, sheep were on the area at various times.

First season

During the first growing season, data were collected to determine what effect EPTC had on the vegetative cover and how the annual grass density changed in relation to clovers and other broadleaf plants. A December observation on herbaceous ground cover showed the untreated area to have a density of 76 per cent, while the two-pound rate of EPTC reduced the cover to 23 per cent. The cover was reduced to seven per cent at the four-pound rate and five per cent at the six-pound rate. These differences were statistically significant. In March the treatments were analyzed by the step-point method which indicated that the reduction of annual grass competition was associated with increased rates of EPTC up to four pounds.

Where the annual grass composition percentage was reduced most, approximately 80 per cent of the increase occurred in forbs (table I). Another result of the chemical treatment was a reduction in the total height of hardinggrass. Check plot observations in March showed the average height of hardinggrass was 9 inches compared with 7 inches on the EPTC plot at the two-pound rate, 6½ inches on the EPTC plot at four pounds, and 4¾ inches on the EPTC plot at six pounds. No other vegetative effect was noted on the hardinggrass. However, at the six-pound rate, occasional leaf deformities were observed on some broadleaf plants but disappeared when rapid spring growth commenced.

Although the planted clover doubled on plots treated at higher EPTC rates, the total percentage of clover was only 8 per cent. Plants in the "other forbs" category, principally filaree (*Erodium botrys*), were apparently more effective than clovers in occupying the space vacated by annual grasses. To make the chemical application pay for itself, a greater increase in the amount of subclover would be needed.

In 1960 the only significant differences in the carryover effect from the EPTC treatments were that less grass was observed on the plots at four- and six-pound

TABLE I
*PERCENTAGE FORAGE COMPOSITION
MARCH 1959—HOPLAND

Species	Check	5 per cent granular EPTC		
		2 lbs	4 lbs	6 lbs
Annual grasses	67a	26b	19b	21b
Planted clovers	4a	5a	8a	8a
Resident clovers	4a	8a	8a	9a
Hardinggrass	10a	13a	7a	10a
Other forbs	15a	48b	58b	52b

* Significant differences between means (5 per cent) are indicated when comparing treatments (not plant categories) if value has no letter in common based on Duncan's Multiple range test.

EPTC rates than on the check plots, and a greater amount of other forbs was found on the four-pound EPTC plots than on the check (table II). In 1961 no significant difference was evident. The greatest annual grass competition reduction from EPTC is realized the first year. This test indicates that some additional assistance is needed if the clover is to fully utilize the advantage resulting from the use of EPTC.

TABLE II
*PERCENTAGE FORAGE COMPOSITION
MARCH 1960—HOPLAND

Species	Check	5 per cent granular EPTC		
		2 lbs	4 lbs	6 lbs
Annual grass	45a	33ab	22b	25b
Planted clovers	8a	6a	5a	6a
Resident clovers	14a	15a	17a	19a
Hardinggrass	10a	12a	10a	9a
Other forbs	23a	34ab	46bc	41ab

*Significant differences between means (5 per cent) are indicated when comparing treatments (not plant categories) if value has no letter in common based on Duncan's Multiple range test.

Other treatments

Two other pastures were later treated with four pounds per acre of EPTC—one in the fall of 1959 and the other in the fall of 1960. These two pastures were similar in planting mixture and soils to the rate-test pasture in previous use. They were also fertilized with single superphosphate and the area was seeded to annual legumes with the rangeland drill. Table III indicates the forage composition changes resulting from the EPTC application. In field Vasser E, the increase in planted clovers was impressive and persisted into the second year. It should be noted that other pastures on the Field Station range had a substantial increase in clovers for this year—indicating that part of the response may be due to climatic conditions.

Only one year of data are available after treating the lower strip field in 1960–61 but in this case EPTC appeared to increase the subclover and resident clover categories but not forbs as in the previous tests. The year of 1961 was favorable for clovers in the untreated fields and less favorable for other forbs. If clovers continue to increase in these two fields as a result of EPTC treatment, then the prospects for this treatment appear favorable.

Good stand of hardinggrass and subclover visible on EPTC-treated plot, to right, contrasts with thick mat of short annual grasses on non-treated area of seeded dryland pasture at Hopland Field Station, Mendocino County.

TABLE III
FORAGE COMPOSITION CHANGES AFTER EPTC TREATMENT

	Per cent composition								
	Vasser E.			Lower strip			Other untreated pastures		
	1961	1960*	1959	1961*	1960	1959	1961	1960	1959
Annual grass	21.0	8.6	49.7	9.4	28.6	49.0	41.3	43.0	40.8
Subclover	36.0	16.0	9.0	21.6	6.0	7.0	20.5	8.9	9.8
Resident clovers	17.7	18.3	6.6	29.3	5.4	9.0	16.0	13.7	11.1
Other forbs	25.0	57.0	33.7	33.7	51.7	26.0	11.8	24.0	27.9
Perennial grass	.3	.1	1.0	6.0	8.3	9.0	10.4	10.4	10.4

*First growing season after EPTC application.

Other counties

In San Benito County, with approximately 13 inches of annual rainfall, three rates of EPTC were tested. EPTC applied in March resulted in a reduction of competition for seeded annual clovers, and the following ground cover estimates were recorded: check, 45.5 per cent; two pounds per acre EPTC, 19.5 per cent; four pounds per acre, 8.5 per cent; and six pounds per acre, 6.1 per cent.

The clover was evaluated near the conclusion of the growing season and the percentage of clover stand recorded (assuming one plant for each 3 inches of row constituted a 100 per cent stand): check, 11 per cent; two pounds EPTC 22 per cent; four pounds, 24.5 per cent; six pounds, 24.5 per cent. In this test even the lowest rate of EPTC significantly increased the clover stand over the check while no increase in clover stand resulted from rates higher than two pounds per acre.

In the Mariposa County plot the principal competing plant was filaree and was not affected by EPTC. Seedling establishment differences for clovers were small. At the Santa Barbara County location a heavy stand of mustard overshadowed any effect of the chemical. The combined effects of the mustard and a short growing season, with limited moisture, appeared to be more critical to clover seedling establishment than the action of EPTC to decrease grass competition.

This study also showed that EPTC is effective without soil incorporation when applied to dry ranges, thus it also might be used to control weedy range grasses, such as medusahead, in certain situations. However, the use of EPTC on forage grazed by livestock is not currently a University of California recommendation because residue information has not been developed.

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The EPTC used in the study was supplied by Stauffer Chemical Company. Assisting with some of the field work were Rocky Lydon, San Benito County; Ray Greberger, Santa Barbara County; and John Anderson, Mariposa County—Farm Advisors, Agricultural Extension Service.

Improper pipe size is a common fault of vacuum supply systems on California dairies. Data presented in this study indicate that a minimum vacuum supply pipe diameter of 1¼ inches is needed to handle four or five milking units and 2-inch pipe is the minimum size required for 7 to 12 units.

PIPE SIZE *and Milking Machine Airflow*

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THE MOST COMMON FAULT still observed in pipeline milking machine installations on California dairies is an inadequate vacuum supply system. This includes the vacuum pump, controller and piping up to the sanitary trap just ahead of the milk receiver and to the pulsator pipe. Equipment checks of over 300 dairies showed that quite often the vacuum pump capacity was adequate for the number of milking units in use, but there was a significant airflow loss between the pump and the milking system due to pipe friction. This loss is the difference between the airflow capacity measured at the vacuum pump inlet and the airflow measured into the system at the sanitary trap, which is properly installed close to the milk receiver.

Experience gained from the California Mastitis Test program has established certain quantitative standards for milking machine improvement—including the desirability of providing a vacuum supply of at least 8 to 10 cubic feet of air at 15 inches of mercury, vacuum, per minute per pipeline milking unit. It is acknowledged that the conventional pipeline milking units of either the claw type or the suspension cup type do not normally require more than 4 cfm each for both pulsator and air bleed.

It is more difficult to define air leak losses that frequently occur—especially when milking units fall onto the floor during the milking process. Some manufacturers of milking equipment may not agree that such arbitrary values are necessary to meet the requirements of their units. Others may specify airflow values in terms of "free air" which has one half the volume of "15-inch air." These factors notwithstanding, 8 to 10 cfm per pipeline unit appears the logical vacuum supply figure based on present field experience.

Engineering texts which treat airflow in pipelines are common, but few discuss negative pressure (vacuum) situations of extreme variation such as commonly occur in milking machine systems. The mathematics of calculation are quite involved and would always remain highly presumptive. Such a treatment would certainly be beyond the interest of all who are more immediately concerned with efficient milking and maximum convenience for both cow and milker. This study