Chemical Control of Brush

Coyote brush effectively cleared by use of 2,4-D in land conservation studies in San Mateo County

J. J. McNamara

Coyote brush—*Baccharis pilularis*—can be killed by 2,4-D if the chemical is applied in May and June when the plants are fully leafed out. In six to eight months after treatment, providing good coverage is obtained, plants are dead and there is very little regrowth.

In 1945 a series of test plots were started in San Mateo County to determine whether 2,4-D—2,4-Dichlorophenoxyacetic acid—would kill coyote brush.

About 25% of the 178,713 acres of agricultural land in San Mateo County—some 46,000 acres—are covered with varying amounts of brush with coyote brush as the main species. In this brush land there are 40,000 acres suitable for cultivation or pasture. An additional 55,000 acres in range, crop, and pasture rotation are subject to brush encroachment. A total of 91,000 acres—over 50% of the agricultura area—are involved in the problem. Control measures vary with the land which falls into three types:

Type *I:* Arable land with varying degrees of steepness devoted to rotation pasture where the problem is one of brush encroachment. Land left untilled returns to a solid stand in 12 to 15 years. Some 6,000 of the 25,000 acres of such land are in brush today.

Type *II:* Steep land capable of being cultivated but where it is not necessarily a good practice. This type is usually found on north slopes and has heavy stands of old brush. About 33,000 acres are involved.

Type *III:* Steep nonarable land which usually is found on southern slopes. Here the brush is sparse to medium and there is generally a good stand of perennial grasses. About 7,000 acres are found under this classification.

Brush extends from the alluvial fans and coastal terraces, that are intensively farmed, all the way to the timber line in the mountain ranges. Throughout this farming area, subject to encroachment, there are interspersed patches of Types II and III lands. On Type I where encroachment is the problem, land is cropped for two or three consecutive years to suppress the brush and then returned to pasture. Except in years of abnormally high returns it is farmed at a loss. Much of this land should never be farmed. Losses from erosion are severe. Further, cultivation thins out such native perennials as danthonia and stipas, and reduces other forage plants. Several years elapse before the pasture improves and then the cycle is repeated.

Bulldozers are used on Type II terrain. Slopes up to 50% are cleared at a cost of $30 to $60 per acre. Two or three years of farming are necessary to suppress the regrowth of suckers. When left uncultivated, brush returns before a good stand of grass becomes established. Erosion is not a serious factor here. With Type III areas, no control measures are generally practiced by ranchers.

One half acre of fairly level pasture heavily infested with coyote brush was sprayed in June of 1947 with a fixed boom commercial ground rig. Two pounds actual acid of the sodium salt were applied in 100 gallons of water per acre. Treatment was made after bur clover and filaree had reached peak growth. The plants were killed with no regrowth the following spring. Cattle pastured the field continually and concentrated on the sprayed part. While feeding, the cattle trampled and broke up the dead brush making the removal of residue unnecessary.

In June 1948, helicopter application and low gallonage per acre sprays were attempted for the first time on three types of test plots.

The first plot was a brush encroachment problem on 25 acres of pasture land where a medium stand of coyote brush was present. Plants varied in size from seedlings to 18 inches in height. Two pounds per acre of actual acid—sodium salt—were applied in 10 gallons of water. Coverage obtained by helicopter with low gallonage spray was excellent. The following year saw only slight regrowth which indicated that young plants are a little more difficult to kill than older plants.

A second test was made on 10 acres of heavy coyote brush, 6 to 10 feet in height. Four pounds of actual acid—sodium salt—were applied in 10 gallons of water per acre. These plants were dead in November of 1948 and there was no regrowth the following year.

A third test involving 10 acres of medium brush was treated using two pounds per acre of actual acid—sodium salt of 2,4-D. The co-operator reported that in the late fall one disking removed the trash and chopped up the dead roots. The site was seeded and has been returned to pasture without regrowth to date.

Early in June 1949, five areas comprising 127 acres were sprayed by helicopter. There had been some difficulty experienced with the wettable powder sodium salt of 2,4-D plugging nozzles when low gallonage was used. For this reason, the liquid or alkanol amine salt of 2,4-D was tried. The amine salt had an advantage over other liquid salts available at that time in that it was reported to be non-volatile—an important factor to be considered where other susceptible crop plants are growing in nearby areas.

About 57 acres of Type I and 70 of Type III terrain made up the tests. Two pounds of actual acid—amine salt of 2,4-D—were applied by helicopter in 10 gallons of water per acre on the Type I plot. The kill of coyote brush was excellent. A good stand of perennials was already present, therefore no burning or reseeding was needed.

The 70 acres of Type III were sprayed with the same material. Here the question was whether to spend $6 to $8 per acre to plow the land, farm at a loss, or spray. The land is steep, subject to erosion, and the pasture was needed. One year after spraying practically all of the brush was dead. At the end of this period the co-operator was of the opinion that the increased feed obtained almost paid for the cost.

Results and experiences as of 1950 indicate that chemicals are effective for brush control on Type I and III lands. Burning is not necessary on these areas since cattle trample the dead plants and there is not enough left to carry a fire. Erosion is no problem after the brush is killed if native pasture is allowed to return or if permanent pasture is seeded.

It has not been demonstrated that heavy brush on Type II land can be killed efficiently. Type II offers a different problem in that other brush species such as California lilac—*Ceanothus thyrsiflorus*, California blackberry—*Rubus vitifolius*, poison oak—*Rhus diversiloba*—coffeeberry—*Rhamnus Californica*—and others in addition to coyote brush are present. Experiments are now in progress using various combinations of 2,4-D and 2,4,5-T—2,4,5-Trichlorophenoxyacetic acid—

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Citrus Mealybug

four new parasites studied in biological control experiments

S. E. Flanders

The citrus mealybug—*Pseudococcus citri* (Risso)—is one of the most damaging mealybugs in the citrus groves of California.

It is injurious in localized areas in San Diego, Los Angeles, Ventura, and Santa Barbara counties.

Nine parasites have been introduced into California in an attempt to control the citrus mealybug in the same manner the citrophilus mealybug—California's most destructive mealybug prior to 1928—was controlled by two parasites introduced from Australia.

Five of these parasites of the citrus mealybug were introduced before 1950:

1. *Leptomastidea abnormis* (Gir.), from Sicily in 1914. It is established in all favorable habitats and does a great deal of good.

2. *Leptomastix dactylopii* How., from Brazil in 1934. It is being used to suppress outbreaks of citrus mealybug by a citrus growers' co-operative at Santa Paula. In spite of the millions released annually it is not permanently established.

3. *Anagyrus pseudococci* (Gir.), from Argentina in 1934. Although colonized in numbers it did not become established.

4. *Anagyrus kivuensis* Comp., from Africa in 1948. It has been used effectively in northern California as a control for the citrus mealybug in greenhouses. Although recovered in the field, its establishment is uncertain.

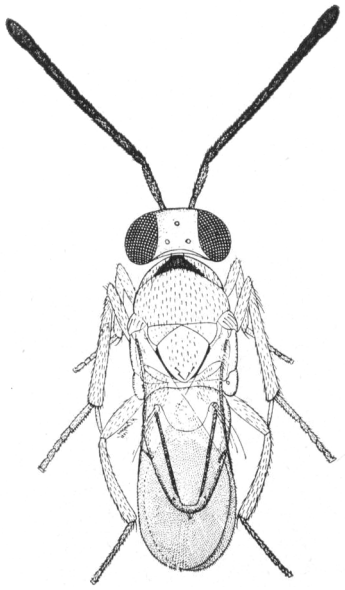
5. *Tropidiophyrne melvillei* Comp., from Africa in 1948. Although colonized in numbers it failed to become established.

Four new species of parasitic wasps were introduced from south China and Formosa in 1950. These parasites may be credited with keeping the citrus mealybug from being a pest in their native areas.

The new introductions are a uniparental species of *Pauridea* and a biparental species of *Allotropa* from Canton; a biparental species of *Pseudaphycus* from Formosa; and biparental species of *Coccophagus* from Hong Kong.

A single unmated female of *Pauridea* was received at Riverside. This female produced female offspring. The stock increased rapidly, and in four generations thousands of females were being produced.

The males of *Pauridea* occur occasionally but play no part in the reproduction.



A parasite of citrus mealybug—*Leptomastix dactylopii* How.—which is being produced by an insectary at Santa Paula at the rate of over 10 millions annually.

The females deposit their eggs in newly hatched mealybugs. The life cycle is about 28 days at 80° F.

Insectaries at Los Angeles, Oxnard and Santa Paula were supplied with large breeding stocks. The species is readily propagated in large numbers under insectary conditions. Field releases began in July in San Diego County, and in September in Ventura County.

The culture of *Allotropa* was initiated with a shipment of three females, one an adult, the others as pupae. In the quarantine insectary one of the females was allowed to oviposit for several days in newly hatched mealybugs. Then this female, and the other females newly emerged from their hosts, were held at cool temperatures until their male progeny matured and emerged 26 days later.

The sexes were mated and three females were placed in a cage containing 20 potatoes infested with citrus mealybug. The progeny consisted largely of males but several females were obtained.

At the end of six generations on the citrus mealybug the production consisted of 300 females and 1,000 males.

When the life cycle is 26 days, the egg-larval period is 18 days and the pupal period eight days. Males predominate in the cultures, presumably because of the rapid rate of oviposition by mated females. Under culture conditions the adult female is short-lived—less than a week at 80° F.

Field releases of *Allotropa* began September 15 in San Diego and Ventura counties.

Coccophagus n. sp. attacks small to medium size nymphs of the citrus mealybug. Only females develop on the mealybug itself. The males develop only as hyperparasites of hymenopterous larvae such as *Pauridea* which also inhabit the mealybug. The development of the male appears to be like that of *C. gurneyi* Comp.

A single unmated female of *Pseudaphycus* sp. was received. It readily oviposited in young citrus mealybug. The life cycle was 14 days at 85° F. The progeny were all males, and further shipments of this species from Formosa are expected.

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The above progress report is based on Research Project No. 1319.

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on this heavy brush. No conclusive results can be determined as yet but there are indications that some of these materials may be highly successful.

Cost

San Mateo County has the highest index of erosion in the nation. Brush is the real cause of bad land use practices in this area. Chemical control of brush is at present the best conservation practice for these agricultural lands.

The carrying capacity of dryland pasture varies from five acres per animal unit along the immediate coast to 10 acres in the higher elevations. Carrying capacity of land now in brush would be about one animal unit per 10 acres. Pasture land rents for $3.50 to $5 per acre and the gross returns to the operators can be two to three times that amount.

The total cost of spraying Type I and Type III areas is about $5.50 to $8 per acre. The chemical costs between $2.50 to $3 per acre and the helicopter application $3 to $5. Fourteen co-operators sprayed 1,000 acres in May and June of 1951 at these costs.

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H. R. Offord, Senior Pathologist, Division of Plant Disease Control, United States Department of Agriculture; Gerald Haet, Secretary, Production and Marketing Administration, San Mateo County; and Ian J. Campbell, Chief Deputy Agricultural Commissioner, San Mateo County, co-operated in the investigations reported above.