

# Southern California Turfgrass Culture

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## CONTROL OF TURFGRASS PESTS

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While sod webworms, or lawn moths, are the most common pests of turfgrass in California, others which also may cause severe damage are cutworms, skipper larvae, white grubs, billbugs, and leaf hoppers. Most of the information given below on the life histories and habits of these pests is taken from the work of Bohart (1947) and for a more complete account the reader is referred to this publication.

Since other lawn troubles are easily confused with insect damage, the presence of injurious insects should be confirmed before insecticides are applied. The pyrethrum test will indicate the presence (or absence) of larvae of lawn moths, skippers, the Lucerne moth and cutworms, but not white grubs or billbugs. To find the larvae of white grubs and billbugs it is necessary to dig below the surface of the ground, and in the case of severe damage the lawn can be rolled back to expose the larvae

(fig. 5). Leafhopper damage is indicated by the drying out of the grass and the presence of adults and nymphs in the affected areas.

**Pyrethrum test.** - Use 2 teaspoons of a water-miscible pyrethrum preparation (containing approximately 2 per cent pyrethrins) to a gallon of water and apply at the rate of a gallon per square yard. The solution should be applied to the green areas in and around damaged sections of the lawn. Lawn moth larvae, skipper larvae and cutworms will be brought to the surface within 10 minutes.

**Insecticides.** - The materials most commonly used for the control of turfgrass pests are DDT, chlordane, toxaphene, aldrin, dieldrin, and heptachlor. None of these is effective against all of the insects encountered. In general, sprays are preferred to dusts, and the only advantage of granular formulations is that they are more easily applied when suitable spray equipment is not available. For convenience, the most effective materials for each pest, and the suggested dosages, are given below in chart form. These insecticides may be used as wettable powders or emulsion concentrates, but not as oil solutions, as the latter may injure the grass.

**Lawn moths.** - The injurious species are *Crambus sperryellus* and *Crambus bonifatellus*. The adult moths are whitish or buff colored with a wing spread of slightly less than one inch. *C. sperryellus* is distinguished from *C. bonifatellus* by its silver-striped forewings (fig. 1

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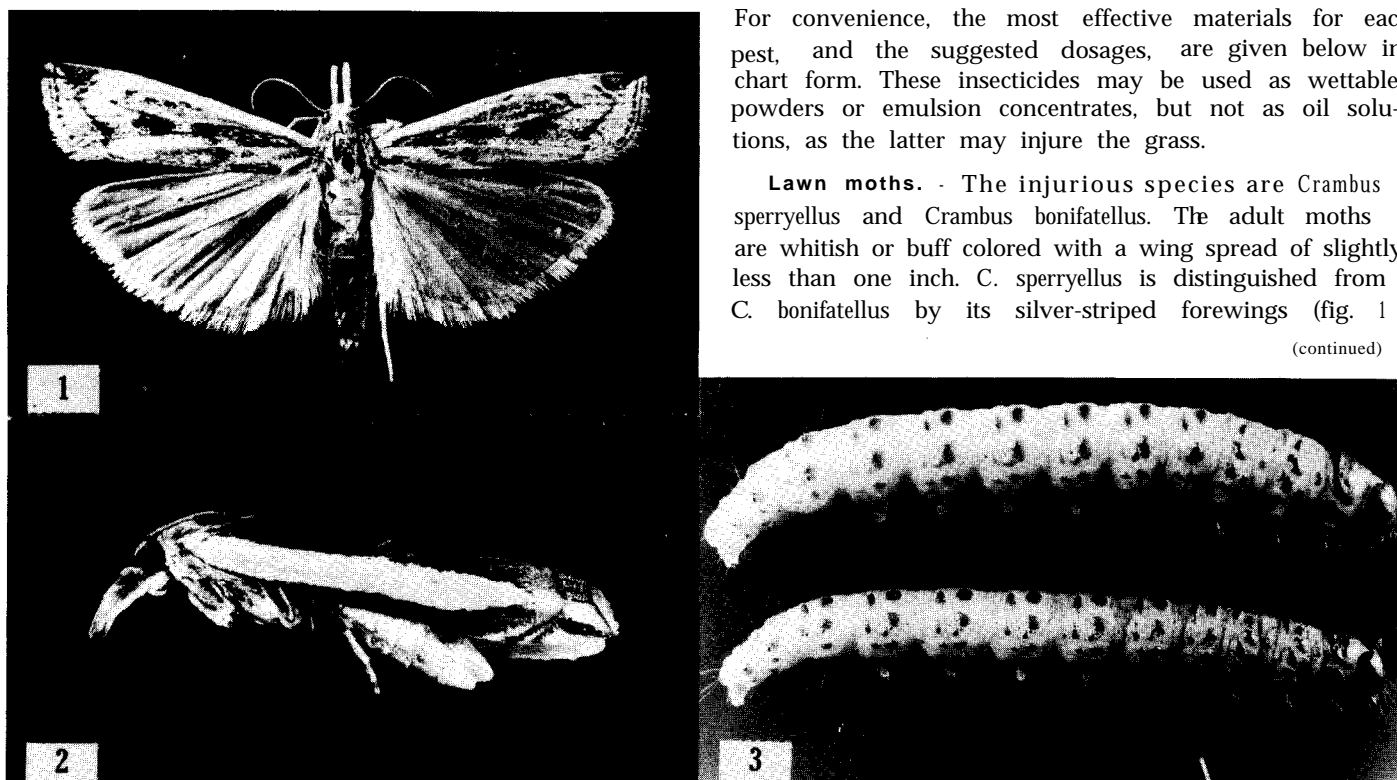


Fig. 1 - *Crambus bonifatellus* Fig. 2 - *Crambus sperryellus* showing position of the wings when at rest and silver stripe on forewing.  
Fig. 3 - Larva of *Crambus sperryellus* above and *C. bonifatellus* below.

## Summary of Control Measures for Turfgrass Pests

PEST	INSECTICIDE	AMOUNT OF ACTUAL INSECTICIDE PER 1000 SQUARE FEET (NOTE 1)	REMARKS
Lawn moths Skippers Lucerne moth	DDT, chlordane or toxaphene sprays	2 oz.	Mow grass and water well before treatment. Apply when grass is dry. Do not water again until necessary.
	Aldrin, dieldrin or heptachlor sprays	1 OZ.	
Cutworms	Toxaphene or DDT spray	2 oz.	
Leafhoppers	Malathion spray DDT spray DDT 10% dust	4 oz.	
White grubs	Chlordane spray	4 oz.	Water heavily after application to wash insecticide into soil.
	Aldrin, dieldrin or heptachlor spray	2 oz.	
Billbugs	Chlordane spray	8 oz.	
	Dichloroethyl ether	See Note 2	
Clover mite	Aramite spray Malathion spray	See Note 3	For outdoor application only.

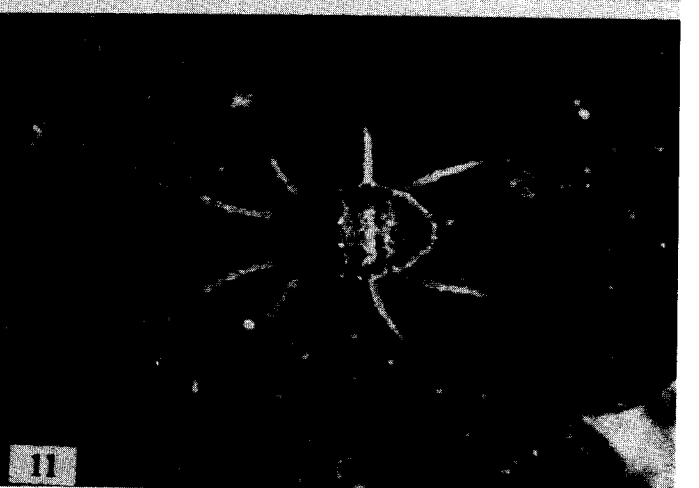
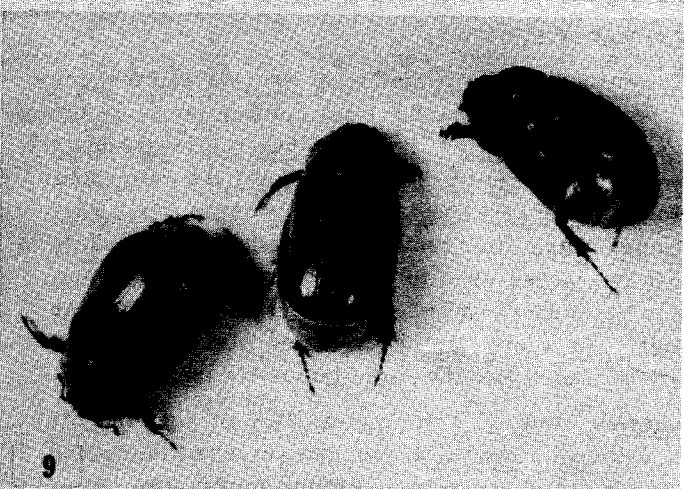
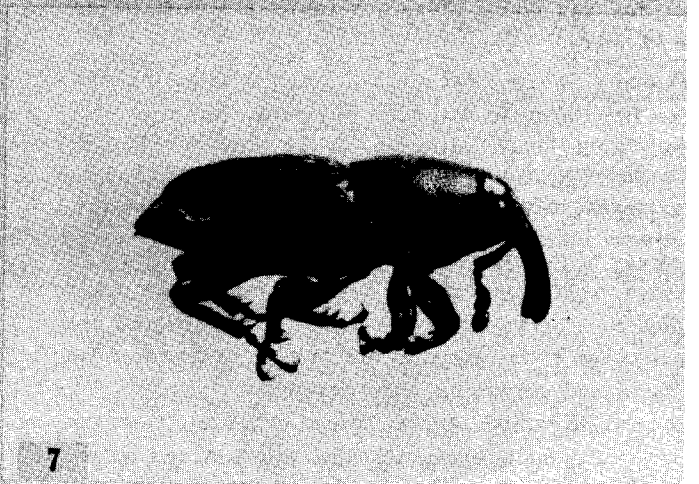
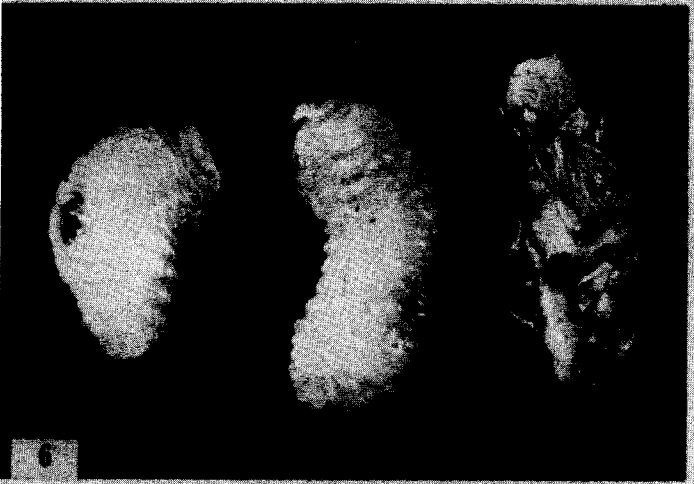
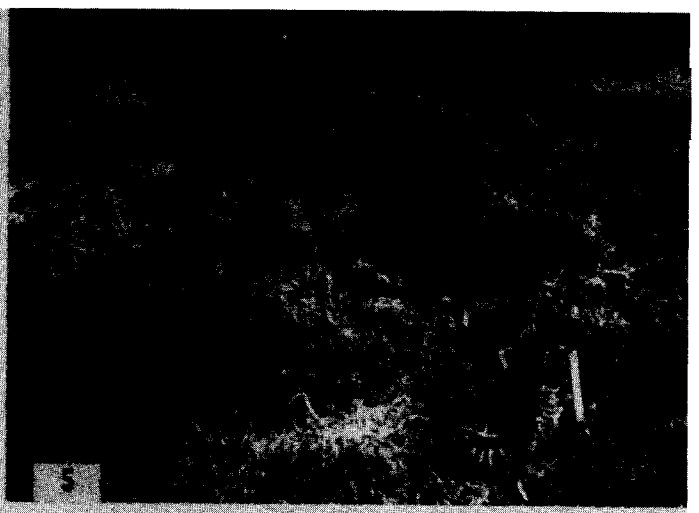
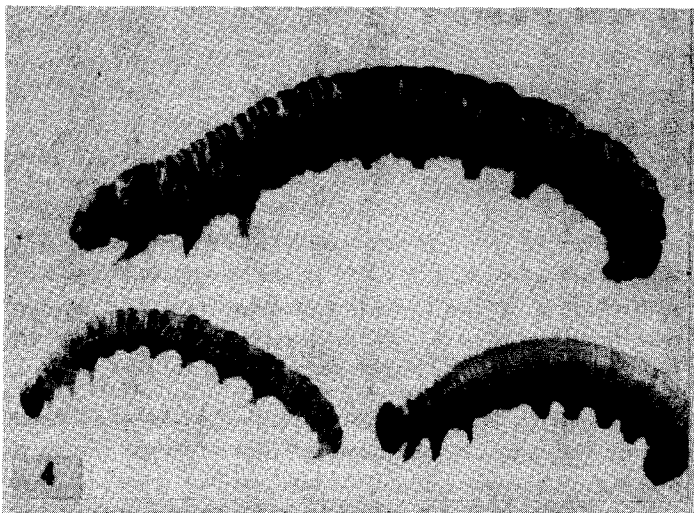
**Note 1.** - For a 50 per cent wettable powder multiply the amount given by 2 to obtain the proper dosage. For emulsion concentrates, which are measured by volume, the number of liquid ounces to use depends upon the number of pounds of insecticide per gallon in the concentrate. For example, with an emulsion concentrate containing 4 pounds of the insecticide per gallon, 1 liquid ounce contains 0.5 ounce of insecticide and 4 ounces would be required to give a dosage of 2 ounces per 1000 square feet.

**Note 2.** - Use 1 part of dichloroethyl ether to 200 parts water, apply at 1 gallon per square yard; or apply according to manufacturer's directions.

**Note 3.** - Thoroughly spray source of infestation - grass, shrubs and other plants - and walks, flower beds, outside walls and all other lines of entry to the house with aramite or malathion. Use 1 quart of 25 per cent aramite emulsion or 2 quarts of 50 per cent malathion emulsion per 100 gallons. High pressure spraying with power equipment usually is required for effective control.

Fig. 4 - Granulate cutworm above, larva of Lucerne moth lower left, skipper larva lower right. Fig. 5 - Damage to lawn by billbugs. Note how turf can be tolled back. Fig. 6 - Billbug grubs and pupa. Fig. 7 - Adult billbug, Fig. 8 - White grub, Cyclocephala sp. Fig. 9 - Adult beetles, Cyclocephala hirta Fig. 10 - A leafhopper. Fig. 11 - The clover mite, Bryobia praetiosa.

The photographs in this article are not to scale. See text for the approximate size of the various pests. Figures 1, 2, 3, 4 and 7 by Roy J. Pence. Fig. 11 from Kodachrome by L. R. Brown.



# Control of Turfgrass Pests

(continued)

and 2). When at rest the wings are folded close to the body, which gives the moths a characteristic slender appearance. In southern California the moths begin flying in April or May and breed continuously through October. There may be 3 or 4 generations a year with the broods overlapping.

The damage to lawns is done by the larvae (fig. 3) which are slender, grayish, black-spotted caterpillars which may be 3/4 of an inch long when full grown. The larvae feed on the grass blades, the growing tips and the greener portions of the crown but not on the roots. Damage is most frequent during July, August and September, although control measures often must be applied earlier. Bentgrass and young bluegrass lawns are most susceptible to injury.

**Skippers.** - The most common skipper found in lawns is the fiery skipper, *Hylephia phylaeus*. Although widespread throughout California, it is only occasionally injurious. While the larvae will feed on all the common lawn grasses, injury is most likely to occur to bentgrass.

Larvae of the fiery skipper are about an inch long and brownish yellow in color. They can readily be distinguished from cutworms by the narrow or constricted neck (the first two body segments are smaller in diameter than the head and remaining body segments -- fig. 4). The adult butterflies have a wing spread of a little more than an inch, the male having orange-yellow wings spotted with black, while the wings of the female are dark brown with orange-yellow spots.

**Cutworms.** - While a number of species of cutworms may be found in lawns the most common ones are the armyworm, *P seudaletia* (*Cirphis*) *unipuncta*, the granulate cutworm, *Feltia subterranea* (fig. 4), and the variegated cutworm, *Peridroma margaritosa*. Cutworms are rather fat-bodied caterpillars ranging in length from an inch to almost two inches when full grown. They are most injurious to bentgrasses and when numerous may cause severe damage. The adults are heavy-bodied moths mostly in dull or somber colors. Only the larvae are injurious.

**Lucerne Moth** - While caterpillars of the Lucerne moth, *Nomophila noctuella*, are found in lawns throughout California, they are seldom serious pests. The larvae are slender caterpillars (fig. 4), very similar in appearance to sod webworms but a little larger, the full grown caterpillars being about an inch long. The adults have a wing spread of an inch or slightly more. The hind wings are gray and the fore wings are mottled gray brown with two pairs of indistinct dark spots. The larvae prefer clover and other legumes but will feed on grasses in their absence.

**White grubs.** - Damage from white grubs is quite sporadic, but when heavy infestations occur it often is necessary to renovate and replant the lawn. While a number of species are found in turfgrass, the most common one in southern California appears to be *Cyclocephala* Hirta. The larvae which are about an inch long when full

grown are illustrated in fig. 8. The adult beetles are a little over a half inch in length, yellowish, and with a reddish head and two indistinct longitudinal brown lines on each wing cover (fig. 9).

Control of white grubs is much slower than for lawn moths and other caterpillars as the insecticide must be washed down to the root zone to be effective. This may take from 3 to 6 weeks and may account for reports of the failure of chlordane, aldrin and dieldrin to give control.

**Billbugs.** - The larvae of several species of billbugs (genus *Calendra*, family Curculionidae) feed on the roots of grasses and occasionally cause serious damage. They are small, white, legless grubs (fig. 6) from 1/4 to 3/8 inch long when full grown. The adult beetles are small weevils with a long snout (fig. 7). As is the case with white grubs, control is slow as the insecticide must be washed down to the root zone. Treatment of the lawn with dichloroethyl ether solution will give an immediate kill of the grubs but has no residual effect. It should be followed by an application of chlordane to prevent reinfestation.

**Leafhoppers.** - Leafhoppers are small, sucking insects (fig. 10) from 1/8 to 1/4 of an inch in length, which occasionally cause damage to lawns. Both adults and nymphs are injurious and the most serious trouble usually occurs during the summer months. Symptoms of injury are a drying out of the grass somewhat similar to lack of water or water penetration.

**Clover mite.** - The clover mite, *Bryobia praetiosa* (fig. 11) is more of a household pest than a lawn pest. However, large populations may build up on grasses, shrubs, and other plants and become a nuisance by invading homes. The clover mite is about 1/30 inch in length with long front legs (fig. 11). The legs are amber or orange colored and the body may vary from reddish brown to a greenish color. An excellent discussion of the clover mite problem with method and materials for its control is given in a recent publication by Barnes (1955).

**CAUTION! All insecticides are poisonous! Carefully follow the precautions given for their use on the label. Do not allow children to play on treated lawns for at least 5 days, or until the lawn has been thoroughly watered.**

## References Cited

- Barnes, M. M. 1955. The clover mite problem. News Letter No. 70, Dept. of Entomology, Citrus Experiment Station, Riverside, California.
- Bohart, R. M. 1947. Sod webworms and other lawn pests in California. *Hilgardia* 19(8): 267-308

<sup>1</sup>Associate Professor of Entomology, University of California, Los Angeles, and Extension Entomologist, University of California Agricultural Extension Service, respectively.

# EVALUATION OF NEW BERMUDAGRASS SPECIES AND STRAINS

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A number of new bermudagrasses obtained from the United States Department of Agriculture were planted in plots of about 125 square feet at UCLA in August 1954. All of the strains were planted by the vegetative method. Single four-inch turf plugs of each strain were also planted at the Antelope Valley Field Station in May, 1954.

A preliminary evaluation of these strains can now be made after observing them for one summer and two winters. Some of these strains appear to be well adapted to much of our Southern California region and may be very valuable new grasses for this area. All, however, must be propagated by stolens as no true breeding strains from seed have been obtained as yet.

Cynodon dactylon var. Barberspan. This is a strain collected on the shores of a lake in Western Transvaal, South Africa. This is a coarse strain but not as coarse as our common bermuda. It is a very prostrate, dense type of an excellent dark grey-green color. The color during the winter months has been good even after night temperatures of 30° F. This strain appears to be completely sterile producing very few seed heads in the mowed turf. The vigor is good and there has been no indication of common bermuda invasion thus far. The plot has been nearly weed free throughout the period of observation.

The single four-inch plug planted at the Antelope Valley Field Station covered an area eight feet in diameter in one season. This planting, however, had very little color in November 1955 after several nights of temperatures near 22° F.

C. dactylon var. Bloupan. This strain was collected near Johannesburg, South Africa. The texture of this selection is much finer than common bermudagrass but it appears to be weak as it has been invaded by common bermudagrass, by the Barberspan strain in the plot adjacent to it, and by numerous weeds. Its color during the summer is a good bright green, but this is lost early in the winter when it becomes reddish-purple in color. It is of doubtful value for Southern California for these reasons.

C. dactylon var. Murray Grass. This fine textured strain was selected at Frankenwald, South Africa. The color and texture is similar to the Bloupan, but it is of superior vigor. A few weeds and a few shoots of common bermuda have invaded the plot, but the common bermuda has not been able to make any growth and may be crowded out eventually. It is a dense, prostrate-growing type free of any stemmy appearance throughout the year. This strain has the best color during the winter of any of the fine textured types. It retains this color especially well when fertilized regularly.

C. dactylon var. densus (also called Hall's Selection). This is a medium coarse type selected in South Africa for resistance to drought and disease. It is slow growing compared to other bermudas but makes a dense turf in

time which is free of weeds. The color of this selection is a dark green retained well into the winter especially when fertilized often.

The four-inch plug planted at the Antelope Valley Field Station covered an area eight feet in diameter in one season. This plot was straw-colored when observed in November 1955 following minimum temperatures of 22°F.

C. dactylon var. Franklin Grass. This type was selected from a golf green in Natal, South Africa. Franklin Grass may not be of any great value for Southern California as it lacks vigor and is readily invaded by other strains. During the summer it has a good dark green color but this is lost quite early in the winter. It is prostrate in growth but may produce many upright flower stems in early summer.

C. dactylon var. Vereeniging. This is a medium fine selection from Vereeniging on the Vall River, South Africa. This selection is of dense prostrate growth and good dark green color which is held well until quite cool weather. It has appeared stemmy during certain stages of growth in early summer. The Vereeniging strain covered an area seven feet in diameter in one summer from the single four-inch plug planted at the Antelope Valley Field Station. Here this strain had more color than any of the other strains planted after temperature lows of 22°F.

C. dactylon var. Royal cape. This is a popular turf-grass strain in South Africa. A dark green color which is retained quite well in the winter, dense prostrate growth habit, and good vigor make this a strain of exceptional promise. The texture is finer than our common bermuda but coarser than several of the other strains tested. Some seed stalks are produced in early summer, but not in large enough numbers to appreciably impair the appearance of the turf. Summer and winter color are both greatly improved by regular and frequent fertilizations.

At the Antelope Valley Field Station plots, a single four-inch plug planted in May covered an area six feet in diameter before cold weather in the fall. Some color was retained after temperature lows of 22°F. but, as was true of all the strains, it was not sufficient to make a good appearing winter turf.

Cynodon bradleyi. This is a South African species differing from the other bermudas in that it spreads by stolons but not by rhizomes. This species is extremely vigorous and rapid growing. It is a prostrate dense grass with a texture somewhat finer than our common bermuda. The color is a dark green which is retained only partially during the winter. This species appears to be completely sterile but does produce numerous seed stalks for a short part of the summer. It has remained nearly weed free at UCLA plots and has not been invaded by our common bermuda so far.

(continued)

## EVALUATION OF NEW BERMUDAGRASS SPECIES AND STRAINS

(continued from page 5)

The single four-inch plug planted at the Antelope Valley Field Station spread to cover an area eight feet in diameter in one summer. No color was retained after a period of cold weather.

Cynodon transvaalensis. Floridagrass is the common name for this species in South Africa where it is reported to be the standard species for a fine dense turf. It is often referred to in this country as African bermuda. This is one of the finest textured grasses useful for turf purposes. The color is a bright green which unfortunately is obscured in the winter when the blades assume a reddish-purple color. It produces a dense uniform turf but is somewhat slower growing than many of the other bermudas. At the Antelope Valley Field Station plots a single four-inch plug spread to cover an area four feet in diameter during the season.

Cynodon species var. Skaaplaas. This selection from the Orange Free State is perhaps a strain of the transvaalensis species which it resembles closely. Its color, texture, and density cannot be distinguished from that of the foregoing species. However, during the winter its color is almost completely lost and little of the reddish-purple cast can be observed. This strain also may have a more rapid growth rate than transvaalensis. The four-inch plug of this variety planted at Antelope Valley covered an area seven feet in diameter during the season, nearly twice as large as that of transvaalensis.

Cynodon species var. Ugandagrass. This introduction from Africa is the finest textured bermuda tested at UCLA. It appears to be as fine in texture as velvet bent and forms a very dense uniform turf of a beautiful bright green. Some seed heads are produced in early summer but never in sufficient number to impair its appearance. Its greatest fault is that it assumes the same reddish-purple cast as transvaalensis at the first cool nights in the fall.

Its growth rate is about the same as the transvaalensis species, covering an area about four feet in diameter from a four-inch plug at Antelope Valley.

Cynodon species from Iran. This selection is nearly identical to the Ugandagrass having the same color, texture, and vigor. A few more seed heads may be produced at some periods of growth.

There are still several unanswered questions about all of these varieties. One of the most important is, Are they able to compete favorably with our common bermudagrass? A new strain will be of little value if it is crowded out by common bermuda in a few years. Studies will be started this summer to answer this question and others.

All of these introductions, like our common bermuda, respond well to heavy nitrogen feeding but will make a turf of fair quality under low fertility levels. Frequent applications of nitrogen fertilizer throughout the winter will improve the winter color of most of these strains and will bring an earlier growth in the spring.

## GOLF OFFERS MANY JOB OPPORTUNITIES

Job opportunities in golf are good in Southern California and promise to get better, according to information on new golf course construction and planning found in the annual report of the National Golf Foundation, just released.

California leads the nation in new golf course construction according to the foundation report, with 30 new courses under construction and 45 in the planning stage. Southern California is the "hot spot" with 17 under construction from Bakersfield to San Diego.

"The need for trained men to maintain and operate these courses is apparent," according to Vern Wickham, western field service representative of the National Golf Foundation. "About seven of the new golf courses are additions to existing nines and the work load will be taken care of by additions to the regular crew, but there are at least ten courses under construction that will need work crews and supervisory personnel."

Needed will be superintendents, greensmen, power equipment operators, watermen as well as managers and starters. Of the 45 courses in the plan stage, at least half of them should get under way this year, Wickham said. For purposes of this survey, field reports were not filed until some definite action was made such as land acquired, plans drawn, money in budget, membership sale started, bond issues passed. With many more golf courses in the talking stage and all existing golf courses crowded it appears that experienced golf personnel will be needed on the West Coast for a long time.

A breakdown on new golf course construction, as reported by the National Golf Foundation for the seven Western states follows:

	Under construction	Planned
California	30	45
Oregon	3	11
Washington	4	7
Arizona	4	3
Nevada	1	3
Utah	2	2
Idaho	2	5

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# USE OF INJURIOUS MATERIALS REQUIRES PERMIT

John Stark, Farm Advisor  
Los Angeles County

For approximately the past three years anyone purchasing or using parathion needed a permit from the local Agricultural Commissioner. In November, 1955, several new provisions were added under section 1080 of the California Agricultural Code. Many pest control materials were added to the category that parathion was in. These insecticides, (listed below) are considered dangerous materials from the standpoint of their effect on human beings and animals.

Certain herbicides, which were formerly regulated in the northern part of the state, now require a permit for use throughout California. These are considered dangerous materials because of possible damage to nearby crops and ornamentals through improper application.

A new provision now calls for the dealers of these materials to demand a signed statement from the purchaser to the effect that a permit for use has been secured.

The following materials are affected by Sec. 1080.

1. Tepp
2. Parathion
3. Methyl parathion (Metacide)
4. EPN
5. OMPA (Schradan)
6. Demeton (Systox)

The following compounds may not be purchased in quantities greater than 50 pounds in any twenty-four hour period without a permit:

1. Calcium arsenate
2. Standard lead arsenate\*
3. Copper acetoarsenite (Paris Green)

The following herbicides may not be purchased in quantities greater than one pint liquid, or one pound of dry formulation in any twenty-four hour period without a permit.

1. 2,4-D
2. 2,4,5-T
3. MCP
4. 2,4-DP
5. Silvex

Applications for permits may be obtained at the following offices:

Los Angeles County: Agricultural Commissioner  
9th Floor, 808 N. Spring Street  
Los Angeles 12, California  
Mutual 9211, Extension 2748

Orange County: Agricultural Commissioner  
8946 South Harbor Blvd.  
Anaheim, California  
Keystone 5-1138

San Diego County: Agricultural Commissioner  
P. O. Box G, San Diego  
Building 2, 4005 Rosecrans Street  
San Diego, California  
Cypress 8-4181, Extension 234

Residents of other counties should write to the office of their local Agricultural Commissioner.

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<sup>1</sup> Certain products containing lead arsenate for the control of crabgrass do not require this permit.

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## RECENT GIFTS

Long Beach Gardeners Association  
Long Beach  
\$15.00

Northrup, King & Co.  
Los Angeles  
12 lbs. grass seed

E. I. DuPont de Nemours & Co.  
Wilmington  
300 lbs. Uramite

Dow Chemical Co.  
Midland, Michigan  
5 lbs. Dalapon

W. Atlee Burpee Seed Co.  
Riverside  
12 lbs. grass seed

George W Koba  
San Gabriel  
2 lbs. dichondra seed

Kelly-Western Seed Co.  
Salt Lake City  
140 lbs. Pax

C. M Volkman & Co.  
San Francisco  
9 lbs. grass seed

O.M. Scott & Sons  
Marysville, Ohio  
15 lbs. grass seed

Germain' s Inc.  
Los Angeles  
9 lbs. grass seed

Ferry-Morse Seed Co.  
Los Angeles  
11 lbs. grass seed

# THE BERMUDAGRASS - BENTGRASS COMBINATION FOR AN ALL - YEAR PUTTING OR LAWN BOWLING GREEN

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On a few golf courses in the East, particularly where the traffic is heavy, mixtures of creeping bentgrass with U-3 bermudagrass have been used successfully for putting greens. In Southern California, where there are many lawn bowling clubs, sometimes the traffic has been too severe for bentgrass greens, and in such cases the introduction of bermudagrass has helped to solve the problem. Occasionally common bermudagrass may be seen in some golf courses as an invader in Seaside bentgrass putting greens. However, the textures and colors of the two grasses do not match well and a highly objectionable effect is produced from all standpoints.

In the spring of 1950, equal quantities of stolens of three strains of bermudagrass were mixed with three strains of creeping bentgrass and planted vegetatively. The grasses were mowed at putting green heights of cut, but with less regularity than would be usual. Fertilizer was used to apply nitrogen at the rate of 15 lbs. per thousand square feet per year. Attempts to reduce the applications of nitrogen particularly during the summer always resulted in some loss of quality and density of the turf. Liberal applications of nitrogen did not unbalance the proportion of the grasses at any season of the year.

Samples of the turf were cut with a one inch soil sampling tube. The plugs were removed to the laboratory and dissected, identifying and counting the individual grass plants under a binocular dissecting microscope. Twelve samples were counted on each plot. The averages in August and February or May are shown for two seasons in Table I.

TABLE I

Seasonal change of the population of bermudagrass plus bentgrass associations.

(Average number of plants per one inch plug)

Date	Congressional & U-3 Bermuda		Collins & Tifton #57		Arlington & Tifton #12	
	Bermuda	Bent	Bermuda	Bent	Bermuda	Bent
May 1951	8.0	22.6	7.3	24.0	5.2	22.1
Aug. 1951	11.0	30.9	11.7	35.8	11.3	33.1
Feb. 1952	0.8	35.0	6.4	30.0	1.6	34.2
Aug. 1952	9.4	33.3	13.8	30.8	11.5	22.8
Feb. 1953	1.2	33.3	10.7	20.1	9.0	9.7

In all combinations, the bermudagrass increased regularly each summer and declined during the winter. The marked dominance of the bentgrass in a region where bermudagrass invades all turf naturally was unexpected.

Fungicides were not applied to the turf for the protection of the bentgrasses against turf disease. During attacks of dollar spot, the most important turf disease in the locality, the infestation was greatly reduced in the mixed turf of bentgrass and bermudagrass in comparison with the same strain of bentgrass alone.

The all-year appearance of the mixture of Congressional bentgrass and the U-3 bermudagrass was outstanding, and both color and texture seemed to be well matched. Another combination, Old Orchard bentgrass with U-3 bermudagrass, proved to be equally desirable. These two combinations are now being tried on a pitch-and-put course in one of the public parks of Los Angeles where the heavy traffic causes great difficulty in maintaining the bentgrass greens. Doubtless other combinations equal or superior in performance could be developed through experimentation. Bentgrasses which have survived on fairways in the lower San Joaquin Valley of California, are being used in an attempt to select strains with unusual heat and drought resistance for use in this type of mixture.

The mixtures of Collins bentgrass with the Tifton 57 strain of bermudagrass and Arlington bentgrass with the Tifton No. 12 bermudagrass were not satisfactory in appearance and performance particularly at certain seasons of the year. This indicates the vital importance of matching suitable compatible strains of the two grasses.

The vigorous clonal strains of creeping bentgrass and the finer-textured bermudagrasses require similar maintenance. Close mowing at reasonable intervals, preferably with the use of a rake or comb attachment on the mower, is advisable. This will help to avoid the production of matted turf and will postpone the need for topdressing. An occasional vigorous raking or brushing before mowing will largely prevent the appearance of grain or matted turf. Correct management is essential with this combination of grasses.

The turf of the best combinations has required so little attention and has had such an excellent appearance that it is seriously suggested for permanent lawns in Southern California since it is almost impossible to prevent the invasion of common bermudagrass in lawns of cool season grasses. One nurseryman in the vicinity of Los Angeles has persuaded many of his clients who have lawns of bermudagrass to use a putting green mower and remove clippings. This has eliminated entirely the need for mechanical renovation of the turf at periodic intervals.

The eventual place of combinations of this type is not clear, but these results are sufficiently promising to encourage cautious trial where heavy traffic is a problem or where natural invasion of the greens by bermudagrass is serious. Experience in Southern California has shown that the U-3 bermudagrass will eliminate or suppress common bermudagrass. Likewise, a suitable strain of bentgrass under proper management will eliminate the objectionable winter color of the bermudagrass and will dominate it at all seasons of the year. This probably will not be true in most parts of the U.S.A. but it is undoubtedly one of the most important discoveries which has been made thus far in our experimental work in turf culture.

<sup>1</sup>Formerly graduate student