group had been only shrink, the weight difference should have been compensated later in the experiment but this did not happen.

It is assumed that once-a-week feeding allows the timid ewes an equal opportunity to consume the supplement, thus a more uniform gain; however, the standard deviations of the gain during the three-day period are nearly the same in all groups. Even though the gains in the once-per-week supplementation group were no more uniform than the other groups, this group did not experience the loss of weight shown by the other groups.

Since the ewes lambed over a three-week period, the gains may be correlated with the stage of gestation. Table 2 gives the ewe gain by weeks (1, 2, 3 and 4) before lambing.

TABLE 2, PRE-LAMBING EWE GAINS PER WEEK

Weeks pre-lambing	Group I	Group II	Group III
1	4.7[1/2]	3.6[2]	5.3[1]
2	4.7[1]	4.6[1]	4.4[1]
3	2.8[2]	4.0[1/2]	5.5[1]
4	4.1[1]	3.5[1]	2.6[1]

[1,2] values differ significantly ($P < .05$) by weeks

During the week before lambing, Group III gained significantly more than did Group II and during the third week pre-lambing, Group III gained significantly more than did the control Group I. Otherwise, the gains were nearly the same for the other weeks and groups.

Lamb birth weights were not affected by supplementation, as shown in table 3.

TABLE 3, LAMB BIRTH WEIGHTS

	Singles lb	Twins lb
Group I	11.8	9.8
Group II	12.0	9.5
Group III	11.3	9.9

No pregnancy paralysis or ketosis was observed whether or not the ewes were receiving supplemental feed. Under more severe conditions when range feed is in critically short supply, weekly feeding of supplements might cause such trouble. These results only apply when reasonable amounts of range feed are available to pregnant ewes. Ewes will consume seven pounds of pellets per head per week in two to three days, which gives opportunity for all ewes to eat some of the supplement.

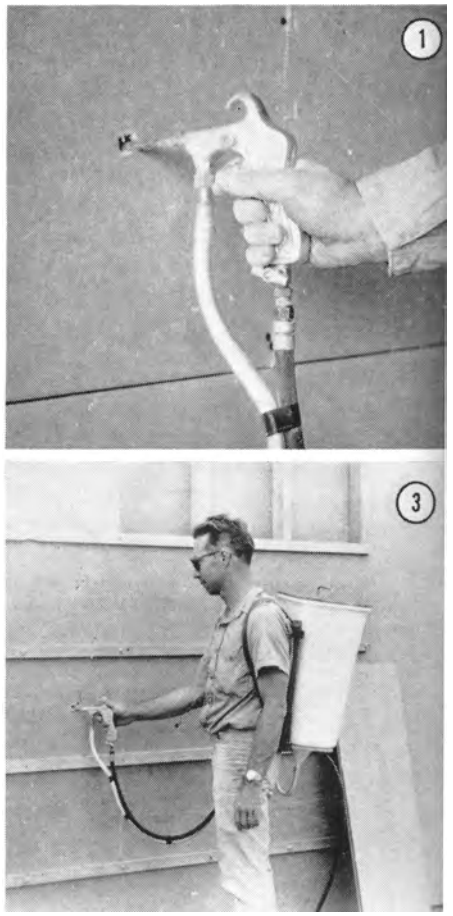
D. T. Torell is Specialist in Animal Husbandry, Hopland Field Station, and W. C. Weir is Professor, Department of Animal Husbandry, University of California, Davis.

Applications of nontoxic sorptive dusts during construction of houses or oth buildings appear to offer a high degree of protection from infestations of coc roaches and other household pests, according to tests during the past six years two large housing developments, as well as in the laboratory at University California, Los Angeles. Excellent results were obtained with applications of silica aerogel (Dri-Die 67) in the walls of houses during construction. To suppl ment this protection for either new or old construction, the additional procedure blowing the same desiccating dust into voids under and behind cabinets, built- kitchen appliances, shelving, bookcases, and similar structures was also found be very effective. Insects are controlled as long as the dust layer remains dr

"BUILT-IN" PEST CO
For Wall and Cabinet
And Other Buildings

A COMPLETE PROGRAM of "built-in" pest control involves first the treatment of the soil for the prevention of infestation by subterranean termites. Since the soil is treated around the periphery of the foundation, ant control is often obtained as a secondary benefit for both slab and joist-type construction. Also, many years of control is possible for pests originating beneath buildings of joist-type construction. Soil treatment is now a standardized method along with attic dusting with sorptive dust for the prevention of drywood termites. Over 40,000 attics have already been dusted for this purpose in California. Information reported here details some problems met in dusting during building construction—both with wood-frame and concrete buildings.

The project involved was the Ventura Town House, a complex of a seven-story concrete and ten one-story wood-frame apartment buildings for senior citizens. The construction involved only "dry wall" both in the concrete and the wood-frame buildings. In the wood-frame buildings, the sheets of dry wall were joined on either a horizontal or vertical line. Holes were drilled for injection of dust only along these lines, because they could then be taped over. Where the sheets were joined horizontally, a hole was made along this juncture, between every two studs. Each interstud void was then dusted separately, using a one-second blast (3 grams) per hole.

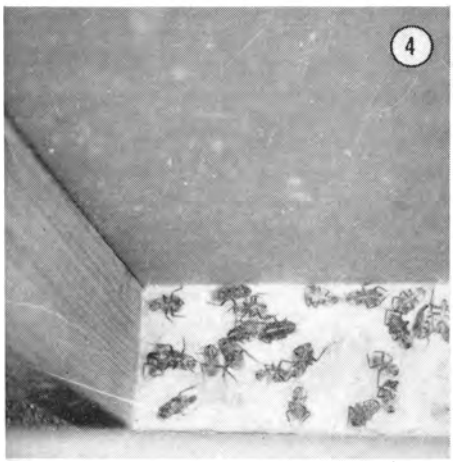


Equipment and technique used in "built-in pe during construction of a building: (1) "Blasto" of silica aerogel dust (Dri-Die 67) as it comes fr bly applying dust in a void below the fire blo board; (4) dead (from desiccation) Oriental co

W. EBELING • R. E. WAGNER

Kitchen cabinets with holes (indicated by arrows) drilled into kick panels for application of silica aerogel in the voids under these cabinets. Food and water containers may be seen at the lower right-hand corner of the figure.

NTROL Voids in Houses *U*nder Construction



:ontrol" program shown in test photos above, is inserted into hole in plaster board; (2) cloud the gun; (3) operator with entire dusting assem- in an experimental wall with removable plaster oaches in the dust on the floor plate.

Where they joined on a vertical line, holes were made only where two sheets came together. In the frame buildings at Ventura Town House, this situation was found only on acoustic partition walls between two apartments. In such cases, metal furring strips were used which kept the drywall about an inch away from the studs so that the dust moved laterally into all interstud spaces. Usually for one wall there were three vertical lines where sheetrock joined, and dust was blown in a hole drilled in each line. Thus, dust was blown in only three holes per wall, using a three-second blast (9 grams or 1/50 lb) per hole.

In the reinforced concrete buildings, the sheetrock joined only on vertical juncture lines. Since there were no studs in the wall, and the volume of the wall void was much less than in the wood-frame buildings, a hole was made only in every second juncture of the sheets of the drywall (8 feet apart). Again 9 grams of dust were blown in each hole.

Use of the 4-inch extension tube on the "Blasto" gun (photos 1, 2, and 3) allowed the operator to direct the dust upward to the ceiling plate (in wood-frame construction) and insure sufficient coverage of the upper parts of the wall void. Directional control was also found desirable to direct the stream of dust downward to the floor plates in insulated walls. Addition of a long copper tube was also useful for insertion into the ceiling spaces of certain multi-storied houses and apartments or buildings in which no attics exist.

For dusting in partition walls of concrete buildings, where holes can be made only at the juncture of two sheets of drywall, the 4-inch tip of the gun was removed leaving the conical tip-retainer. This tip fit snugly into the ½-inch holes drilled in the drywall junctures and resulted in a better lateral dispersal of the dust over the 4-foot distance (in each direction) to reach into the extremities of the sheetrock sections.

Voids under cabinets

Treatment of voids existing under cabinets, built-in kitchen appliances, shelving, book-cases and similar places in a house was found to be a valuable additional procedure to round out the program of "built-in" pest control. It consisted of drilling a ½-inch hole at the top of each kick panel (see photo of cabinets), covering the voids and blowing silica aerogel into the holes at the rate of 1 gram per sq ft of floor space. Effectiveness of these treatments was observed in tests with Dri-Die 67 over the past seven years, as well as in laboratory tests described in this article.

In the Ventura Town House project, Dri-Die was also applied in the voids under various types of built-in cabinetry and kitchen appliances. The efficiency of the dust in such areas was first demonstrated in a mock-up kitchen assembly built into an 8 × 12-ft insect-proof room so that one of the kick panels (toe spaces)

was 47 inches and the other 34 inches in length. A ½-in hole was drilled into the top of each of these two panels at the points indicated by the arrows in photo of cabinets. There appears to be no objection to drilling holes at the top of the usual kick panel, because the cabinet usually extends horizontally over the panel for several inches, thus hiding the hole from view.

The uncovered hole serves as a permanent trap for cockroaches, silverfish and most other crawling pests, which are almost all negatively phototropic and use the hole as a means of getting into the darkness of the void. The insects are guided to the holes by following the intersection of the kick panel and the horizontal overlap of the cabinet floor. Death by desiccation is possible only as long as the Dri-Die remains dry. Once it becomes wet (and subsequently dries) it adheres to the floor too firmly and insects can not pick it up on their bodies. Since Dri-Die kills by physical rather than chemical means, it is effective as long as it is present in a dry state.

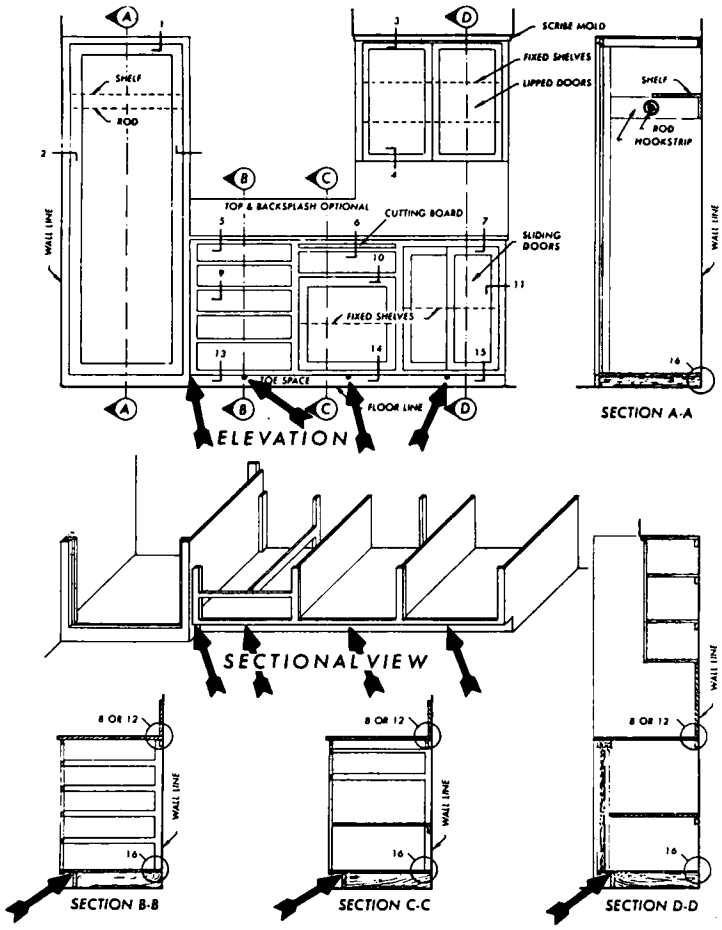
In each of the two holes in the kick panels, 6 gr of dust (0.013 lb or about 1/75 of a pound) was applied.

Food and water were placed on the floor in containers, and 75 adult German cockroaches—about half of them males and half females—were liberated in the room. The room was held at a constant temperature of 80° F and controls were set to allow for 12 hours of light per day. In four days the cabinets were removed and taken apart. All the cockroaches had reached the Dri-Die and had succumbed.

The next experiment consisted of moving a refrigerator, with a severe infestation of German cockroaches in the insulation, into the mock-up kitchen. Otherwise the conditions of the experiment were the same as before. The refrigerator was turned on so that the area underneath would remain warm and favorable for maximum development. In addition to the cockroaches continuously issuing forth from the refrigerator (mainly young nymphs), 50 adults, half males and half females, were placed in the room. The cockroaches continued to leave the insulation of the refrigerator in large numbers, in search of food and water, for there were many egg cases in the insulation, and hatching was continuous. Undoubtedly many returned to the refrigerator, but in their wanderings, many were also attracted to the sub-cabinet voids via the holes drilled into them.

After 42 days, the cabinets were removed and the Dri-Die in the voids was placed in water so that the dust would sink to the bottom, leaving the dead, desiccated cockroaches to float on top. A total of 393 cockroaches had died in the voids—37 adults and 356 nymphs (mostly very young). During the same period 76 cockroaches (nearly all adults) had been found dead on the floor of the room or on top of the cabinets or in drawers. These had crawled out of the holes, but had accumulated a lethal dose of dust while they were in the voids. Thus a total of 469 cockroaches were trapped and killed during a 42-day period by means of a dusting method that involved the use of no poisonous insecticides and no visible residues.

No doubt the cockroaches would have continued to breed in the insulation of the refrigerator for a long time. The logical control procedure under ordinary circumstances would have been to spray or dust the underside of the refrigerator with an effective insecticide. However, the experiment provided ample evidence of the attraction of the sub-cabinet voids, even for the newly hatched nymphs. It should be borne in mind that the void-dusting would ordinarily be a preventive measure and should effectively trap such cockroaches as may occasionally be brought into a house or apartment in beverage or food boxes or by other means. Principal reliance should be placed on the dusting of wall voids, particularly for prevention of migration of cockroaches between apartments or rooms in a house. However, dusting sub-cabinet voids is a desirable added feature to control insects entering a room by some means other than the wall voids.



Construction details for typical kitchen cabinets, with arrows indicating points for holes to be drilled for application of silica aerogel to subcabinet voids.

Existing infestations

Although the dusting of voids can be done most efficiently at the time of construction, there may be circumstances in which this kind of dusting is justified in the treatment of existing cockroach and other infestations in occupied buildings. It involves drilling through plaster to get at the wall voids. This may be practicable in residences if the walls can be painted after treatment. In commercial establishments such as restaurants, grocery stores, drug stores, dry-cleaning establishments, etc., the partition walls where this kind of

treatment can be made are often internal and accessible only from the back, out of sight of the customers. The outside walls of the building, visible to the public, are often solid concrete.

Proprietors generally did not object to drilling in the plaster of the back-room partition walls, if convinced that this was the only way the cockroach problem could be solved. Merely having the holes filled with a patching plaster after treatment was often satisfactory.

Many proprietors of commercial establishments have had difficulty obtaining satisfactory cockroach control and were desperate for a solution to the problem. One such drug store proprietor in Santa Monica was referred by his pest control operator. This store was heavily infested with German cockroaches. One ½-inch hole was drilled about 4 ft above the floor, and between every two studs on one side of every partition wall. In addition, one hole was drilled per 3 lineal ft at the top of each kick panel under cabinets, stockroom shelving, etc. To obtain a rapid knockdown of the cockroaches, each wall void was fogged using a "Hi-Fog" applicator for 2 seconds, injecting 7.2 ml of 1% dichlorvos (DDVP) in base oil, and in sub-cabinet voids for periods that seemed appropriate. Fogging was also done in other places within the rooms with insecticide applied according to the usual methods. However, this portion of the treatment was rapid and superficial and required no clearing of closets, shelves and pantries, or any preparation whatever on the part of the proprietor.

Later tests with an experimental wall, which could be quickly disassembled and examined, showed that a 3-second fogging (10.8 ml) with a 0.5% dichlorvos solution is sufficient to kill all German cockroaches in one hour. Cockroaches in the adjoining void were unaffected by the vapors, even when left in the void for 48 hours. Also there was no effective residue in the treated void after 72 hours.

In the drug store, Dri-Die was blown into the wall voids for 1 second (3 grams) per void at a pressure of 40 psi and into the sub-cabinet voids at the rate of 1 gram per sq ft of void space. The dust was applied 30 minutes after the dichlorvos fog. This treatment combined rapid knockdown with the ultimate in long-term residual effectiveness. The treatment was applied on July 26, 1963, and no cockroach has been seen since.

There is no reason to believe that toxicants applied for rapid knockdown would have any effect on the ultimate residual effectiveness of a Dri-Die treatment applied as described above. On October 11, 1963, ½-inch holes were drilled between every two studs in walls surrounding kitchen, service porch, bathroom and bedroom areas in a house in which the plaster was later to be removed for remodeling. Twenty-five adult German, brown-banded, American and Oriental cockroaches were placed in wall voids, each species in a different void. In two weeks the plaster was removed. The American and Oriental cockroaches were unable to leave the voids and all had died. Many of the two small species, the German and brown-banded cockroaches, had escaped from the wall voids. Within two days, three dusty German cockroaches could be seen crawling about in the house, where food and water were available. Also some dead ones were eventually found in various areas of the house, but no live cockroaches were ever seen again.

Normally, confinement in wall voids for two weeks without food and water would cause very little mortality of American and Oriental cockroaches and would result in approximately 50% mortality of German and brown-banded cockroaches.

Supplemental treatment

To this point the discussion has been confined to the treatment of voids and confined spaces. Cockroaches may also become established in large numbers in other areas, particularly under electric or gas ranges and refrigerators. The insulation in the walls of such appliances, along with the higher temperatures beneath them creates ideal breeding areas for cockroaches. Either as a preventive or for control of existing infestations, a dust may be blown under such equipment. Dri-Die tends to float about excessively when applied in such areas, but a proprietary formulation of Dri-Die with 1% pyrethrins, known as "Drione," does not possess this adverse characteristic of Dri-Die. The base panel of the refrigerator or range should be removed whenever present and the Drione blown under the appliances, directing it up against the bottom of the equipment, into channels that usually exist on either side, on the floor beneath, and back as far as the baseboard in the rear. In refrigerators of recent manufacture it is desirable to take out the drip pans to facilitate thorough dusting of the equipment compartment.

The most satisfactory duster found for applying dust under these conditions is the "Getz Gun," well known to commercial pest control operators. This is a bellows-type duster with a 2½-inch spout attached at a right angle from the bottom of the bellows so that the dust can easily be directed under appliances or furniture at the floor level. The Getz Gun holds 35 grams of Drione and about 30 grams is generally applied under both the refrigerator and the range.

The dust adheres well, particularly when applied with the Getz Gun, which does not atomize the dust excessively. It may also be blown up against the bottom of the sink, particularly in the area between the sink and the wall, as well as in the corners of shelves, in closets, cabinets, and pantries.

Drione not only provides for the rapid elimination of the existing cockroach infestation, but the powder that remains

Tracks of German cockroaches in layer of dust obtained by blowing silica aerogel into the sub-cabinet voids at the rate of 1 gr per square foot of floor space.

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after the pyrethrins decompose is a long-term preventive against reinfestation, because of its continued effect as a desiccating dust.

Tests are also being made on the longevity of the pyrethrins in Drione, for in this formulation they possess an unusually prolonged residual effectiveness. In quantities such as those recommended under kitchen appliances the dust knocked down (paralyzed) adult male cockroaches in about one minute when it was freshly applied, and in about four minutes after two weeks. This was true of deposits kept either in darkness or in a well-lighted room. When the cockroaches crawled across a one-inch-wide band of Drione onto clean surfaces they were all knocked down in four minutes when the dust was fresh, and in 18 minutes when it was two weeks old. When once knocked down, the cockroaches never recovered.

The base panels under cabinets, appliances, etc. may be drilled, and the voids dusted, unless they have already been treated, along with the wall voids, according to the same procedure.

Drione is being applied in cooperation with the San Francisco Housing Authority within living spaces in conjunction with Dri-Die treatment of wall and subcabinet voids in hundreds of apartments in which cockroaches now exist. Adequate controls, with currently used liquid toxicants, will be maintained as long as possible so as to compare the dust method with conventional spray methods. Cockroach population estimates are being made by means of recently devised trapping methods.

The procedure that has been followed in public housing projects provides that the dust under refrigerators and ranges be reapplied only when the tenant moves out, at which time this equipment is cleaned, the floor is washed, and the areas under appliances are redusted as before.

In public housing projects the use of Drione is particularly appropriate because all apartments within a building are treated in one continuous operation. It has not been found practicable to request that occupants clear the shelving of closets, cabinets and pantries, as is generally the case when toxic sprays are used. The relatively nonhazardous properties of pyrethrins permits the dusting of any uncovered space without removing the contents of the treated area.

Walter Ebeling is Professor and Entomologist and Robert E. Wagner is Laboratory Technician IV, University of California, Los Angeles.

Tight-fill PEACH PACKING Reduces costs and transit bruising

The tight-fill method of peach packing not only eliminates the need for hard-to-maintain skilled labor and reduces vibration injury to fruit during transit, but also results in savings of both labor and materials. Laboratory tests, trial shipments, and other tests of handling and transit injury conducted during the last three years show that the tight-fill pack will carry peaches of any given maturity to their destinaton in as good condition as the conventional hand-placed paper cup or tray pack—as reported in one of the two articles included here. Economic-engineering studies of comparative costs—summarized in the other article—show that the tight-fill method can save from 18 to 25 cents per lug in costs of labor and materials, as compared with hand packing. These estimates applied to total annual shipments of fresh peaches and nectarines (using 1961 figures) indicate a possible saving to the packing industry of $3 to $4 million.