The Use of Insecticide Treated Cords for Housefly Control

By JOHN W. KILPATRICK, M.S., and H. F. SCHOOF, Ph.D.

IN RECENT years, the resistance of houseflies to residual treatments of DDT and other chlorinated hydrocarbon insecticides has stimulated intensive search for new insecticide materials and control techniques. Numerous synergistic compounds have been screened in an effort to develop a chemical formulation effective against insecticide-resistant houseflies (*1–3*). Other fly control methods include larviciding (*4*), space spraying (*5*), and poison baits (*6–8*).

Baker and co-workers (*9*) evaluated the effectiveness of DDT-treated cords for housefly control in food establishments, while Pimentel and associates (*10*) used screen strips treated with high concentrations of dieldrin and festooned from barn ceilings as a means of controlling houseflies in dairies. Variations in these techniques have included the use of cords impregnated with other insecticides, including organophosphorus compounds. Laboratory studies of Fay and Lindquist (*11*) indicated the type, size, and color of cords most suitable for treatment and the effective concentrations of the dipping solution. Maier and Mathis (*12*) in 1952 demonstrated that cotton cords $\frac{3}{16}$ inch in diameter treated with parathion gave considerable promise as a method of fly control in dairy barns near Savannah, Ga. Further field tests in 1953 in rural areas (*13*) and in dairy barns substantiated these earlier results. These tests indicated that cotton cords $\frac{3}{16}$ inch and $\frac{3}{32}$ inch in diameter impregnated with parathion produced satisfactory control of flies in dairies and rural areas when the cords were installed at the rate of 8–15 linear feet of cord per 100 square feet of floor area.

In 1954, field studies with cotton cords $\frac{3}{32}$ inch in diameter were designed to evaluate different installation techniques, cord dosages, and chemicals (parathion and Diazinon). Cord installations were tested in dairy barns, rural areas, and military dining halls.

Mr. Kilpatrick and Dr. Schoof are entomologists with the Technical Development Laboratories, Communicable Disease Center, Public Health Service, Savannah, Ga. Dr. Schoof is chief of the Biology Section of the laboratories.

Methods

Cotton cords were treated by immersion in either a 7.5-percent or a 10-percent parathion-xylene solution which, by chemical analysis, showed a dosage of 75–100 mg. of parathion per linear foot of cord. For uniform impregnation, the cords remained in the insecticide solution for approximately 2 minutes. The Diazinon-treated cords were impregnated by dipping them in either a 10-percent or a 25-percent (an estimated 200–250 mg. per linear foot) Diazinon-xylene solution. All cords were installed at the rate of 30 linear feet of cord per 100 square feet of floor area, with the exception of one test with Diazinon-impregnated cords in which the dosage was reduced to 25 linear feet of cord to 100 feet of floor space. The cords

Figure 1. Insecticide-impregnated cords installed in a feedroom of a dairy.

were suspended vertically either from the ceiling or from horizontal cords extending from wall to wall (fig. 1).

In dairies and rural areas, the cords were installed at all protected potential fly-resting sites, particularly those within barns, pigpens, calf pens, and chickenhouses. In the rural area tests, treated cords also were suspended in the kitchens and on porches of unscreened houses. Treatments in military food establishments included complete installation of cords in the dining halls and partial treatment of the kitchens. In the kitchens, cords were placed so that the affected flies would have little chance of falling into food-preparation sites. Cords also were installed beneath the overhang of the entranceways.

Appraisal of the housefly populations in dairies was accomplished by selecting the highest grill count (5 counts per station) from each of 4 stations. These stations were not fixed sites but general areas, such as stanchions, entranceways, and feedrooms. The average of the four highest counts constituted the weekly fly index. In the rural areas, 5 grill counts were made on each of 10 premises every week. The highest count at each of the premises was recorded, and the average of these counts was employed as a weekly index. In the unscreened kitchens, total fly counts were recorded. In military dining halls, the weekly fly index was made by obtaining a total count of houseflies found in the kitchen and dining hall. The fly densities were evaluated during the same time interval each week to avoid, as much as possible, variations in fly behavior.

All dairies used in the study maintained herds of 100 to 400 cows. One dairy (C, fig. 2) received installations of freshly treated cords impregnated in a 7.5-percent parathion solution and air dried for 3 weeks before installation. The second and third dairies (T and Ra, fig. 2) received installations of freshly treated cords impregnated in a 7.5-percent and a 10-percent parathion solution, respectively. The 3-week-old cord installed in dairy C was used as a means of overcoming the 3-week period usually required to bring fly populations to control levels, a lag possibly caused by the repellency to flies of freshly treated cords.

Two areas (2 x 3 miles each) containing approximately 25 houses each were selected for the rural study. In one area, the individual premises were treated with cord impregnated in 7.5-percent parathion solution; the second area served as an untreated check. The 15 premises of highest fly potential in each area were selected for grill index determinations.

Two military dining halls of similar construction and area were selected for study. One dining hall received treatment with cord impregnated in a 7.5-percent parathion solution; the other was used as an untreated check.

Results

The results of the parathion cord treatment in dairies are shown in figure 2. Housefly populations at dairy C, which received a treatment with 7.5-percent parathion-impregnated cord air dried for 3 weeks, were sharply reduced to control levels the first week after treatment,

Figure 2. Control of houseflies in dairies with parathion-treated cords.

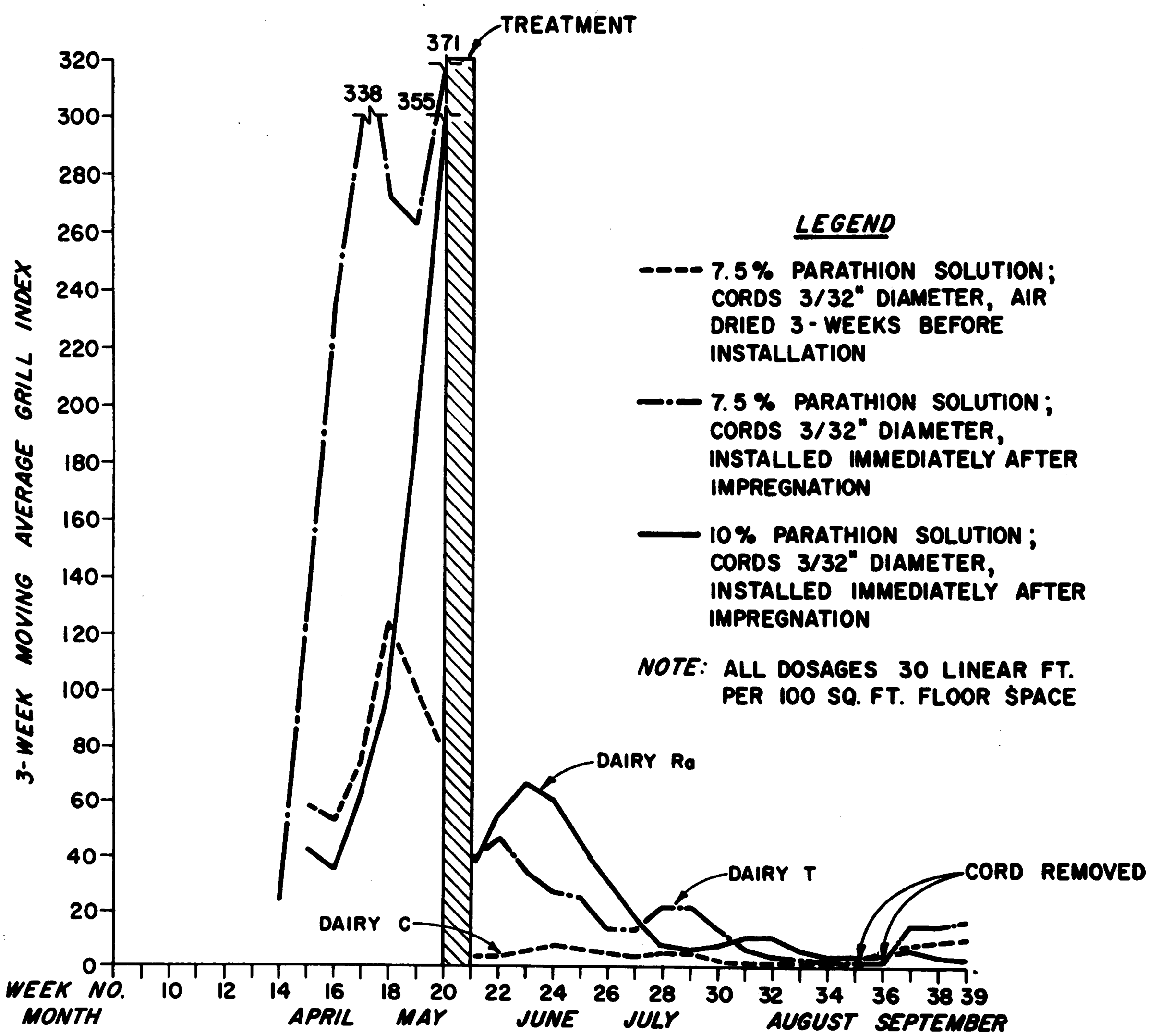
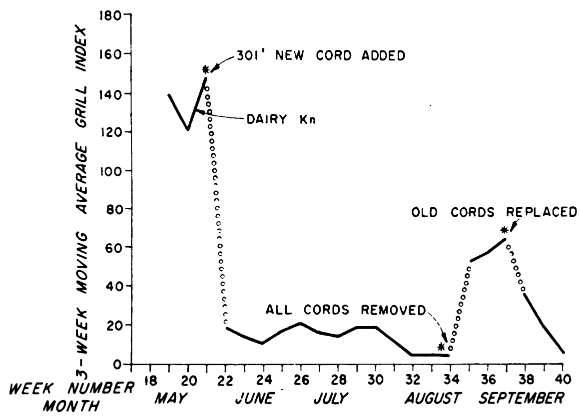


Figure 3. Control of houseflies in dairies with 12-month-old parathion-treated cords (1953).



and fly densities remained at very low levels throughout the entire season. The second dairy (T), treated with cord freshly dipped in a 7.5-percent parathion solution, showed an immediate reduction in the fly population, but control levels were not reached until several weeks after treatment. However, once control levels were obtained, low fly populations prevailed the remainder of the season. The third dairy (Ra), treated with cords freshly dipped in a 10-percent parathion solution, showed a gradual decline in fly densities which did not reach control levels until 7 weeks after treatment. This unsatisfactory slow drop in fly densities was due in part to a disruption of normal sanitation practices coincident with the treatment of the dairy. As a result, the pressure of fly production was abnormally high. After the usual practices of manure handling were reestablished, control levels were maintained.

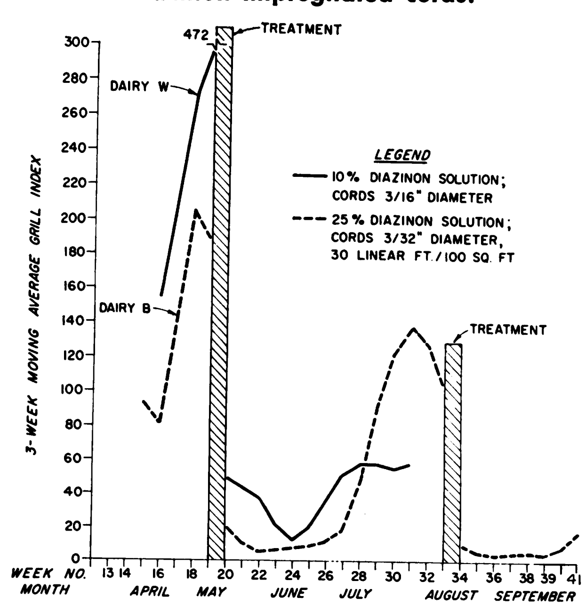
The effect of parathion-impregnated cords on fly populations is depicted most graphically in figure 3. In this dairy (Kn), parathion-treated cords $\frac{3}{16}$ inch in diameter installed the previous year were allowed to remain in the dairy establishment throughout the winter months. In addition, 300 feet of newly treated cord ($\frac{3}{16}$ inch in diameter) was installed in a recently built calf shed. Satisfactory control of flies ensued throughout the following summer. In August, all cords were removed from the barns and immediate increases in fly population levels were noted. In early September, the same cords were reinstalled and an immediate reduction of fly indexes to control levels was achieved.

The results with Diazinon-treated cords are shown in figure 4. In 1953, the dairy (B) treated with cords ($\frac{3}{16}$ inch in diameter) impregnated in a 10-percent Diazinon solution displayed substantial reductions of the housefly populations, with reduced indexes persisting for 3 to 4 weeks. In 1954, the same dairy treated with cord ($\frac{3}{32}$ inch in diameter) impregnated with a 25-percent Diazinon solution showed immediate reduction of housefly densities to control levels, and these low levels were sustained for 7 weeks. After this period a sharp increase in fly indexes occurred. In mid-August, retreatment with freshly impregnated cord again resulted in excellent housefly control for a period of 7 weeks.

In figure 5 are shown the comparative housefly population trends in treated and untreated rural areas. After installation of the parathion-treated cords, excellent fly control was obtained for the remainder of the season. In the untreated area, the reduced fly levels were caused by the use of poison baits by individual residents. However, fly population indexes were not lowered to the levels obtained in the zone treated with parathion-impregnated cords.

The results of installation of parathion-

Figure 4. Control of houseflies in dairies with Diazinon-impregnated cords.



treated cord in a military dining hall and kitchen (fig. 6) indicate excellent control of houseflies during the 10-week observation period. Total fly counts in the treated dining hall and kitchen ranged between 1 and 16 flies per inspection, whereas total counts in the untreated dining hall and kitchen ranged between 110 and 260 flies per inspection.

Discussion

The use of smaller cords ($\frac{3}{32}$ inch in diameter rather than $\frac{3}{16}$ inch in diameter) in 1954 was based on the similarity in the control performance of cords of both sizes in previous studies. In addition, the $\frac{3}{32}$ inch in diameter cord is cheaper and reduces the potential hazard to humans because of the lesser amount of parathion per unit length of cord (75–100 mg. vs. 150–250 mg.). It also permittted an increase in cord dosage per 100 square feet, thereby augmenting the toxic area available for fly contact without increasing the overall amount of parathion within a barn.

In general, the results of the 1954 tests and those of previous studies indicate that parathion is the most effective chemical tested for the treatment of cord for control of *Musca domestica* since it is the only impregnant to date which gives satisfactory control of insecticide-resistant houseflies for extended periods of 2–3 months. Indications are that air drying

Figure 5. Control of houseflies in rural areas with parathion-impregnated cords.

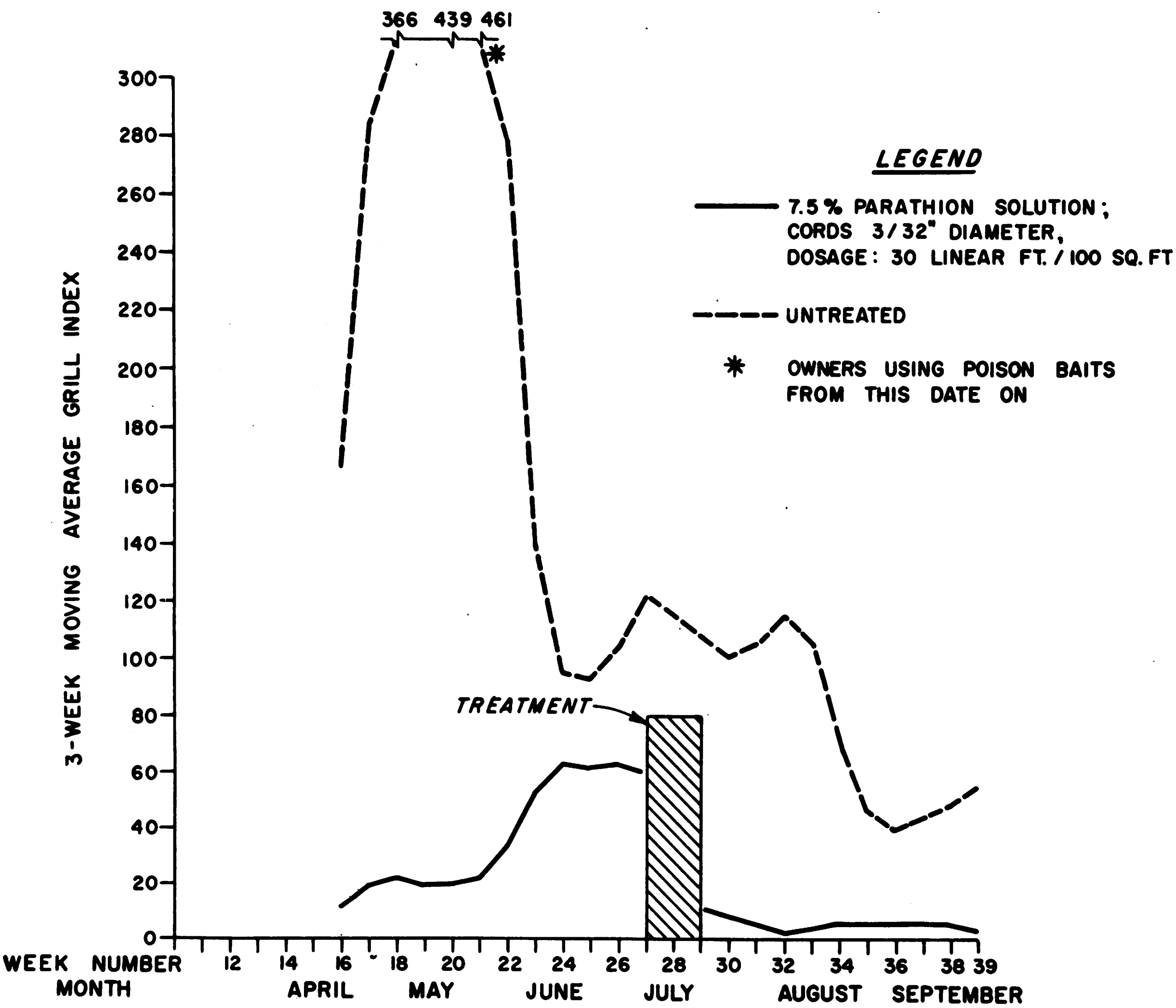
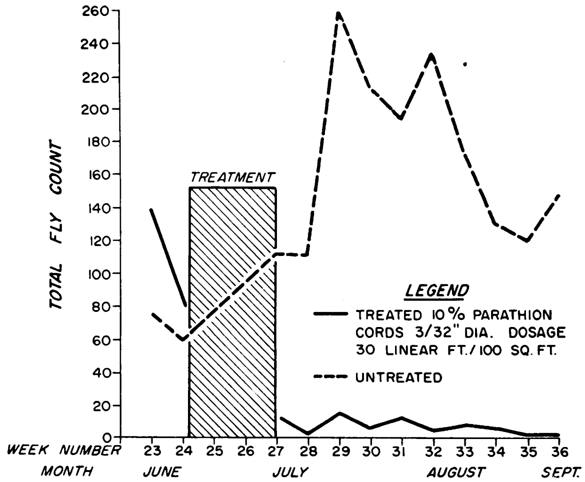


Figure 6. Control of houseflies in a military dining hall and kitchen with parathion-impregnated cords.



of the cords for a period of 3 weeks before installation tends to improve their initial efficiency. Assumptions are that during the 3-week air-drying process various fractional impurities of parathion dissipate, leaving a treated cord which apparently is less repellent to the flies. Although the dairy treated with parathion-treated cord, air dried for 3 weeks, gave the highest level of control, it should be noted that the pretreatment indexes at this dairy were much lower than at the other two dairies.

Diazinon-treated cords when impregnated by dipping in a 25-percent solution were extremely effective for periods of 7 weeks. The shorter residual activity of these cords as compared to parathion-treated cords may be compensated for under certain conditions by the lower toxic hazard to mammals.

Chemical evaluation of the parathion concentration in the air of several dairies and kitchens has indicated a level of only 0.02 microgram of parathion per liter of air. Routine checks on the cholinesterase levels of individuals preparing and handling treated cords have shown no significant change in these indexes nor have there been any reports of any toxic effects of the treatment upon the exposed human populations in the dining halls, kitchens, or dairies employed in the studies.

The commercial development of parathion-impregnated gauze in Denmark as reported by Wichmand (*14*) and its widespread use on farms in that country have demonstrated that parathion-treated gauze can be used safely and efficiently by the public in fly control. Under similar conditions of commercial preparation, parathion- and Diazinon-impregnated cords offer definite promise as a general fly control measure in the United States. Such cords should be properly identified by poison labels affixed at intervals of 5 feet. In view of the toxic hazards involved in impregnating the treated cord, it is not recommended that such cords be prepared by anyone other than commercial formulators.

Summary

Cotton cords $\frac{3}{32}$ inch in diameter, impregnated in 10-percent and in 7.5-percent parathion-xylene solution, have given seasonal control of insecticide-resistant housefly populations in dairy barns. Cords impregnated by immersion in a 25-percent Diazinon solution yielded 7 weeks' effective control. Cords treated with 7.5-percent parathion solutions provided excellent control of houseflies for more than 10 weeks in rural areas and for 10 weeks in a military dining hall and kitchen. Air samples in dairy barns and in kitchens of rural homes revealed only 0.02 microgram of parathion per liter of air. No significant changes in cholinesterase levels were noted in individuals processing or installing parathion- and Diazinon-treated cords.

REFERENCES

(*1*) March, R. B., Metcalf, R. L., and Lewallen, L. L.: Synergists of DDT against insecticide-resistant houseflies. J. Econ. Ent. 45: 851–860, October 1952.

(*2*) Perry, A. S., and Hoskins, W. M.: Synergistic action of DDT toward resistant houseflies. J. Econ. Ent. 44: 839–850, December 1951.

(*3*) Summerford, W. T., Goette, M. G., Quarterman, K. D., and Schenck, S. L.: The potentiation of DDT against resistant houseflies by general structurally related compounds. Science 114: 6–7, July 1951.

(*4*) Quarterman, K. D., and Mathis, Willis: Field studies on the use of insecticides to control fly breeding in garbage cans. Am. J. Trop. Med. & Hyg. 1: 1032–1037, November 1952.

(*5*) Smith, W. W.: Fly control in a small city by use of DDT-oil mists. J. Econ. Ent. 41: 828–829, October 1948.

(*6*) Farrar, M. D., and Brannan, C. C.: Fly control on dairy farms. J. Econ. Ent. 46: 172, February 1953.

(*7*) Gahan, J. B., Wilson, H. G., and McDuffie, W. C.: Organic phosphorous compounds as toxicants in housefly baits. J. Econ. Ent. 47: 335–340, April 1954.

(*8*) Langford, G. S., Johnson, W. T., and Harding, W. C.: Bait studies for fly control. J. Econ. Ent. 47: 438–441, June 1954.

(*9*) Baker, W. C., Scudder, H. I., and Guy, E. L.: The control of houseflies by DDT sprays. Pub. Health Rep. 62: 597–612, Apr. 25, 1947.

(*10*) Pimentel, D., Schwardt, H. H., and Norton, L. B.: New methods of housefly control. Soap and Sanit. Chem. 27: 102–105, January 1951.

(*11*) Fay, R. W., and Lindquist, D. A.: Laboratory studies on factors influencing the efficiency of insecticide-impregnated cords for housefly control. J. Econ. Ent. 47: 975–980, December 1954.

(*12*) Maier, P. P., and Mathis, W.: Fly control at dairies with parathion-impregnated cords. Modern Sanitation 7: 32, 48–53, April 1955.

(*13*) Kilpatrick, J. W.: The control of rural fly populations in southeastern Georgia with parathion-impregnated cords. Am. J. Trop. Med. & Hyg. 4: 758–761, July 1955.

(*14*) Wichmand, H.: Control of multi-resistant houseflies. Nature 172: 758–759, Oct. 24, 1953.

Diabetes Control Courses in Boston

Four courses in diabetes control will be given at the Public Health Service Diabetes Field Research and Training Unit, Boston, Mass., for physicians, public health administrators, nurses, dietitians and nutritionists, social workers, health educators, and medical technicians. The courses for 1956 are:

Patient education in diabetes, designed for those concerned with individual and group instruction of persons with diabetes and with the families of these patients, will be given from February 27 to March 2. It is recommended for teams of workers. Membership for this course is limited to 12.

Nursing aspects of a diabetes program, designed for nurses in official and nonofficial health agencies, general and special hospitals and other institutions, clinics, schools, and hospitals, will be given March 19–23. Enrollment is limited to 15.

The clinical and community approach to diabetes will be given April 23–27 and again October 1–5. Planned for professional workers interested in diabetes programs, membership is limited to 20. Priority is given to applications from teams of staff workers from one agency.

Nutritional aspects of a diabetes program, given May 21–25, is arranged for dietitians and nutritionists in public and private health agencies, clinics, hospitals, and other institutions. Membership is limited to 15.

There is no fee for registration or tuition. The classes run from 9:00 a. m. to 4:30 p. m. daily. Part-time or intermittent attendance is not accepted. Application for admission to any one course should be filed as early as possible. Information about hotel accommodations will be sent after application is received. Further inquiries should be addressed to: Diabetes Field Research Training, 639 Huntington Avenue, Boston 15, Mass.