if they lend themselves to increased safety through improved formulation. In fact, in some cases the substitution of a highly poisonous compound with no cumulative effect for a material having less acute but more residual toxicity may be desirable. The hazard in the use of the former type of compound on food products involves only the spray workers, while the latter potentially involves the whole population.

Irrespective of the type of toxic ingredient employed, the desirability of using improved formulations or other safety devices which tend to reduce intake through the skin, the respiratory system, or the digestive tract should be emphasized to all those connected with the pesticides industry.

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INSECTICIDE TOXICOLOGY

Manifestations of Cottonfield Insecticides In the Mississippi Delta

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A survey of school attendance records for white children in one Delta county, mortality figures for the entire state of Mississippi, and morbidity figures for a Delta plantation hospital was undertaken to determine the possible toxic hazard from the use of modern insecticides. In all studies reported no evidence could be found that pesticides were the direct or indirect cause of any chronic disease or a contributing cause in diseases generally recognized as having other etiologies. A definite problem exists in relation to widespread use of toxic compounds by inadequately trained and sometimes careless people.

WITH THE INTRODUCTION OF MODERN economic poisons of the chlorinated hydrocarbon and organic phosphorus groups, agricultural practices have undergone considerable revision. The widespread use of these toxic compounds obviously suggests the possibility of acute or chronic intoxication of the resident and particularly of the worker population. It is proper that all physicians should be alert to the possible dangers of new pesticides and that a continuing study of the toxicology of these materials should be made by trained specialists. This point of view should not be confused with the opinion expressed in a few highly publicized reports, both in the popular press (*5*) and in medical literature (*1*, *2*, *4*), which have caused considerable alarm.

The Yazoo-Mississippi Delta is an almost exclusively agricultural area specializing in cotton production. Large quantities of various insecticides are used, primarily for control of cotton insects. During the past 3 years, the Mississippi State Board of Health has been requested repeatedly to determine whether the large-scale use of the newer insecticides presents a toxic hazard to the population of the Delta. This board, being unable to initiate such an investigation at the time, relayed the requests to the Technical Development Branch of the Communicable Disease Center. Because such an investigation had not only local but also general interest, a study was begun in June 1952. Operations were centered at the Cleveland, Miss., Field Station, which is located in the heart of the Delta.

The Yazoo-Mississippi Delta is a flood plain lying between the Yazoo and Mississippi Rivers in northwestern Mississippi. It includes all or almost all of eleven counties and parts of seven more, as shown in Figure 1.

The area is farmed intensively and, because of its physical characteristics, lends itself readily to mechanized cultivation. Many large plantations of several hundred to several thousand acres are located there.

The Delta has been described as "one of the most highly specialized cotton-producing areas in the world" (*6*). This is perhaps not quite as true now as formerly, for some other crops are be-

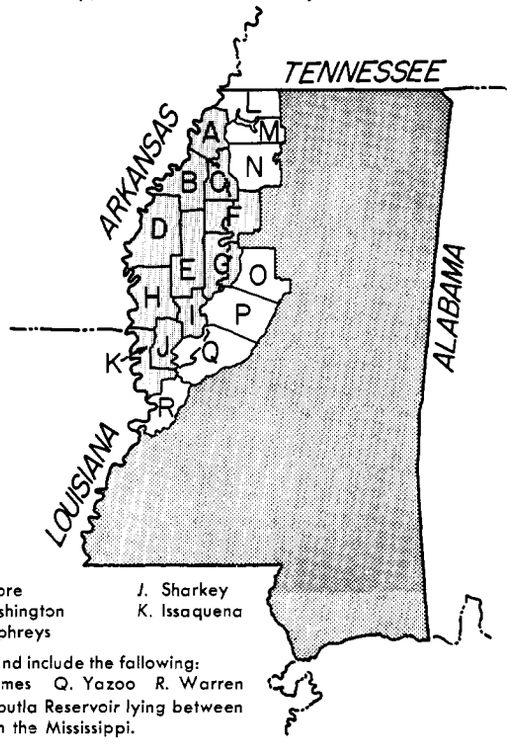

Figure 1. Map of the State of Mississippi showing the Yazoo-Mississippi Delta

Counties lying entirely or almost entirely in the Delta are stippled and are as follows:

A. Tunica	*D.* Bolivar	*G.* Leflore	*J.* Sharkey
B. Coahoma	*E.* Sunflower	*H.* Washington	*K.* Issaquena
C. Quitman	*F.* Tallahatchie	*I.* Humphreys	

Counties lying partially in the Delta are not shaded and include the following:
L. DeSota *M.* Tate *N.* Panola *O.* Carroll *P.* Holmes *Q.* Yazoo *R.* Warren

Headwaters of the Yazoo River pass through Arkabutla Reservoir lying between DeSoto and Tate counties; the river flows south to join the Mississippi.

coming economically important. However, the Delta still accounts for about half of the cotton produced by the state of Mississippi. Roughly, 50 to 60% of the cropland is in cotton, 12 to 16% in soybeans, 5 to 8% in oats, and 5% in hay. The remainder of the land is occupied by miscellaneous crops, pasture, gardens, and idle cropland. Rice is rapidly assuming a position of importance, and livestock production (beef, hogs, and sheep) has become a major enterprise on a few farms (*3*).

Cotton requires more treatment with insecticides than do the other crops raised in the Delta. Several different compounds are employed for cotton insect control, both as dusts and as sprays, utilizing ground equipment (tractor spray and dust rigs) and air equipment. However, since airplane application of dust and sprays is considered by the local farmers to be less economical and perhaps less effective than ground equipment, it is used only in the latter part of the season when the plants would be damaged by running tractors through them. Favored compounds in the area are aldrin, dieldrin, and toxaphene with the addition of DDT when needed for bollworm control. In addition, benzene hexachloride is used widely in the airplane dusts, frequently in combination with DDT and sulfur in the percentages 3-5-0, 3-10-0, 3-5-40, or 3-10-40 (gamma isomer of BHC-DDT-sulfur). The organic phosphorus insecticides are utilized sparingly, chiefly against infestations of red spiders and aphids which tend to occur in the latter part of July and in August.

Cotton is usually planted beginning the second week in April. Early season insect control is directed against cutworms, thrips, boll weevils, and other minor pests which have survived the winter. Application may be required as soon as the first pair of leaves have spread and may be repeated three or four times at approximately weekly intervals. Mid- and late-season schedules are dependent upon the extent of infestation with the boll weevil and other pests, a 15 to 25% boll infestation demanding three or more treatments at 4- or 5-day intervals. In an average season, approximately 10 applications of insecticide will be required; the range is 6 or 7 to 20 or more applications. Hot dry weather, such as prevailed through the summer of 1952, greatly lessens the amount of poisoning required, because of lessened insect infestation. For example, one large plantation used only about 25,000 pounds of insecticides during the 1952 season as compared to 250,000 pounds during the 1951 season. The poisoning season is usually completed by September 1.

Methods of Investigation

The Mississippi State Board of Health originally requested a study because of recurrent questions from the Delta area regarding the possible effect of the newer pesticides on health. Some of the questions, which are similar to statements published by Biskind (*1*, *2*), were as follows:

1. Does exposure to insecticides bring about a change in intestinal flora leading to gastrointestinal upsets and fungus infections such as thrush?
2. Do insecticides, by their selective action on the central nervous system, cause an increase in cases of insanity?
3. Does insecticide dust suspended in the air cause an increase in hay fever, asthma, and sinusitis?
4. Is there a toxicological hazard from residual DDT on the walls of houses caused by the release of phosgene upon exposure to excessive heat—for example, in winter when heated stoves are in proximity to the walls?
5. Do electrolyte disturbances follow exposure to insecticides? For example, does local gastrointestinal irritation result from exposure and lead to vomiting and thus to dehydration, or does direct stimulation of the respiratory center result from exposure and lead to hyperventilation and thus to alkalosis?
6. Is the increased number of infiltrations noted in films taken by mobile x-ray survey units, and frequently interpreted as virus pneumonitis, actually a result of insecticide exposure?
7. As another stress on the organism, may insecticide exposure contribute to increased incidence of diseases of stress and strain, including neuroses and perhaps even cancer and polio?
8. Through repeated or continuous digestive upsets, does insecticide exposure contribute to malnutrition and deficiency diseases?
9. Do the insecticides cause derangements in enzyme systems and contribute ultimately to chronic diseases such as arteriosclerosis and heart disease?

Because these questions were so broad and so theoretical, it was recognized that obtaining undeniable proof of the absence of a toxicological problem would be nearly, if not quite, impossible, although if such a problem were present to a significant degree, it would not be difficult to obtain proof of the fact. It was felt that the best approach would make use of general morbidity data in several ways, comparing figures when the newer insecticides were in use against a time when they were not in use.

After the general view of medical and agricultural experts in direct contact with the local situation had been obtained, existing statistics were evaluated and morbidity surveys were conducted to study the amount and kind of sickness existing under local plantation conditions. An investigation was made of any reported case of suspected poisoning.

In order to increase the probability of reporting, all physicians were approached through the local medical societies. It was urged that suspected cases of poisoning of whatever nature be reported to the nearest county health officer, or directly to the Cleveland Field Station which was headquarters for the investigation. Other groups, including hospital staffs, county agricultural agents, and civic clubs, were also approached for the same purpose.

Opinion of Local Health Officers and Agricultural Agents

In order to evaluate local feeling concerning the problem of cotton-field insecticide intoxication, several county health officers were first consulted. One reported that the doctors in his county had not complained of the problem to him. Another expressed interest in the possibility of intoxication, but stated that it had not become a problem in his county as judged by his contacts with the physicians. A third stated, in summary, that he had been aware that some laymen and physicians had attributed illness to insecticides, but that he had not found convincing evidence that insecticides play a major role in the causation of illness. Still another stated positively that such a problem did not exist in his county. However, one health officer had received many questions similar to those outlined above and, for this reason, was worried that the problem might be a pressing one. He was anxious that an

Table I. White School Attendance in One Delta County by School Year

School Year	Total Possible Pupil-Days of Attendance	Total Pupil-Days of Absence	Absentee Percentage
	A. Before Introduction of Modern Insecticides		
1943–44	713,592	50,041	7.0
1944–45	683,641	45,470	6.7
1945–46	689,927	51,151	7.4
1946–47	705,383	46,202	6.6
Total	2,792,543	192,864	6.91
	B. After Introduction of Modern Insecticides		
1947–48	707,584	54,270	7.7
1948–49	760,475	56,776	7.5
1949–50	786,756	57,256	7.3
1950–51	799,280	63,706	8.0
1951–52	801,319	58,528	7.3
Total	3,855,414	290,536	7.53
Grand total	6,647,957	483,400	7.26

investigation be launched to determine the true situation.

As the county agricultural agents are intimately concerned with insecticides and are in close touch with the farmers who use them, an expression of opinion from some of their offices was sought. They felt that the insecticides in current use had proved to be safe, although an occasional case of minor poisoning, usually associated with gross carelessness, had come to their attention.

Review of Existing Statistics

School Attendance Records Total school attendance records for all white children in one Delta county were computed and absentee figures were compared for the 1943–47 period, representing the years before the introduction of the modern agricultural insecticides, and the 1947–52 period, representing the time of widespread use of these compounds (Table I). The absenteeism figures were 6.91 and 7.53%, respectively.

No absolute explanation for the small increase in absence can be offered, although there was an increase in total enrollment during the later period and this increase was derived in part from a group of children who were of school age during the earlier period but did not attend school. When this group did enter school they were a relatively poor risk so far as absenteeism is concerned. Attention is called also to the more general sociological differences between the war and postwar periods, which the figures represent to a large degree. Both rates undoubtedly include absence based on socioeconomic factors as well as illness. A similar set of attendance data for Negro schools of the same county was found to be so incomplete and so inaccurate that it could not be used.

Mortality Reports From the annual statistical summary released by the state of Mississippi, mortality figures were obtained for the state as a whole, and for the following twelve Delta counties: Bolivar, Coahoma, Humphreys, Issaquena, Leflore, Quitman, Sharkey, Sunflower, Tallahatchie, Tate, Tunica, and Washington. Death rates for the Delta and for the state for certain diseases considered germane to this study in view of the previously outlined questions, were compared for 3 years prior to, and 4 years following, the introduction of modern insecticides into this area. These figures are shown in Table II.

Death rates decreased in a similar way for both the Delta area and the state as a whole in tuberculosis, dysentery, pneumonia, and deaths from all causes (crude death rate). The Delta showed a decline in death rate for diarrhea, while the state as a whole showed a slight increase. For cancer, the Delta showed no change, while the state as a whole showed an increase. Only in heart disease was there a pronounced rise for the Delta counties, and this was similar to the rise recorded for the state as a whole. Rates for certain diseases, particularly communicable diseases, show a higher figure for the Delta than for the state both before and after the introduction of modern insecticides. This is due in large part to the predominantly white population in other areas of the state as contrasted to the predominantly Negro population in the Delta with the differences in medical care, economic status, and other factors implicit in this distribution.

Table II. Average Yearly Death Rates per 100,000 Population from Selected Diseases

(For periods 1944–46 and 1947–50 for Delta area and entire state of Mississippi)

Cause of Death	Average Yearly Death Rates per 100,000 Population			
	Delta Area[a]		Entire State	
	1944–46	1947–50	1944–46	1947–50
Tuberculosis (all forms)	46.3	35.2	40.0	27.7
Dysentery (all forms)	3.9	3.1	2.3	1.8
Diarrhea	10.0	8.0	4.1	5.1
Cancer (including leukemia)	70.1	70.5	78.4	86.2
Heart diseases	141.3	189.4	170.0	213.7
Pneumonia (all forms)	27.4	26.9	34.2	28.0
Crude death rate (all causes)	952.0	921.1	936.7	882.5

[a] Values given for Delta area represent average for 12 counties.

Hospital Records Records of a hospital located on a large Delta plantation (Plantation A) were reviewed for the period of September 1938 through August 1949. This hospital is operated for the Negro tenant population of the plantation, which averages around 2500 persons.

Records of this hospital furnish a more complete account of illness on the plantation than might be expected, because tenants are hospitalized without cost to themselves and are freely admitted, inasmuch as the company operating the plantation feels it is economically sound to prevent serious illness by means of adequate early care. Furthermore, it is apparent that patients eligible for admission to this hospital are drawn from a population which undergoes a greater exposure to agricultural insecticides than the population from which admissions to most general hospitals are drawn.

Table III. Yearly Amount of Older and Modern Types of Insecticides Purchased for Use on Plantation A for 1945–52

Year	Older Types, Pounds	Modern Types, Pounds
1945	185,000	500 (DDT)
1946	200,000	0
1947	160,000	234,000
1948	0	195,000
1949	119,200	408,000
1950	0	369,800
1951	0	441,500 lb. 11,875 gal.
1952	0	449,950 lb. 19,525 gal.

September 1938 to August 1946 is used as the pre-modern-insecticide period, and September 1946 to August 1949 as the insecticide-exposure period, since 1947 marked the introduction of significant quantities of modern agricultural insecticides on this plantation (Table III). DDT had been used previously in the area as a residual insecticide applied to dwellings. The amount, however, is insignificant when compared to the bulk used for agricultural purposes, and is not considered in this study.

Admission rates for selected diseases are compared in Table IV. The same physician was in charge during the entire period (1938–49) covered by the table. It will be noted that the only disease group showing an increased admission rate in the 1946–49 period is the cardiac group of diseases. This probably reflects the rising trend in cardiac disease shown in all recent studies. All other diagnoses showed a lower rate in the latter period. The total admission rate for September 1951 to August 1952 under a different physician who used different criteria for hospitalization, attempting particularly to bring all maternity cases into the hospital, was 27.2 per hundred population.

Morbidity Surveys

Survey Of Workers This survey was done on Negro male laborers, chiefly tractor drivers, on Plantation A. Brief medical histories were taken and physical examinations were done on 83 individuals who were interviewed afterward by the same medically trained investigator at biweekly intervals from July 9 through September 24, a total of six interviews per man. Some individuals could not be reached every time. At each interview, the laborers were questioned closely and individually about any illness or symptoms occurring since the previous interview and about the type of work done since the last interview. Thus, it was possible at the end of the season to divide the group into an exposure group (occupational contact with insecticides at some time during the season), and a

Table IV. Admission Rates for Selected Diseases at Plantation A Hospital for Negro Tenants

Periods represent eras before and after introduction of modern insecticides

Diagnosis	September 1938–August 1946[a] Average annual admissions for specified diagnosis	September 1938–August 1946[a] Average annual admission rate per 100	September 1946–August 1949[b] Average annual admissions for specified diagnosis	September 1946–August 1949[b] Average annual admission rate per 100
Respiratory diseases	188	6.3	102	4.6
Genitourinary diseases	106	3.6	51	2.3
Gastrointestinal diseases	103	3.3	42	1.9
Cardiac diseases	35	1.2	36	1.6
Rheumatism and arthritis	23	0.8	15	0.7
Nervous disorders	18	0.6	10	0.5
Deficiency diseases	5	0.2	1	..
Metabolic diseases	1	..	1	..
Neoplastic diseases	1	..	3	..
Admissions, all causes	833	28.0	488	22.2

[a] Average annual tenant population 2979. [b] Average annual tenant population 2204.

Table V. Illness Reported in Season-Long Morbidity Survey of 83 Negro Male Farm Laborers on Plantation A

Symptom or Disease	Group with Occupational Exposure: No. times occurring	Group with Occupational Exposure: Rate[a] per interview week, %	Control Group: No. times occurring	Control Group: Rate[b] per interview week, %
Headache	18	4.6	16	6.0
Colds	16	4.1	14	5.2
Backache	15	3.9	10	3.7
Skin complaints	10	2.6	..	..
Gastrointestinal complaints	7	1.8	3	1.1
Rheumatism and arthritis	6	1.6	4	1.5
Cardiac complaints	5	1.3	..	..
Infections	4	1.0	4	1.6
Injuries	3	0.8	1	0.4
Hemorrhoids	3	0.8	2	0.8
Allergy	1	0.3	..	..
Toothache	1	0.3	..	..
Miscellaneous	7	1.8	6	2.2
Total morbidity	96	24.9	60	22.4

[a] Based on 386 interview weeks. [b] Based on 268 interview weeks.

control group (no occupational exposure during the interview season); these groups numbered, respectively, 48 and 35 individuals. Information was obtained for 386 interview weeks on the exposure group and 268 interview weeks on the control group. Total illnesses numbered 96 (24.9 per hundred interview weeks) for the exposure group, and 60 (22.4 per hundred interview weeks) for the control group. This is not a statistically significant difference (p = 0.4). These illnesses were of the type expected from any population in a general morbidity survey. Signs and symptoms usually associated with insecticide intoxication were not recognized except as described below. This study is summarized in Table V.

An interesting sidelight observed at the initial examination was the high incidence of elevated blood pressure, usually without associated symptoms. Twenty-seven of the 83 (33%) had pressures above 145 systolic or 90 diastolic. These were found to be distributed as follows: 15 in the exposure group (31% incidence), and 12 in the control group (34% incidence), indicating that the two groups were comparable statistically.

The only diagnosis showing a marked difference in the control and exposure group was the frequency of skin complaints. When the records were reviewed, it was noted that this was accounted for by three individuals who complained repeatedly. One had a chronic fungus infection which had been present since about 1918. The other cases involved irritation by insecticides, and are as follows:

One laborer had a chronically infected ulcerated area on one shin which he irritated by spilling some poison concentrate (probably dieldrin) on it.

A worker spilled a dieldrin concentrate on his left leg and did not wash it off or remove it in any way for several hours. About one week later the skin broke down and blister formations and serious exudation occurred. The skin healed slowly under medical supervision, leaving a depigmented area. The role played by the insecticide and that played by the solvent are uncertain in this case.

Other illnesses which could be related directly to insecticides are as follows:

A tractor driver putting out spray of undetermined type (possibly dieldrin) on a windy day had some blown into his left eye. The eye was treated medically, but remained erythematous and burned for several weeks. Recovery was complete.

A tractor driver putting out both spray and dust of an undetermined composition on a windy day complained of burning in the chest for several days thereafter. Examination of the chest was negative. Recovery was apparently complete.

Survey of General Population

The second type of morbidity survey was carried out at another large Delta plantation (Plantation B). An initial rapid morbidity survey was carried out on the personnel living on this plantation, information being obtained on 639 people. This survey was accomplished during the latter part of July 1952, when the use of insecticides was at a minimum because of a long period of hot, dry weather. The survey data concerned only illnesses for the week prior to the interview in order to hold the memory loss factor to a minimum. Results of this survey are recorded in Table VI.

A similar, follow-up survey was carried out in September after the population had been exposed to atmospheric concentrations of insecticides from airplane dusting of the fields. The experience

Table VI. Results of Morbidity Surveys on Plantation B

Illnesses within Past Week	July surveys[a] Number	July surveys[a] %	September Surveys[b] Number	September Surveys[b] %
Colds and/or sore throats	61	9.6	20	3.4
Headaches	34	5.3	7	1.2
Gastrointestinal complaints	28	4.4	15	2.5
Arthritis and rheumatism	7	1.1	11	1.9
Cardiovascular disease	15	2.3	10	1.7
Infections, including "chills and fever"	7	1.1	5	0.8
Obstetrical and gynecological complaints	7	1.1	5	0.8
Toothaches	6	0.9	2	0.3
Backache	5	0.8	4	0.7
Nervous conditions	4	0.6	3	0.5
Injuries	4	0.6	4	0.8
Asthma	2	0.3	1	0.2
Skin rash	2	0.3	0	0
Miscellaneous	27	4.2	11	1.9
TOTAL	209	32.7	99	16.7

[a] Based on 639 subjects interviewed.
[b] Based on 592 subjects interviewed (3 dead, 44 others not contacted).

of this season was not typical, however, as a total of only about 25,000 pounds of dusts was used as opposed to approximately 250,000 pounds during 1951. This dust, in 1952, was applied to about one third of the cotton by seven applications during August, and that chiefly in the sparsely populated or unpopulated areas. A small amount of defoliant (calcium cyanamide) had also been applied in September to some of the fields which were scheduled for machine picking. Comparisons of the results of this survey with those of the original survey are indicated in Table VI.

Only 592 (93%) of the original 639 individuals were contacted on the follow-up survey. Three of the original group had died, and attempts to reach 44 others were unsuccessful.

Information on the cause of death of the three individuals who died was scanty:

A 36-year old Negro housewife (G.R.) and field worker died suddenly and unexpectedly in July. She had expressed no complaints during the initial interview. The doctor who saw her at the time of death expressed the opinion that she had died of a heart attack.

A 70-year-old Negro man (S.O.) died in August after a prolonged illness. At the time of the initial interview he was under medical care for heart and kidney trouble and had ascites.

A 70-year-old Negro man (G.M.) died in August after a prolonged illness characterized by abdominal pain and emaciation. At the time of the initial interview he was under medical care but no diagnosis had been expressed. Malignancy appears to be the most likely explanation.

The total morbidity was approximately half that of the original survey. This decline in the second survey was accounted for mainly by the respiratory group, headache group, gastroenteritis group, and miscellaneous group of diseases. The reduction in headaches was probably due to cooler weather, since many of the original attacks occurred during the middle of the day in persons doing physical labor when environmental temperatures usually exceeded 100° F. The decrease in gastroenteritis is typical of the seasonal incidence of the disease. An explanation for the decline in the other two groups is not so apparent. Arthritic complaints increased slightly, as could be expected from the changing weather (onset of lower temperatures). Finally, a lower rate would have been obtained in the second survey, even if all the subjects who were not available for questioning at that time had, in fact, been sick.

Reports of Poisoning Cases

It was anticipated that a certain number of cases of acute poisoning would be uncovered because of the widespread use of toxic compounds by a group of inadequately trained and sometimes careless people. The limited number of such cases found is rather surprising in view of the publicity given to the request for complete reporting. In addition to the four cases in the Plantation A survey, the following cases were discovered through other sources:

One case of acute mild aldrin poisoning occurred in a Negro tractor driver who tried to clean clogged spray nozzles by blowing through them. His face, arms, and legs were thoroughly saturated, and he probably inhaled and swallowed small amounts in addition. Shortly thereafter he developed headache, nausea, burning of the skin, and jitteriness. He was treated with phenobarbital and recovered completely within 48 hours.

Two cases of nausea, vomiting, and weakness occurred in a house where window fans were operating while a plane was dusting a field directly behind the house with 1% parathion dust. Onset of symptoms occurred within 30 minutes of the time the plane began putting out dust. One of these individuals appeared completely recovered within 6 hours, but the other continued to complain of weakness for several days.

No other cases which seemed to have any reasonable connection with insecticides were reported.

Summary and Conclusions

A survey of local expert opinion in the Yazoo-Mississippi Delta area showed that local county agricultural agents who were in close touch with farmers and four county health officers who were in close communication with physicians did not consider that there was any evidence in the general population of widespread chronic intoxication by insecticides. A fifth county health officer felt that the problem might be a pressing one and should be investigated. The county agents were aware of isolated instances of minor poisoning.

A comparison of the total school attendance records for all white children in one Delta county for the 1943–47 period, representing the years before the introduction of the modern agricultural insecticides, with those for the 1947–52 period, representing the time of widespread use of these compounds, showed that the absentee figures were slightly higher for the latter period (7.53%) than for the former (6.91%).

Mortality figures for 1944–46 and for 1947–50 were obtained for the entire state of Mississippi, and an average mortality rate was calculated for twelve of the Delta counties for the same periods. Of the seven causes of death studied, only heart disease showed a pronounced rise for the Delta counties during the modern-insecticide era, as compared with the earlier period, and this was similar to the rise recorded for the state as a whole. These mortality figures indicated a general improvement in health conditions in the Mississippi Delta as well as the entire state.

Morbidity records for a Delta plantation hospital showed a lower rate for all diagnoses except cardiac diseases in the 1946–49 period than in the 1938–46 period.

A morbidity survey on 48 exposed and 35 unexposed laborers showed no marked difference between the two groups except in the frequency of skin complaints. Part of these complaints were caused by fungus disease and part by direct, excessive exposure to insecticides.

A morbidity survey on 639 unselected people living on a large plantation was carried out in July when the use of insecticides was still at a minimum, and was repeated in September after the population had been exposed to atmospheric concentrations of insecticides from airplane dusting of the fields. The total morbidity in September was approximately half that of the original survey.

Seven cases of acute insecticide poisoning were found in the Delta area during the summer of 1952.

No one of the studies reported above can be considered absolutely conclusive. There are variables other than insecticide usage which cannot be ruled out as contributing factors in these studies, especially in the comparison of morbidity or mortality rates for two different chronological periods. However, in all the studies reported, no evidence could be found that pesticides were the direct or indirect cause of any chronic disease, nor a contributing cause in diseases generally recognized as having other etiologies.

A definite, though not extensive, problem exists in relationship to the widespread use of toxic compounds by a class of inadequately trained and sometimes careless people. This problem is in the nature of acute, often mild, intoxication due to excessive exposure which is frequently associated with gross carelessness. Improvement in this aspect may be expected on a long-term basis in view of the intensive and extensive educational program being carried on by physicians, county agricultural agents, agents of insecticide-producing companies, agricultural experiment station staffs, and other interested people.

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