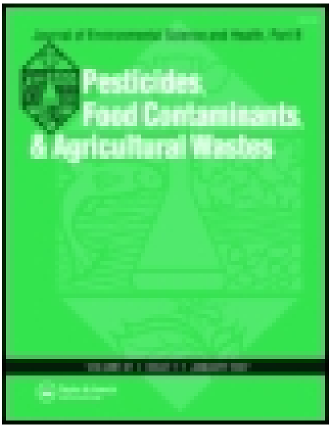


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# Pesticide poisonings reported by Florida citrus fieldworkers

Jack Griffith [a b], Robert C. Duncan [a] & Janet Konefal [a]

[a] Division of Biostatistics, University of Miami School of Medicine, D8-4, POB 016960, Miami, Florida, 33101

[b] Health Effects Research Laboratory, U.S. Environmental Protection Agency, MD-55A, Research Triangle Park, North Carolina, 27711

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# PESTICIDE POISONINGS REPORTED BY FLORIDA CITRUS FIELDWORKERS

Key Words: Pesticide Poisonings, Fieldworkers, Citrus

Jack Griffith,* Robert C. Duncan, and Janet Konefal

Division of Biostatistics, University of Miami School of Medicine, D8-4, POB 016960, Miami, Florida 33101



## ABSTRACT

In a 1981 survey of 1811 Florida citrus fieldworkers, 25 pesticide related poisoning incidents involving 29 fieldworkers were reported. Suspected poisonings were categorized into possible and confirmed poisonings, and from these reports it was possible to project an estimated 438 possible poisonings, and 73 confirmed poisonings among all citrus fieldworkers. Confirmed pesticide poisonings were developed into an incidence rate of 34 poisonings per 10,000 permanent and semi-permanent fieldworkers. The number of possible and confirmed poisonings, for all fieldworkers, was then developed into an incidence rate of 160 poisonings per 10,000 fieldworkers.

*Present address: U.S. Environmental Protection Agency, Health Effects Research Laboratory, MD-55A, Research Triangle Park, North Carolina 27711.



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## INTRODUCTION

Worker poisonings related to occupational exposure to pesticides are considered to be a significant hazard to agricultural workers (Popendorf et al. 1976; Davies et al. 1976; and Kilgore et al. 1977). Early symptoms of pesticide poisoning include eye and skin irritation, headache, nausea, vomiting, sweating, diarrhea, and abdominal pain. In the latter stages of more severe poisonings, symptoms may progress from difficult and labored breathing to loss of muscle control, convulsions, and possibly death (Tabershaw and Cooper, 1966; Morgan, 1976; Davies et al. 1980).

Fieldworker exposure is closely tied to the job since applicators, mixers and loaders are believed to experience more exposure than harvest workers (Griffith and Duncan, 1985a; Davies et al. 1980; and Kilgore and Akesson, 1980). Davies et al. (1976) have characterized occupational pesticide poisonings into applicator and mixer-loader poisonings, and picker or thinner poisonings. In the former, illness is usually severe, occurring among small numbers of workers, and results from direct exposure to the concentrate through accidental exposure, or misuse. Picker poisonings result from contact with pesticide residues on the foliage, culminating in less severe illness, among larger numbers of workers. Absorption of pesticide residues may occur through respiration, and ingestion, however, the primary means of absorption is dermal (Batchelor et al. 1954; and Culver et al.

1956). In fact, Wolfe (1973) has estimated that more than 97% of a pesticide, in an exposure situation, is deposited on the skin.

Several studies have been reported over the years that reflect pesticide exposure, absorption, and many of the health effects described above. For example, Quinby and Lemmon (1958) reported five outbreaks of parathion poisoning among apple thinners and orchard irrigators in central Washington state between 1952 and 1957. Milby et al. (1964) reported on 94 clinically ill peach orchard workers exposed to parathion in 1963. Reich et al. (1968) reported on 24 occupationally related pesticide poisonings associated with OP's in Florida, from 1964 through 1967. In 1970, 20 Florida fieldworkers were hospitalized after entering a field which had been sprayed the previous day with parathion (Davies et al. 1976). Spear et al. (1975) reported on 35 citrus harvesters who were hospitalized following exposure to parathion residues near McFarland, California, in 1970. Bogden et al. (1975) reported on 14 migrant workers in New Jersey who were experiencing health symptoms following OP exposure. Peoples and Maddy (1978) reported on 118 fieldworkers who had become ill harvesting grapes near Madera, California, in September 1976. Despite these anecdotal reports, it has been suggested that the magnitude of the poisoning problem among fieldworkers is unknown (Davies et al. 1976; Kilgore and Akesson, 1980; and Popendorf and Leffingwell, 1982). With the exception of California (and its mandatory Doctor's First Report of Illness) there are no states with viable pesticide poisoning reporting systems. Consequently, reported incidents of worker poisonings are relatively rare (Spear et al. 1975). In fact, several researchers feel that worker poisoning incidents are underreported (Howett and Moore, 1975; Kahn, 1976; Zweig et al. 1980; and Popendorf and Leffingwell, 1982), due to the reluctance of a worker to seek, or an inability to secure, medical care for economic or other reasons.

The Environmental Protection Agency (EPA) has attempted to gather national figures on pesticide poisonings through its Pesticide Incident Monitoring System (PIMS). However, the system is voluntary, and reporting has been sporadic over the years. To our knowledge, there has been no attempt to project numbers of poisonings, or incidence rates per numbers of fieldworkers, from this system.

Although reporting of farmworker pesticide poisonings in California has been more informative than that of other states since 1973 (Kilgore and Akesson, 1980), incidence rates, based on the number of cases per number of exposed workers, have not been developed. For example, Zweig et al. (1980) reported on 182 fieldworker pesticide poisoning cases from the Doctor's First Reports of 1977. While it was possible to classify the cases experienced by the fieldworkers as systemic illnesses, and/or skin or eye injuries, due to the lack of denominator data (number of workers exposed), it was impossible to determine the magnitude of the poisoning problem experienced by California fieldworkers from the data presented. The lack of such denominator data may reflect the difficulty in characterizing the population at risk, as reported by the Task Group on Occupational Exposure to Pesticides (Milby et al. 1974). However, based on Doctor's First Reports, there can be little doubt that more occupationally related poisonings are reported in California than in any other state.



It has been suggested that the occurrence of pesticide related poisonings in California may be due to climatic conditions, and the type and amount of concentrate applied to the crops (Davies et al. 1976), and may not be representative of other states. This position is supported by California data reported by Speår et al. (1975). In 26 reported incidents, from July 1949, to August 1973, involving approximately 616 ill persons, 65% occurred during July through September (the dry season), and involved parathion 81% of the time. Eighteen of the 26 incidents (69.2%) involved citrus crops, and of those, 89% were associated with parathion. Interestingly, parathion is no longer used to any extent on citrus in Texas, and Arizona, or in Florida (Griffith and Duncan, 1983) where picker poisonings are rarely observed (Davies et al. 1976).

The purpose of this paper is: 1) to present data on physician-diagnosed pesticide poisonings reported from a probability sample of Florida citrus fieldworkers; and 2) to establish a worker reported incidence rate for pesticide poisonings among Florida citrus fieldworkers.

## METHODS

For the purpose of this study, we are defining a citrus worker as any individual performing physical labor in a grove, e.g., the owner or operator of the grove, his family, permanent employees, migrant laborers, and seasonal farm labor including children less than 16 years of age. The most recent available data show that Florida has as many as 26,000 persons employed in citrus harvesting, and 7,000 to 10,000 in grove caretaking.* The practice of pesticide application in Florida is somewhat variable. Most application takes place from May through October, however, among some varieties of citrus, further application occurs in February and March. In addition, diseases such as scab and melanose are controlled in Florida with oil and/or Benlate in June or July, depending on the time of bloom on the tree, with another spraying on dormant plants in February (Knapp, 1981). Among the pesticides used on Florida citrus are: aldicarb; benomyl; bromacil; captafol; carbophenothion; chlorobenzilate; copper hydroxide; copper salts; copper sulfate; dicofol; diuron; diuron and bromacil; ethion; glyphosate; paraquat CL; simazine; sulfur; zineb; and proparagite (Griffith and Duncan, 1983).

In order to clearly define the population at risk (population of inference), we developed estimates for two subpopulations: the permanent and semi-permanent workers concerned primarily with

*Florida Department of Labor, 1980.

caretaking, i.e., grove maintenance and pesticide application, and the more transient group (pickers) concerned primarily with harvesting fruit.

*The sample design is a two stage sample with the first stage* (grower within stratum) being selected with equal probability, and the second stage (fieldworkers) being selected randomly within selected first-stage units. The first-stage sample has been described elsewhere (Griffith and Duncan, 1985b) and will not be repeated here. The two stage design was chosen since growers were the only reliable access to large numbers of workers in the actual work place. Sample size had more to do with logistics and resources than estimates of precision. It was anticipated in planning that a five per cent sample of all growers would produce about 3200 citrus fieldworkers. During the grower interview, an aggregate list of all fieldworkers employed by that grower was obtained, and from that listing, workers were randomly selected. In this study we interviewed 1811 fieldworkers, of whom 1200 were permanent or semi-permanent workers and 611 were pickers. Due to costs and time constraints, an upper limit of no more than 17 workers per grower was set, and alternates were chosen to replace absent workers. In an attempt to reduce non-response bias, the grower and fellow workers were questioned to ascertain information on the nature of the selected workers absence, i.e., was the absence due to a pesticide related illness. Attempts were made to contact the absent worker, but often, no address or telephone listing was available, and it was necessary to rely on information provided by the grower and/or fellow workers. Since the workers did not know in advance of the interview that the survey team would be on site, we have no reason to believe anyone missed work to escape the interview. Furthermore, each participant was provided an incentive (financial) to encourage his or her participation in the study.

In Florida, 30% of the citrus groves are managed by the owners, while 70% are managed by a contract manager or management company (Griffith and Duncan, 1983). For the owner-operated groves, the total number of workers in the State was estimated by finding the average number of workers per grower and multiplying by the total number of growers who operate their own groves. When a grower who retained a manager was identified in the sample, the manager was asked to identify other growers in the sample for whom he also managed. The ratio of the work force employed by the manager was then formed and inflated by the proportion of growers represented in the sample. From these data, the average number of permanent and semi-permanent workers per grower was calculated.

The estimation of the yearly total of pickers in Florida citrus required a different strategy, since there was no listing available on citrus workers, by name or address from any source, e.g., government agencies, migrant health clinics, or farmworker organizations. In fact, the Florida Rural Legal Services, Inc., has written:*

> "...Experts agree that it is impossible to determine the exact number and precise location of the south Florida farmworker population. Many farmworkers lead a transient lifestyle, and their homes are often located in remote rural areas, invisible to official eyes..."



Although the point of initial survey contact was through a sampled grower, we recognized that pickers are not "attached" to a particular grower or manager as are the semi-permanent and permanent workers. Rather, they usually work in crews under the supervision of a crew chief who has contracted the work force to the grove. The pickers go from grove to grove as crop and weather conditions permit. In addition to getting a listing of workers from each crew chief identified by the sampled growers, we gathered additional information on the personal characteristics of crew members, and most importantly on the duration of the time spent in the particular grove which was the site of the interview. From these data, the average number of growers on whose groves the pickers worked during a season could be estimated, as well as the average number of workers per crew. Then, using the total number of growers in the state (Griffith and Duncan, 1983), the total number of pickers per season could be estimated.

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**Grannis*, K. *and* Zacovic, B., Danger in the Field: The Myth of Pesticide Safety., Florida Rural Legal Services, Inc. May, 1980.

The combined estimates of the number of permanent and semi-permanent workers, and pickers estimated to work in Florida citrus per year are shown in Table 1. The standard errors include the fact that population sizes are estimates, and are based on the principle of the propagation of error. These figures compare favorably with official estimates* of citrus fieldworkers and were used to estimate age-sex-race specific population totals shown in Tables 2 and 3 based on the observed age, sex, race distributions.

The initial identification of a potential poisoning was based on the workers reporting an incident in response to the following question: Are you aware of any pesticide related incidents among your family or your fellow workers within the past 12 months? An incident was defined as the exposure of the individual, family member or fellow worker to a pesticide resulting in any, or all of the symptoms noted in the introduction. To examine the worker-reported incidents closely, an extensive analysis was made of each report. Physicians and hospitals were contacted, medical records and diagnoses were reviewed, and the person reporting the incidents interviewed. A physician diagnosis and/or laboratory confirmation was necessary to confirm an incident as a pesticide poisoning.

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*Florida Department of Labor and Employment Security, 1980.

TABLE 1

Estimated Total Number of Fieldworkers in Florida Citrus Per Year

| | Permanent and Semi-Permanent | Pickers | Total |
|---|---|---|---|
| Total | 11,939 | 21,237 | 33,176 |
| Standard Error | 3,246.2 | 2,728.3 | 4,240.5 |
| Confidence Interval (95%) | 5,447-18,431 | 15,780-26,694 | 24,695-41,657 |



Urine samples were collected on 597 adult fieldworkers and 29 children less than 17 years of age employed in the Florida citrus industry and monitored for alkylphosphate residues. The collection procedure, method of analysis, and results of residue values found among the adults are reported elsewhere (Griffith and Duncan, 1985a) and will not be discussed here. In this paper we will present the urinary alkyl phosphate mean levels for the children as determined by the method of Lores and Bradway (1977) and performed by the staff of the Division of Chemical Epidemiology, University of Miami School of Medicine.

## RESULTS

Through careful observation of the medical and exposure history it was possible to separate the 25 reported incidents

TABLE 2

Estimated Distribution of Florida Citrus Permanent and Semi-Permanent Fieldworkers by Age, Sex and Race

| | White N=7,633 | | Black N=3,731 | | Other N=578 | | Total[a] N=11,942 |
|---|---|---|---|---|---|---|---|
| Ages | Male | Female | Male | Female | Male | Female | |
| 12-17 | 219 | 40 | 20 | 0 | 0 | .0 | 279 |
| 18-24 | 1,244 | 109 | 338 | 10 | 209 | 10 | 1,920 |
| 25-34 | 1,602 | 119 | 736 | 50 | 169 | 0 | 2,676 |
| 35-44 | 1,244 | 139 | 677 | 0 | 40 | 0 | 2,100 |
| 45-54 | 1,413 | 80 | 736 | 30 | 90 | 0 | 2,349 |
| 55-64 | 1,035 | 40 | 686 | 30 | 30 | 0 | 1,821 |
| 65-74 | 229 | 0 | 358 | 0 | 0 | 0 | 587 |
| 75 | 70 | 30 | 50 | 10 | 0 | 0 | 160 |
| Unknown | 20 | 0 | 0 | 0 | 30 | 0 | 50 |
| Total | 7,076 | 557 | 3,601 | 130 | 568 | 10 | 11,942 |

[a]Due to round-off, the tabulated total 11,942 differs slightly from the estimated total 11,939.



(involving 29 people) into two groups (possibles and confirmed). Fourteen of the 29 cases reportedly involved a pesticide, while 11 clearly involved reentry, however, there were no laboratory tests, nor diagnoses made. Therefore, these cases were classified as possible. There were four cases confirmed by physician

TABLE 3

Estimated Distribution of Pickers by Age, Sex and Race

| | White N=9,107 | | Black N=11,053 | | Other N=1,078 | | Total[a] N=21,238 |
|---|---|---|---|---|---|---|---|
| Ages | Male | Female | Male | Female | Male | Female | |
| 12-17 | 695 | 278 | 174 | 104 | 104 | 0 | 1,355 |
| 18-24 | 2,120 | 487 | 1,634 | 452 | 382 | 70 | 5,145 |
| 25-34 | 2,120 | 487 | 2,085 | 313 | 243 | 0 | 5,248 |
| 35-44 | 1,251 | 313 | 2,190 | 452 | 139 | 35 | 4,380 |
| 45-54 | 730 | 104 | 1,807 | 313 | 70 | 0 | 3,024 |
| 55-64 | 452 | 35 | 973 | 104 | 35 | 0 | 1,599 |
| 65-74 | 35 | 0 | 382 | 0 | 0 | 0 | 417 |
| 75 | 0 | 0 | 0 | 35 | 0 | 0 | 35 |
| Unknown | 0 | 0 | 35 | 0 | 0 | 0 | 35 |
| Total | 7,403 | 1,704 | 9,280 | 1,773 | 973 | 105 | 21,238 |

[a]Due to round-off, the tabulated total 21,238 differs slightly from the estimated total 21,237.



diagnosis and/or laboratory confirmation (Table 4). The clothing worn by the workers was fairly standardized. Permanent and semi-permanent workers wore leather shoes or boots, long pants, short sleeved or no shirts, while the pickers wore essentially the same articles of clothing, except that pickers wore long

TABLE 4

Fieldworker Reported Pesticide Poisonings by Chemical, Age, Sex and Symptom

| Pesticide | | Sex | Age | Health Effects | Occupation |
|---|---|---|---|---|---|
| (1) | diuron, bromacil and paraquat[b] | F | 20 | eye irritation | applicator[a] |
| (2) | dicofol | M | 65 | nausea and | applicator[a] |
| | | M | 59 | vomiting | applicator[a] |
| (3) | aldicarb | M | 20 | nausea/dizziness confusion | applicator[a/c] |
| (4) | unknown | M | 22 | skin/eye irritation | applicator |
| (5) | diuron and bromacil | M | 57 | skin/eye irritation | applicator |
| (6) | dicofol | M | 19 | nausea/weakness | applicator |
| (7) | sulfur | M | 29 | skin/eye irritation | mixer |
| (8) | proparagite | M | 48 | skin rash/itching | applicator |
| (9) | captafol | F | 39 | skin/eye irritation | mixer |
| (10) | unknown | M | 17 | burning/peeling of skin | applicator |
| | sulfur | M | 17 | eye irritation | picker |
| (11) | unknown | F | 21 | headache | picker |
| (12) | unknown | M | 29 | chest pain | picker |
| (13) | unknown | M | unk | swelling/skin rash | fieldworker |
| (14) | unknown | M | 43 | burning eyes | picker |
| | unknown | M | 38 | burning eyes | picker |
| | unknown | M | 19 | burning eyes | picker |
| (15) | unknown | M | 53 | skin irritation | picker |
| (16) | unknown | F | unk | skin/eye irritation | picker |
| (17) | unknown | M | 53 | skin irritation | picker |
| (18) | unknown | F | 38 | skin/eye irritation | picker |
| (19) | unknown | M | 24 | skin irritation | picker |
| (20) | unknown | M | 58 | skin irritation | picker |
| (21) | unknown | M | 42 | skin/eye irritation | picker |
| (22) | unknown | M | 22 | skin/eye irritation | picker |
| (23) | unknown | M | 18 | skin irritation | picker |
| (24) | unknown | M | unk | skin irritation | grasscutter |
| (25) | unknown | M | 46 | skin/eye irritation | irrigator |

[a]Confirmed poisonings.
[b]Restricted use pesticide.
[c]Hospitalized.

sleeved shirts with protective padding surrounding the arm from wrist to elbow, with heavy leather/cotton gloves. Case histories are shown below:

(1) A 20 year old white female was exposed to diuron, bromacil and paraquat while at work. She was employed as a tractor driver and was exposed by spray drift during application. She was seen in the local hospital emergency room, where her eyes were lavaged, and she was released. No laboratory work was done. Her condition was diagnosed as "chemical irritation to both eyes". The worker did not seek follow-up care, and missed no additional time from work. Grove personnel described the incident as "minor", requiring no follow-up, and stated that the worker wore no goggles, respirator, face shield, mask or hat.

(2) Two male workers ages 59 and 65 were involved in the application of dicofol, and experienced nausea and vomiting. Illness as a result of "contact pesticides" was the diagnoses. The workers were not hospitalized. The 59 year old worker drove a pesticide supply truck and the 65 year old drove a spray rig. They wore no goggles, respirator, mask or face shield, however, the spray rig had a canopy for protection. Both workers were under the supervision of a certified applicator at the time of the incident. The men received two weeks leave, and returned to work, however, they no longer work with pesticides.

(3) The worker was a 20 year old white male exposed while applying the pesticide aldicarb (Temik) from a ground rig appli-

cator. He wore no face shield, mask, respirator, hat or goggles while applying the pesticide. The physician diagnosis was "pesticide Temik poisoning." The worker described as being nauseous, dizzy and somewhat confused was hospitalized. Laboratory results indicated significant cholinesterase depression.

(4) A fieldworker reported an incident occurring to a fellow worker, identified as a 22 year old male, applying an unknown pesticide who was involved in an accidental spill. The worker was reported to have inhaled the chemical and experienced skin and eye irration. The worker reportedly was hospitalized, however, there were no details available on the worker's name, address, place of employment, or treatment facility.

(5) A 57 year old black male reported that he was exposed to diuron and bromacil while applying the chemicals by ground rig applicator. He reported skin and eye irritation, and although he received medical attention he was unable to recall the name or address of the attending physician. The worker was not hospitalized.

(6) A fieldworker reported that a fellow worker, a male, approximately 19 years of age was exposed while applying dicofol from a ground rig sprayer. The worker was not wearing protective clothing or equipment. He experienced nausea and general weakness, and was seen by a physician the day after the exposure. The worker was not hospitalized. The physician treating the patient said there was a "good possibility" that the illness was due to

pesticides, however, he could not rule out other causes since the worker had been under emotional stress and that heat in the field may have accounted for the illness.

(7) A 29 year old black male fieldworker reported being exposed while mixing granulated sulfur on the job. The worker reported inhaling some of the sulfur and experiencing skin and eye irritation. He was not wearing goggles, mask, or respirator at the time of the exposure. The worker was not hospitalized, and was unable to identify the name or address of the treating physician.

(8) A 48 year old white male, employed as a field hand, was exposed to proparagite while mixing and applying the insecticide to citrus groves. He experienced skin rash and subsequent itching and swelling on the hands and lips. A physician diagnosed the condition as "contact chemical dermatitis, possibly pesticide related". No laboratory tests were completed. Subsequently the worker had an eruption on the right thigh, a macula which ran down toward the knee. On a third visit to the physician he had a swelling around the lips. The physician stated that it "looked like herpes simplex or possibly an allergic reaction to something". He stated that at no time could he say that any of the worker's conditions were directly pesticide related. According to the grove owner/manager the pesticide applicators are enclosed in an air conditioned cab and wear long sleeved shirts and overalls as protective clothing.

(9) A 39 year old white female worker reported being exposed to captafol, as a result of an accidental spill while mixing the chemical on the job. The worker experienced skin and eye irritation, however, she was not seen by a physician. She wore no protective equipment, e.g., goggles, or respirator. There was no medical or exposure history available for review.

(10) A 17 year old black male picker reported being exposed to sulfur, while picking in a citrus grove, and experiencing eye irritation. He received no treatment at the grove, and did not consult a physician. The same worker reported that a 17 year old male had been exposed while applying an unknown pesticide by ground rig applicator. The worker was reported to have experienced a burning and peeling of the skin, however, he did not see a physician. Both workers were said to have worn standard picker clothing.

(11) A 21 year old black female picker reported inhaling an unknown chemical as a result of aerial spray drift while working in a grove. She was wearing standard picker clothing at the time of exposure. The worker experienced a headache but did not seek treatment from a physician.

(12) A 29 year old black male, dressed in standard picker clothing, reported being exposed by skin and mouth to an unknown pesticide he described as "black dust", while picking in a citrus grove. The worker complained of chest pains, however, he did not consult a physician.

(13) A fieldworker reported that a fellow worker, a male, experienced swelling and skin rash after exposure to a pesticide. The pesticide involved, type of clothing worn, or the exposure or treatment history were not known.

(14) A black male, 43 years old, reported an incident where he, and a 38 year old man, and the man's 19 year old son were all exposed to an unknown pesticide while harvesting. The workers were wearing standard picker clothing. All three men experienced burning eyes, however, they were not treated by a physician.

Incidents 11-25 involved citrus pickers about whom little information could be gathered. No picker reported seeing a physician or seeking other medical treatment.

All confirmed pesticide poisonings were reported among the permanent and semi-permanent fieldworkers involved in the application of pesticides. There are an estimated 40 confirmed pesticide poisonings per year, and an incidence rate of 34 poisonings per 10,000 permanent and semi-permanent fieldworkers (Table 5).

There were no confirmed pesticide poisonings among the pickers. However, there are an estimated 626 possible pesticide poisonings per year, and an incidence rate of 295 poisonings per 10,000 pickers/field hands (Table 6).

When all fieldworkers are considered, there are an estimated 73 confirmed, and 458 possible pesticide poisonings per year, and a combined incidence rate of 160 poisonings per 10,000 citrus fieldworkers (Table 7).

TABLE 5

Estimated Number of Confirmed and Possible Pesticide Poisonings, and the Incidence Rates for Permanent and Semi-Permanent Citrus Workers

| | Permanent and Semi-Permanent Fieldworkers (n = 1200; N = 11,939) | | | | |
|---|---|---|---|---|---|
| Poisoning Category | Obs. | Est. | Std. Er.[a] | CI (95%) | Rate/ 10,000 |
| Possible | 7 | 70 | 21 | 8 - 131 | 59 |
| Confirmed[b] | 4 | 40 | 22 | 4[c] - 82 | 34 |
| Possible & Confirmed | 11 | 109 | 43 | 25 - 194 | 91 |

[a]All standard errors include the fact that population sizes are estimates.
[b]A confirmed poisoning must have a physician diagnosis and/or laboratory confirmation.
[c]Computed lower bound less than zero, so observed value was substituted for the lower bound.

TABLE 6

Estimated Number of Confirmed and Possible Pesticide Poisonings, and the Incidence Rate for Citrus Pickers

| | Citrus Pickers (n = 611; N = 21,237) | | | | |
|---|---|---|---|---|---|
| Poisoning Category | Obs. | Est. | Std. Er.[a] | CI(95%) | Rate/ 10,000 |
| Possible | 18 | 626 | 164 | 304 - 948 | 295 |
| Confirmed[b] | 0 | - | - | - | - |

[a]All standard errors include the fact that population sizes are estimates.
[b]A confirmed poisoning must have a physician diagnosis and/or laboratory confirmation.

TABLE 7

Estimated Number of Confirmed and Possible Pesticide Poisonings, and the Incidence Rates for all Citrus Fieldworkers

| | Fieldworkers Population (n = 1,811; N = 33,176) | | | | |
|---|---|---|---|---|---|
| Poisoning Category | Obs. | Est. | Std. Er.[a] | CI (95%) | Rate/ 10,000 |
| Possible | 25 | 458 | 106 | 250 - 666 | 138 |
| Confirmed[b] | 4 | 73 | 37 | 4 - 145 | 22 |
| Possible & Confirmed | 29 | 531 | 117 | 302 - 760 | 160 |

[a]All standard errors include the fact that population size are estimates.
[b]A confirmed poisoning must have a physician diagnoses and/or laboratory confirmation.



## DISCUSSION

In this paper we were able to characterize by age, sex, and race a major agricultural work force, and to establish for the first time an estimate of fieldworker reported pesticide poisonings in the Florida citrus industry. Although the estimated number (33,176) of citrus fieldworkers shown in Table 1 was derived from a statistical sample, the number is very close to estimates (33,000 - 36,000) published by the Florida Department of Labor*, and lends credence to the reliability of the estimated numbers of pesticide poisonings reported in this paper.

*Florida Department of Labor and Employment Security, 1980.

White workers compose a majority of the permanent and semi-permanent workers, and a minority of the picker group. Although a large majority (60%) of workers, in both groups, are between 25 and 54 years of age, among pickers, the percentage of workers less than 25 years of age is two fold greater than among permanent or semi-permanent workers. Less than six per cent of the permanent and semi-permanent work force are women, while almost 17% of the picker group are women. A key finding must be the estimated 1634 children less than 17 years of age employed as fieldworkers. Children pose a rather special problem, as set forth by the U.S. Department of Labor (1979) in setting reentry standards for 10 and 11 year old strawberry pickers. There can be little doubt that children, working in citrus fields, are absorbing pesticide residues. When we analyzed for urinary alkyl phosphate residue values we found dimethylphosphate (DMP), diethylphosphate (DEP), and diethylthiophosphate (DETP) mean values of 0.02, 0.05, and 0.02 ppm respectively in the urine of the children, however, these values are lower than those found in adult workers (Griffith and Duncan, 1985a).

The data presented in this paper indicate that citrus field-workers reporting a pesticide poisoning experienced many of the early symptoms described by Tabershaw and Cooper (1966); Morgan (1976); and Davies et al. (1980). One worker required hospitalization, and seven others were treated by a physician and released. All of the workers actually diagnosed as having a pesticide related poisoning were applicators and three of the four presented systemic symptoms. Thus, it appears, as suggested by Davies et al. (1976), that the most severe poisonings, i.e., requiring treatment by a physician, are found among applicators, while pickers experience less severe symptoms. It is possible, as suggested by Popendorf et al. (1982); Durham and Hayes (1962); and Milby (1971), that the discrepancy in the numbers of confirmed pesticide poisonings between applicators and pickers is due in part to the difficulty in diagnosing subacute illness, with limited exposure history, and no laboratory confirmation, as a pesticide poisoning. However, it would be reasonable, it seems, to make the assumption that when an incident is sufficiently severe, medical treatment will be sought and perhaps a diagnosis made. In fact, in this study, 75% of the applicators reporting an incident sought treatment, and 44% of these were diagnosed as a pesticide poisoning. It also appears reasonable to assume that when symptoms are primarily topical, involving only skin and/or eye irritation, the worker neither brings the condition to the attention of the grower, nor seeks medical attention. It is interesting, in this context, that, with one exception, all incidents reported by the pickers lacked an agent, laboratory confirmation, medical treatment, and a diagnosis, and that symptoms reported by the pickers involved skin and/or eye irritation. While the incident may not be of sufficient severity for the worker to seek medical treatment, it appears to be real, as evidenced by the 295/10,000 incidence rate for possible poisonings reported by the pickers. Although it is possible that the incidence of skin irritation is, in fact, citrus dermatits, a condition caused by the contact of skin with oil from citrus foliage, exacerbated by sunlight, it is equally possible that it is pesticide related. For example, Griffith and Duncan (1983) reported that more pounds of active ingredient sulfur are applied to Florida citrus crops than any other single pesticide. Sulfur, which is applied with no time limit on reentry (Knapp 1981) is known to cause skin irritation. Thus, it seems reasonable to assume that sulfur, applied shortly before pickers enter the field may be responsible for the reported incidence of skin and/or eye irritation among the pickers.

The incidence rate of 34 confirmed pesticide poisonings per 10,000 permanent and semi-permanent citrus workers is remarkably similar to the incidence rate of 34 confirmed poisonings per 10,000 citrus workers developed from a probability sample of citrus growers and reported elsewhere (Griffith and Duncan, 1985b). In our opinion, this rate accurately reflects the incidence of severe pesticide poisoning taking place among Florida citrus workers employed on a permanent or semi-permanent basis and involved with grove maintenance.

If one proceeds on the premise that poisonings serious enough to need a physician are more likely to be reported, then the rate for confirmed poisonings should establish a bench mark upon which to base an evaluation of the significance of the hazard faced by citrus fieldworkers occupationally exposed to pesticides. If, on the other hand, one takes the position that any reported incident and/or effect, without confirmation, should be characterized as a poisoning, then the estimated numbers and rates of possible poisonings should provide a base of support for such an interpretation.



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