PESTICIDES AND HUMAN HEALTH IN AGRICULTURE

A review of findings presented at the 12th Congress of the International Association of Agricultural Medicine and Rural Health

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I would like to thank the above mentioned for their interest and concern about pesticide and health issues, and hope that the information contained in this report will encourage further support for research in this area in the future.

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BACKGROUND

The International Association of Agricultural Medicine & Rural Health

The International Association of Agricultural Medicine and Rural Health (IAAMRH) was formed 40 years ago, and has an ever-increasing membership of medical professionals and others interested in work related and other medical problems in the farming population. A Congress of the IAAMRH is held every third year, while workshops and seminars are held at various times of the year, in various parts of the world. The IAAMRH acknowledges agriculture as one of the most important industries in the world, and recognises the urgent need for agricultural health and safety issues to be addressed.

The 12th International Congress of Agricultural Medicine and Rural Health held in Stockholm, Sweden, July 1994, dealt with occupational health problems in agriculture, whether highly mechanised or traditional practices, as well as considering rural health problems in general. Pesticides and their effect on both the environment and human health were a component of the Congress.

The responsibility of all countries to live up to the World Health Organisation's goal of "Health to all by the Year 2000" was a major focus, the theme of the 1994 Congress being "Healthy food for all, produced by healthy farmers".

The Australian Agricultural Health Unit

The Australian Agricultural Health Unit (AAHU) was established in 1985 and is based in Moree in North West New South Wales. The Unit is also the National Operations Centre for Farmsafe Australia, the name given to a consortium representing Federal Government, national Farmers Association, Country Womens' Association, Australian Workers Union, Worksafe Australia, Rural Training Council of Australia and the AAHU.

The role of the Unit is to assist rural people to attain improved levels of health and well-being through action to reduce the incidence and severity of illness and injury associated with life and work in agriculture.

NSW Health - Pesticides & Human Health Program

The Pesticides and Human Health program run by the Australian Agricultural Health Unit, Moree, NSW, is an initiative of NSW Health and commenced in November 1991. The program was initiated in response to community concern, and to increase knowledge of the potential magnitude of the problem of pesticide exposure, and its effect on the health of the population.

The objective of the program is to prevent and mitigate adverse human health effects related to exposure to pesticides. Specific goals of the program are as follows:

- To collate and create a resource centre and inventory of reports of programs, activities, strategies and promotional material relating to pesticides and human health in NSW, for use by Government, health centres and the community
- To facilitate the development of health monitoring programs of at-risk groups and communities in NSW associated with industries of high pesticide usage
- To undertake research programs aimed at identifying health risks
- To recommend appropriate strategies to reduce the risk of adverse human health effects associated with agricultural pesticide usage
- To identify training needs of rural health professionals in the area of pesticides and recommend and/or develop programs
- To provide a cholinesterase screening service to people in North West NSW, and to advise and assist in the provision of a screening service to other areas of NSW
- To prepare a report on the current activities, programs and issues in the area of pesticides and human health

Programs and activities for 1995 include the following:

- a study of pesticide exposure in sheep handlers
- provision of an information service to the community and organisations (ongoing)
- provision of on-site pesticide testing for company groups (at request)
- participation in the National Registration Authority Interim Community Consultative Committee
- development of educational material for occupational groups (eg aboriginal cotton chippers/ itinerant workers)
- production of the "Pesticides & Health" newsletter (ongoing)

CONGRESS PROGRAM

Monday, July 11, 1994

Plenary sessions: "Organic dusts and farmers' lung problems
Keynote speaker - Per Malmberg, M.D. Professor

"Health hazards in farm work - prevention strategies"
Keynote speaker - Kaj Husman, M.D. Professor

"Organisation of health care in rural areas"
Keynote speaker - Yair Yodfat, M.D. Professor

Poster and Oral Sessions:
Attended/ poster presentation
"Accidents and work injuries"
Chair - Kaj Husman
Co-chair - Peter Lundqvist

Tuesday, July 12, 1994

Plenary sessions: "Pests or Pesticides"
Keynote speaker - Birgitta Kolmodin-Hedman, M.D. Professor

"Rural health and rapidly changing farming"
Keynote speaker - Horst Huyoff, Professor

"Psycho social factors in farming"
Keynote speaker - Anders Thelin, M.D., PhD.

"Health to all by the year 2000. A rural viewpoint - a challenge"
Keynote speaker - John Stoke, FFOM, FAFOM, FAFPHM

Poster and Oral Sessions
Attended
"Pesticides and Other Chemicals"
Chair - B. Kolmodin-Hedman

Wednesday, July 13, 1994

A whole day excursion to Sanga Saby Farm and Training Centre

Station 1 - the organisation of Swedish farming, the Farmers Health Association, important areas of environmental and health problems in Swedish agriculture, healthy food prospects, occupational health clinic for farmers

Station 2 - Work environment in cow stable with tied up cows. Rail system for transportation etc.

Station 3 - Ergonomics in tractor driving. Coupling of equipment. A new power take-off shield etc.

Station 4 - Safety in forestry work. Manual motor cutting. Instruction for safe work. The forest harvester.

Station 5 - Advanced horticulture in greenhouses.

Further details on each of the above Stations is provided (see Appendix 1).

Thursday, July 14, 1994

Visit with Professor Birgitta Kolmodin-Hedman, Department of Occupational Medicine, Institute of Medicine, Karolinska Institute, Huddinge University Hospital, Huddinge, Sweden (see Appendix 2).

Tour of Department laboratories.

REVIEW OF CONGRESS PRESENTATIONS - PESTICIDES & HEALTH

The following information is also reported in the Annals of Agricultural and Environmental Medicine (AAEM), Volume 1, No. 2, 1994 - containing abstracts from the XII International Congress of Agricultural Medicine and Rural Health, 1994. This is an international journal, produced by the Institute of Agricultural Medicine, Lublin, Poland.

Information relating to the AAHU "Pesticides and Human Health" Program (presented as a poster in the 'Accidents and Work Injuries' session) is attached (see Appendix 3).

PLENARY SESSIONS

"Health Hazards in Farm Work - Prevention Strategies"
Kaj Husman, M.D.
Kuopio Regional Institute of Occupational Health,
Kuopio, Finland

Farming as an occupation was discussed, with reference to work-related health hazards. "Farmers and farm workers are exposed in their daily work to many traditional physical, chemical and microbiological energies and agents, work injuries caused by accidents....Not only farmers and farm workers are affected but women and children living on farms are exposed to these occupational health hazards as well.....most, if not all of these health hazards are preventable."

Professor Husman devised a list of the most important/urgent prevention strategies:

A. Environment - oriented strategies
- Structural prevention
- Technical prevention

B. Individual - oriented strategies
- Modification of behaviour: Use of protectors, hygienic working practices, avoidance of contributing risks
- Monitoring of personal exposures
- Monitoring of early effects
- Health examinations - early diagnosis
- Selection of individuals

C. Information
- Signalling and labelling - chemicals etc
- Registry of exposures

D. Legislative strategies
E. Inspection and services

- Occupational health and safety inspections
- Chemical inspections - pesticides
- Occupational health services

It was noted that all of these strategies are available but are not used to prevent health hazards in farming in many countries.

"Pests or Pesticides"
B. Kolmodin-Hedman, Prof., M.D.
Department of Occupational Medicine, Karolinska Institute,
Huddinge University Hospital, Huddinge, Sweden

The different types of pesticides (insecticides, fungicides, licicides etc.) were briefly reviewed, as were chemical groups such as organophosphates, pyrethroids. Professor Kolmodin-Hedman discussed the pyrethroid group in terms of human health - "Common compounds such as permethrin, decamethrin and cypermethrin....are excellent from a human toxicity point of view. They are self-warning with a low acute and chronic toxicity."

The occurrence of fatalities due to pesticide intoxication are more common in countries where information concerning preventive measures is difficult to obtain/communicate, due to language difficulties, changing work populations etc. ***"Preventive measurements concerning work practice, knowledge of human risk pattern...stresses the importance of information strategies."***

ORAL & POSTER PRESENTATIONS

"Use of Focus Group Data in Farm Injury Prevention"
S.A. Randolph, MSN, RN, COHN
Farm Injury Project, Department of Environment, Health and Natural Resources
Raleigh, North Carolina, USA

The objective of the study was to determine the perceptions of farm workers about agricultural health and safety issues through focus groups.

Focus groups of farmers, farm workers, farm wives and teenagers were held. All groups were aware of the numerous hazards of farm work, but varied in their perceptions of risk. The main variable which seemed to influence the degree of risk perceived was the perception of control over hazards. ***Frequently identified hazards included farm machinery and equipment, pesticides,*** skin cancer, hearing loss and stress.

"Multidisciplinary Study on Assessment of Pesticide-Related Genotoxic Risk in Floricultural Workers"

C. Bolognesi, F. Merlo, A. Abbondandolo
Instituto Nazionale per la ricerca sul Cancro
Genova, Italy.

Genotoxicity is considered an adverse effect resulting from the indiscriminate use of pesticides. In Italy a large part of flower production occurs in the Liguria region, and pesticide consumption in this area is large compared to the national average. The aim of this study was to determine potential genotoxic risk associated with the occupational exposure to pesticides in floriculture.

Methods employed included questionnaires, toxicological profiles of pesticides in use, experimental studies on genotoxicity of frequently used pesticides and 2 biomonitoring studies to evaluate cytogenetic damage.

The study results revealed that the increase of cytogenetic damage may correlate with the intensity of exposure, and is influenced by personal working habits (eg use of protective devices).

"Review on Chronic Poisoning or Disorders from Pesticide Exposure"

S. Matsushima, M.D.
Saku Central Hospital
Nagano, Japan

The most frequently observed disorders resulting from pesticide exposure were discussed, these being:

- ***neuropsychiatric disorders***
- ***lung diseases***
- ***blood diseases***
- ***liver disorders***
- ***stomach disorders***

The most frequently observed disorder in previous studies was reported as neuropsychiatric, caused in many cases by organophosphates. It is classified into 3 types - delayed polyneuropathy, sequelae from acute poisoning and neuropsychiatric disorders.

In past cases of acute poisoning, there have been reported cases of persistent headaches and psychopathic sequelae.

Chronic neuropsychiatric disorders include neurobehavioural effects, dementia, mental abnormality and parkinsonism.

Cases of lung infiltrations and chronic progressive lung fibrosis, named pesticide lung, have been reported. Blood diseases such as PCP-induced aplastic anaemia and leukemia are frequently observed.

"Accidental Pesticide Exposures and non-Hodgkins Lymphoma"

G. Theriault, P. Pahwa, N. W. Choi, D. Robson, J. Spinelli, L. F. Skinnider, D. White, H. H. McDuffie, J. R. McLaughlin, S. Fincham, J. A. Dosman
Centre for Agricultural Medicine
Saskatoon, Sask, Canada

Pesticides are ubiquitously used by farmers and non-Hodgkin's lymphoma (NHL) is a rare disease. Nontrivial exposure to certain pesticides increases the risk of NHL.

The study involved eligible and control subjects who participated in a population based, multicentre, case-control study of NHL, and who had resided/worked on a farm. Participants were asked questions regarding the source of their drinking water, accidental inhalation of pesticides, accidental pesticide spills on skin or clothing, and use of protective clothing and equipment.

It was concluded that accidental exposures and preventive behaviours should be included in studies of agricultural exposures and risks of cancers.

Toxic Effects of Pesticides on Cholinesterase and Hepatic Functions in Exposed Workers

M. Milosevic et al
Institute of Hygiene and Human Ecology
University of Beograd
Yugoslavia

The aim of this study was to examine levels of cholinesterase (ChE) in blood and hepatic functions in exposed agricultural workers. The study group consisted of 180 tractor drivers who were exposed to pesticides throughout the study period (1987 - 1993).

Results indicated that ChE values were significantly lower in 1993 than in 1987, indicating exposure, and significantly lower in the last year of study. The study recommended that liver functions have to be examined in all workers exposed to pesticides. ***The constant application of preventive measures in agricultural workers is of the utmost importance.***

"Congenital Anomalies and Pesticides"

L. Stallones, D. Merchant, L. Criswell, S. Keefer.
Colorado State University, Department of Environmental Health
Fort Collins, Colorado, USA

The objective of the study was to describe the distribution of congenital anomalies in relation to pesticide application practices and crop type in Colorado.

Data from the Colorado Registry for Children with Special needs were obtained for 1989, and birth defects were grouped by major category and assigned to county based on residence of mother. Counties were then grouped by crop reporting districts; the birth defects were classified based on these groupings. Crop reporting districts were grouped into high, medium and low based on chemical applications, herbicides, insecticides, corn and wheat as a ratio of the total acres of the variable to total acres in agricultural production. Rates were calculated for high, medium and low districts for pesticide application, wheat acreage, corn acreage, herbicide application and insecticide application. Rate ratios were calculated with the rate of the low district as the denominator and the high and the medium district as numerators.

The results of the study support previous findings related to congenital anomalies and agricultural activities. Recent studies suggest as association between atrazine use and increased rates of birth defects. Corn and chemical fallow are the primary uses of atrazine. More detailed evaluations of these relationships are needed.

"Clinical Manifestation of Intoxication due to 2,4-D in Agricultural Workers"

Vitaly V. Voznyuk, Romen Ye. Sova
Ukrainian Research Institute of Ecohygiene and Toxicology of Chemicals
Ukraine

A case of 44 workers intoxicated with 2,4-D and complex products of pesticides and fertilisers was examined in the southern region of Ukraine.

Most recurrent and acute were the cases of neurological disorders, which were described in all cases of poisoning with 2,4-D.

89.74% of patients were marked with asteno-vegetative syndrome
66.67% with vegetative-sensoral polyneuropathy
10.26% with toxic encephalopathy
56.49% had skin and mucosa disorders
49.00% of patients serum had an increased quantity of 2,4-D

"Male Reproductive Toxicity of the Pesticides Hostathion, Sumithion and Dithane M-45 in Rats"

N.A. Hemeida et al
Department of Theriogenology, Faculty of Veterinary Medicine
Cairo University, Giza, Egypt

Reduced fertility due to exposure to certain pesticides has caused great concern. To assess the effects of hostathion, sumithion and dithane M-45 (pesticides widely used in Egypt) on male reproduction, daily oral doses of 1/20 and 1/10 of the LD_{50} were given to mature male rats for 30, 45 and 60 consecutive days.

Oral administration of hostathion (4 & 8 mg/kg body weight), sumithion (25 & 50 mg/kg b.w.) and dithane (200 & 400mg/kg b.w.) caused a marked decline in fertility.

Total sperm cell abnormalities as well as dead sperm percentages significantly increased in rats treated with hostathion, sumithion and dithane. Most of the sperm cell abnormalities observed were in the form of detached heads, blunt heads, kinked middle pieces, protoplasmic droplets as well as bent and coiled tails.

Hostathion and sumithion, in both doses, significantly decreased the weight of the testes and epididymides, mostly after 60 days administration. The fungicide dithane significantly increased the testes and epididymides weight after 30 days only, especially with the large dose level (400mg/kg).

Histopathological examination of the genital organs of male rats given orally histathion, sumithion and dithane for 60 days revealed mild testicular degeneration with low doses and moderate testicular degeneration with the high doses of tested pesticides. Epididymal sperm reserves were greatly reduced with the high doses of all tested pesticides.

"Pesticides Contact Allergy in Rural Population, Fruit-Growers and Greenhouse Workers"

S. Luty, Associate Prof., B. Torun, Prof., G. Chodorowska, M.D., J. Latuszynska, Dr., B. Sobczynska, M.A.
Institute of Agricultural Medicine
Lublin, Poland

This study examined the frequency of pesticide contact allergy in rural and urban population, fruit growers and greenhouse workers. The study was conducted in the years 1987-1993.

Pure active ingredients of 23 pesticides were applied in patch-tests. Each substance was used in two concentrations (0.5%, 1.0%). 631 urban dwellers, 118 fruit growers and 205 greenhouse workers were examined.

Pesticides contact allergy was observed in 23.0% of the rural population, compared to 22.5% of the urban population. The lack of significant differences in the frequency of the occurrence of pesticide contact allergy between the examined populations may be due to the common use of pesticides, both in rural and urban areas. ***The highest degree of contact allergy to pesticides was noted in fruit growers.***

In all examined populations the contact allergy was often caused by the following pesticides:

- trichlorphon (9.2%)
- dichlorvos (9.0%)
- fenitrothion (7.3%)
- chlorfenvinphos (7.1%)
- carbaryl (5.8%)
- thiram (4.7%)
- lindane (4.6%)
- 2,4-D (4.1%)
- dicamba (3.4%)
- malathion (2.7%)

"Nontrivial Pesticide Exposure and non-Hodgkins Lymphoma"

McDuffie, G. Theriault, P. Pahwa, N. W. Choi, D. Robson, J. Spinelli, L. F. Skinnider, D. White, J. R. McLaughlin, S. Fincham, J. A. Dosman
Centre for Agricultural Medicine
Saskatoon, SK, Canada

The objective of the study was to assess the relationship between agricultural exposures, specifically pesticides and non-Hodgkins lymphoma (NHL) in a multicentre study which encompasses a vast geographical area with diverse farming practices.

Nontrivial exposures to pesticides were defined as >= 10 hours per year of occupational exposure to any combination of insecticides, herbicides, fungicides and fumigants. Male incident cases (442) with a first diagnosis of NHL were selected from 6 population based provincial tumour registries. Controls (803) were obtained from population based sources and matched to cases by age, sex, and province of origin of case. Questionnaires obtained details of life and exposure histories, and use of protective equipment.

Results indicated that non-trivial pesticide exposure is a risk factor for NHL. The study team are currently investigating the role of individual pesticides and pesticides grouped by their active chemical composition.

"Haematological Changes in Agricultural Workers exposed to Pesticides (a 7-year follow-up)

D. Popara, M. Milosevic, R. Antic, B. Jakovljevic, G. R. Miric
Institute of Hygiene and Medical Ecology, University of Beograd
Beograd, Yugoslavia

The aim of this study was to examine levels of haematological changes in workers exposed to pesticides during their work. The study group consisted of 180 tractor drivers working under the same conditions during the 1987-1993 year period. The control group were non-exposed agricultural workers.

Significant difference were found among the study group versus the control group regarding red blood cell count, white blood cell count, haemoglobin and reticulocytes. Mean values were significantly lower in 1993 than in 1987 in the study group.

Data obtained indicated that ***constant exposure to pesticides may provoke haematological changes***, so a constant follow-up of these parameters as well as certain preventive measures must be applied.

"The Evaluation of a UK Tripartite Health and Safety Initiative to Control Chemicals in Agriculture"

A. E. Watterson, PhD.
Centre for Occupational Safety and Health, The Nottingham Trent University
Nottingham, U.K.

The main objective of the study was to identify methods for measuring the health and safety impact of an advisory group involving employees, employers and government agencies: the Chemicals in Agriculture (ChemAg) Group.

A wide range of activities and initiatives were taken by the Group. ChemAg members had different aims and objectives and different approaches.

The study concluded that tripartite initiatives provide a means for a wide variety of opinions and proposed actions on chemical hazards in agriculture to be identified and discussed. Such groups may also channel conflict. Legislative policy, enforcement and economic forces are the primary influences on controlling chemical hazards in agriculture.

"Protective Equipment: Modifying Farmers' Behaviour"

J. Ivory, M. Hill B.S. N., L. Marvel B.S.N., P. Jenkins PhD., J. May M.D.
NY Centre for Agricultural Medicine and Health
Cooperstown, NY, USA.

(see Appendix 5)
The study was performed to determine the effectiveness of a strategy designed to modify farmers' behaviour regarding the use of appropriate protective equipment (PE).

The strategy employs screening followed by individual teaching of farmer/spouse, and was designed for use at agricultural shows. The effectiveness of this method was tested in 2 independent programs (hearing protection - H and respiratory protection - R) over a 3 year period.

Participants completed a detailed prescreening questionnaire. Audiometric screens (H) and spirometry (R) were used to screen farmers - participants. Each was followed by a 5 minute teaching session complete with written instruction and samples of PE. Information on the use of PE was gathered by mail at 6 weeks and 3 years.

Positive behaviour change (PBC) was defined as use of approved protection by a previous non - user. Results indicated that ***the strategy appeared to induce PBC with regard to protective equipment. This persisted over 3 years.***

"Farm Show Participants Perceptions of Chemically Resistant Gloves"

J. Stone, S. Padgitt, W. Wintersteen, M. Shelley
Iowa State University
Ames, Iowa, USA

(see Appendix 5)
The objective of the study was to ***help farm show participants improve their understanding of chemically resistant gloves to minimise pesticide exposure,*** and to gather their perceptions about neoprone, barrier laminate and nitrile gloves for changing spray nozzle tips used in pesticide spraying operations.

An educational exhibit at a 3 day farm show introduced attendees to the 3 types of gloves suitable for use with pesticides. Participants hands were measured, then each received neoprone, barrier laminate and nitrile gloves to change spray nozzle tips. Afterward, participants completed a questionnaire giving their perceptions of chemical resistance, grip, fit, ease of donning and doffing, protection and comfort. No pesticides were used.

The 5 minute activity was completed by 602 participants (day 1), 526 participants (day 2) and 395 participants (day 3). Each day, neoprone was judged to give the most secure grip. The barrier laminate was judged as most protective more often when used as a liner.

"Educational Needs Assessment of Rural Health Care Practitioners"

J. J. Mazza M.D., B. Lee R.N., M.S.N., P. D. Gunderson, PhD., D. T., Stueland, M. D.
National Farm Medical Centre, Marshfield Clinic
Marshfield, Wisconsin, USA

(see Appendix 5)
The aim of this study was to assess the professional competency and educational needs of rural health care providers in order to develop and disseminate relevant disease, injury and environmental information to health care practitioners in rural and agricultural settings.

Data collected from medical doctors (MD) and veterinarians (DVM) from the midwest region of the USA indicated that the most common exposures of their farming clientele included heavy lifting, environmental dusts or irritants, hazardous machinery and excessive sun exposure. MDs reported greatest competence in diagnosing and treating traumatic injuries, back strain, skin cancer and psychological disorders. MDs indicated they ***felt least competent in diagnosing and treating zoonotic illnesses, exposures to pesticides,*** noxious gases and volatile organic chemicals. DVMs were frequently asked about zoonotic diseases, pesticide exposures and respiratory ailments, but reported competence only in zoonotic diseases.

Survey results indicated variations in professional competency and educational resources to address agricultural health problems.

See Appendix 5 for other 'Pesticide and Health' material presented at the 1994 Congress.

FINDINGS & FUTURE DIRECTIONS FOR THE AAHU "PESTICIDES AND HUMAN HEALTH" PROGRAM

Based on reports presented at the 1994 congress

Cholinesterase Testing

The Australian Agricultural Health Unit (AAHU) currently offers cholinesterase testing as part of it's pesticide screening program. The blood cholinesterase test is the most common pesticide screening procedure currently used in Australia, testing for exposure to organophosphates and/or carbamates. Cholinesterase testing has been used as an indicator of pesticide exposure in past studies performed by the AAHU.

Findings from the Congress which relate to cholinesterase testing are as follows:

- The cholinesterase test for exposure to organophosphate and carbamate pesticides is currently the most ***commonly used test for pesticide exposure*** by those countries represented at the Congress.

- Pesticide testing programs and/or studies, as reported by other countries, examined cholinesterase levels as an indicator of exposure. ***It is widely accepted that the cholinesterase test is an accurate and reliable biological indicator.***

- The dibucaine number test may be used to indicate when an individual has a genetic pre-disposition to low cholinesterase levels. The dibucaine number test is important when investigating a depressed cholinesterase level in an individual (as used by the AAHU in the case of two or more successive unsatisfactory test results).

  The dibucaine number test was not considered/employed in many of the exposure studies reported. Future correspondence with Professor Kolmodin-Hedman will involve ***further investigation of dibucaine as an indicator of a genetic pre-disposition to low cholinesterase.***

- The AAHU pesticide screening program currently tests for liver function only in the instance of successive unsatisfactory cholinesterase results, and following a dibucaine number test. It is interesting to note that in Yugoslavia and Poland, screening programs and/or studies test routinely for liver function. One Yugoslavian study reported that.... ***"results show that liver function has to be examined in all workers exposed to pesticides" (Milosevic et al, 1994; Congress).***

  This will be further examined in relation to the AAHU screening program.

Program Activities

The AAHU "Pesticides and Human Health" program was presented as a poster display (see Appendix 1).

- The poster presentation sessions involved the author of the poster giving a quick summary of the work, followed by the chairman and co-chairman offering comments and criticisms. The floor was then open for questions.
  The chairman and co-chairman in the "Accident and Work Injuries" session were Kaj Husman M.D. (Kuopio Regional Institute of Occupational Health, Finland - Congress Keynote Speaker) and Peter Lundqvist PhD (Swedish University of Agricultural Sciences). Both Kaj and Peter ***commented favourably on the range and number of activities being undertaken as part of the "Pesticides and Human Health" program;*** the AAHU program differed from many programs/studies being performed in other countries which tended to focus on one particular method/activity, rather than a number of activities.

  The majority of questions following the presentation related to the effectiveness of "such a broad range" of action. The United Kingdom was interested in whether a "bottom-up" approach worked (ie dealing direct with ag. chemical users), as their activities tend to follow a "top-down" structure (ie legislation, government/research based).

- Education of agricultural chemical users, a major component of the AAHU program, is also being attempted in many other countries. The USA in particular is developing a great deal of material relating to safe chemical use, and especially protective clothing. ***Future correspondence will be maintained with those research bodies/organisations involved in production of educational material for agricultural chemical users.***

- A U.S. sociologist presented a poster on "Farm Show Participants' Perceptions of Chemically Resistant Gloves" (Stone et al, 1994). The main objective of the study was to help farm show participants improve their understanding of chemically resistant gloves, to minimise pesticide exposure. The method for organising and running such an event is well documented, and can be adapted to include other protective equipment. ***Following discussions with the US. author, a similar event is planned for AgQuip 95, using the method (and possibly questionnaire?) provided in the study.***

- A group of researchers in the USA (Stallones et al, 1994) have begun investigations into ***congenital anomalies in relation to pesticide application practices and crop type, in Colorado. This activity is also on the agenda of the AAHU pesticides program.***

  The Findings of the USA study are preliminary, but suggest an association between atrazine use and increased rates of birth defects. The USA study provides an example of a method for data collection and collation, and should be able to be adapted for use with Australian data.

The USA team are happy to assist a similar Australian study via information, experience etc. (Correspondence to be maintained).

Future Contacts

As a result of the Congress, many overseas contacts have been made with whom correspondence will be maintained in the future. ***Much of the information presented at the Congress relating to pesticides and human health will be adapted to, and used by the AAHU in it's own pesticides program.***

TRENDS IN 'PESTICIDE AND HEALTH' RELATED RESEARCH

It is encouraging to note that there is considerable research currently being performed in the area of pesticides and human health effects, as made apparent by the number of papers presented at the Congress dealing with these issues.

Long Term/Chronic Health Effects

In the past, the long term health effects of pesticide/chemical exposures, whether resulting from a singular, extreme exposure or repeated smaller exposures over a long period of time, have not been well documented. Increasingly, neurological and neuropsychiatric disorders resulting from exposure to organophosphates (OP) are being reported as they become more apparent. The increased use of organophosphates in the last few decades has contributed to the problem.

Studies by Rosenstock et al (1991) and Savage et al (1988) describe chronic neuropsychological effects due to pesticide exposure, such as decreased performance in the areas of intellectual functioning, academic skills, abstraction, visual memory, sequencing and problem solving and motor steadiness and dexterity. A review of disorders resulting from pesticide exposure presented at the 1994 Congress further substantiated the aforementioned findings, listing neurobehavioural effects, dementia and mental abnormality as the most commonly documented chronic health effects resulting from pesticide exposure.

Grandjean et al (1991) investigated the non-specificity of clinical signs and symptoms caused by environmental chemicals. A review of the scientific literature revealed that 220 environmental chemicals had caused documented systemic toxicity in humans. While this number is relatively small compared to the large number of industrial chemicals in the environment, it was interesting to note that a total of 149 of the chemicals were verified as neurotoxins, while organophosphorous compounds constituted a major group of these chemicals.

As research in this area continues, it is likely that chronic or long-term effects of pesticide exposure will become better understood (this area of study was of particular interest to those attending the Congress, provoking much discussion).

Acute Health Effects

Acute effects resulting from chemical exposure are well known, and information on the signs and symptoms of acute poisonings/ intoxications is readily available. This information is being used in the examination of pesticide exposure by occupational group.

The AAHU has performed/been involved in studies examining pesticide exposure in cotton chippers, cotton consultants and workers in the horticultural industry in NSW. In these studies, cholinesterase measurements (via blood sample) were used as an indicator of exposure, as were reported signs and symptoms of acute exposure (eg in relation to OP use - headache, nausea, giddiness).

A paper presented by Bolognesi (1994; Congress) similarly examined a specific occupational group (pesticide-related genotoxic risk in floricultural workers) revealing that cytogenetic damage increased with the intensity of pesticide exposure. Luty et al (1994; Congress) reported pesticide contact allergy in fruit growers and greenhouse workers, again a occupational-specific study.

Education and Training

The identification of occupational groups at risk of exposure to chemicals (via acute signs and symptoms, and via testing services such as cholinesterase testing, occupational health and safety checks etc.) is part of the ***emerging trend towards preventive strategies with regards to agricultural and worker safety.*** This can be seen through the number of research studies currently being performed in the area of education and behavioural change. Ivory (1994; Congress) reported on the effectiveness of a strategy designed to modify farmers behaviour in relation to the use of personal protective equipment. Stone (1994; Congress) looked at modifying farmers behaviour towards wearing chemical resistant gloves, through a 'hands-on' agricultural field day activity. Strategies and activities such as these are becoming increasingly common, the emphasis being on prevention of pesticide exposure through education.

It was interesting to note the study on educational needs of rural health care practitioners, performed in Wisconsin, U.S.A. (1994; Congress). The areas identified as those in which practitioners felt least competent in diagnosing and treating patients included, amongst others, pesticide exposures. A similar educational need has been identified in NSW, and the AAHU is currently developing home study packages for rural general practitioners, community health workers and acute care nurses in a number of areas, including pesticides, zoonoses, respiratory disease, farm injury etc.

Cholinesterase Testing

Cholinesterase testing as an indicator of exposure to pesticides (organophosphates and carbamates) ***remains the most commonly used test for pesticide exposure, and is widely accepted as an accurate and reliable biological indicator.*** The cholinesterase screening service offered by the AAHU involves not only cholinesterase measurement but, in the event of an abnormal result, has a range of follow-up tests which may be performed to further ascertain whether the cholinesterase depression is the result of a chemical exposure.

The questionnaire administered prior to blood collection provides a detailed work practice profile of the individual (including type of protective clothing used, hygiene, chemical used etc. - see Appendix 4). Dibucaine number tests (indicating a genetic predisposition to a depressed cholinesterase level) and liver function testing (decreased liver function may also result in a depressed cholinesterase level) are also options for further testing.

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Appendix 1

Whole day excursion to Sånga-Säby July 13, 1994

The aim of this study tour is to demonstrate different aspects of modern agriculture from work environment and health point of view. We will visit the Sånga-Säby farm and training center which belongs to the Swedish Farmers' Federation. The demonstration will take place in five different stations, which will be shortly presented.

Station 1
The organization of Swedish farming

The objective of this station is to give a background and overview information of how Swedish farmers are organized and how work environment and health aspects are considered within Swedish agriculture. The majority of Swedish farmers are members of the Swedish Farmers' Federation, which cares not only about economical and political matters, but also takes responsibility for social, cultural and health aspects of farm life. Within Swedish agriculture other organizations work together with the Swedish Farmers' Federation, especially concerning work environment and health. With support from the Swedish state the Work Life Fund has brought considerable amounts of money into projects concerning work environment improvement in agriculture and forestry. The Swedish University for Agricultural Sciences, workers' and employers' organizations, institutes of agricultural engineering, producers of farm equipment, the Swedish Farmers' Safety and Preventive Health Association etc collaborate in these aspects.

Dominating hazards within agriculture and forestry are summarized at this station and some of the preventive measures are indicated. Information material is available and the set-up of an occupational health station for farmers and farm workers is demonstrated.

Further information by:
The Swedish Farmers' Federation, telephone +46-8-787 5000
The Swedish Farmers' Safety and Preventive Health Association, telephone +46-8-787 5220
Association of Swedish Forestry and Agricultural Employers, telephone +46-8-762 7200

Station 2
Forestry work environment

Two kinds of forestry work will be demonstrated. Swedish farmers to a great deal are also forestry owners and work in forestry on a small scale. The big forestry areas, especially in the north, are owned by the state or by the forest industry and are harvested in a highly mechanized way.

A: Privat small scale forestry
There will be a presentation of a project "Accidents in small scale forestry". It will contain a survey over different organizations taking part in the project, the actual frequency of accidents, the prerequisites for accident prevention, the declaration of the aim of the project and the concept of education of instructors. Certain work elements as they appear in this education will be demonstrated.

B: Large scale forestry
There will be a presentation of the work force and work environment situation in large scale forestry.

It will contain a survey of the development of productivity at harvesting, the work force situation and the work environment problems in mechanized felling. Further there will be a demonstration of how work environment problems can be solved in a harvesting machine cab. There will also be a demonstration of how a forestry harvester works.

Further information by:
County Forestry Boards, telephone +46 155-262 400
The Swedish Forestry Workers' Union, telephone +46 26-115 275

Station 3
Work environment in a stable

The station will show the work environment problem in a stable with tied up milk cows. Information will be given about the work force in Swedish agriculture about the number of cattle and milk production today in comparison to earlier times. The frequency of accidents in milk production will be shown and there will be an exposé over different types of equipment used in milking. Modern equipment in the handling of fodder and in milking tied up cows will be demonstrated in the stable. The Alfa Line system, which is a rail attached to the ceiling and used for carrying the milk organs through the stable will be demonstrated. This system reduces the work load of the milkers considerably. It was constructed by the Alfa Laval company in cooperation with the Swedish Farmers' Safety and Preventive Health Association. It has been shown to reduce injuries from neck, shoulders and arms, especially in female milkers.
The relief system for milk farmers will be discussed as well as the recent venture concerning milking instructors offering education in better work techniques in milking to farmers and farm workers in order to reduce work injuries.

Further information by:
The Swedish Farm Workers' Union , telephone +46 480-870 95
The Swedish Farmers' replacement service, telephone +46 8-787 5000
Alfa Laval Agri Scandinavia AB, telephone +46 8-550 294 00

Station 4
Horticulture at Thorslunda Green House

This green house has been in production since 1992 and has 23 000 m2 under glass. The production is the year around vegetables grown in closed circulating systems. No pesticides are used. Every year 4 million salads and about 5 million small products are produced, all in small pots. Twentytwo workers are employed.
The visit at the green house will include background information concerning the work environment and health problems in horticulture in general. The enterprise is presented and the hollistic view concerning work environment and high quality production is discussed. It will also be shown the results from a work environment study of small cultivators and grass movers. Check lists for good work environment using these tools will be presented.

Further information by:
The Swedish University of Agricultural Sciences, telephone +46 46-11 75 10
The National Machinery Testing Institute, telephone +46 40-46 44 20

Station 5
Work environment in tractors

Two tractors will be demonstrated. One is a Valmet 705 in use ordinary. The work environment will be discussed outgoing from the ergonomic check list for tractors and agricultural machinery. The other tractor is a new Mezzo 6606 with turnable driver´s seat. Improvement concerning work environment will be discussed. Furthermore equipment for the clutch, automatic hydraulic coupling of equipment and the new power take off cover will be shown. There will also be posters concerning climat in driver´s cabs, power needed to work the clutch pedal and emergency stops.

Further information by:
The Swedish Institute of Agricultural Engineering,
telephone +46 18-30 33 00
The Swedish Farmers´ Safety and Preventive Health Association, telephone +46 8-787 5220

Appendix 2

OCCUPATIONAL MEDICINE, HUDDINGE HOSPITAL

The department of Occupational Medicine of Huddinge Hospital serves a population of about half a million in the southern half of the County of Stockholm.

The work carried out by the Department focuses on the impact on health and the pathogenic effects of environmental contact with chemicals, physical hazards such as vibrations and the effects of electrical fields in both the working and domestic environment. Topics under investigation include injuries to the hands caused by vibrations and respiratory disorders resulting from exposure to irritants and allergens.

Work is also being carried out to identify the health disturbances experienced by groups and individuals connected with work and residence in "sick buildings". In a special project undertaken by a newly established amalgam unit, investigations are also being made of the effects of mercury, a problem which was formerly associated principally with the work environment, but which is now more closely related to the use of amalgam in dental fillings.

The department is currently strengthening its investigative and laboratory resources in the field of toxicology, particularly environmentally conditioned toxicology. In the field, special analyses are being undertaken in Sweden and in related Nordic countries concerning the effects of exposure to pesticides.

Research and developing methods that the Department specialises in include:

- occupational and environmental exposure as it relates to respiratory diseases and allergies;
- the effects of heavy metals (such as mercury and cadmium) in terms of occupational and environmental medicine;
- the chemical and biological causes of reproductive problems;
- controlling the handling of pesticides by various occupational categories;
- and the development of methods for the assessment of hazards arising out of the organisation of work or of a psychosocial nature.

In its research work, the Department collaborates with the Karolinska Institute, The Institute of Environmental Medicine, the National Institute of Occupational Health and the Royal Institute of Technology. Its principal sources of funding are the Swedish Work Environment Fund, the Swedish Medical Research Council and the National Environmental Protection Agency.

Professor Birgitta Kolmodin-Hedman is Chief of the Department of Occupational Medicine, Huddinge Hospital. She is also Deputy Prefect at The Division of Occupational Medicine, Institute of Internal Medicine at Karolinska Institute, Huddinge.

Appendix 3

Presentation made by Louise Faulkner, Research Officer, Australian Agricultural Health Unit, at the 12th International Congress of Agricultural Medicine and Rural Health, Stockholm, Sweden, July 1994 - information below is taken from poster presentation.

PESTICIDES AND HUMAN HEALTH PROGRAM
Australian Agricultural Health Unit, Moree
NSW Health

INTRODUCTION

the "Pesticides & Human Health " program was initiated by the Department of Health of New South Wales, Australia, in response to community concern and to increase knowledge of the potential magnitude of the health problem.

OBJECTIVE & GOALS

The objective of the program is to prevent and mitigate adverse human health effects related to exposure to pesticides. Specific goals of the program are as follows:

- To collate and create a resource centre and inventory of reports of programs, activities, strategies and promotional material relating to pesticides and human health in NSW, for use by Government, health centres and the community
- To facilitate the development of a health monitoring program of at-risk groups and communities in NSW associated with industries of high pesticide usage
- To undertake research programs aimed at identifying health risks
- To recommend appropriate strategies to reduce the risk of adverse human health effects associated with agricultural pesticide usage.
- To identify training needs of rural health professionals in the area of pesticides and recommend and/or develop programs
- To provide a cholinesterase screening service to people in North West NSW, and to advise and assist in the provision of a screening service to other areas of NSW.
- To prepare a report on the current activities, programs and issues in the area of pesticides and human health.

STRATEGIES & PROGRAMS
Pesticides & Human Health Program

1. Pesticide Screening Program

The blood pesticide screening service is available to all people who handle and use agricultural chemicals, and to those concerned about being indirectly exposed. The service covers North West NSW, an area where pesticides are used and applied extensively in farming activities (predominantly cotton).

The service tests for exposure to organophosphate (OP) and carbamate (Carb) classes of insecticides, used heavily in the area. OP and Carb pesticides exert their main acute toxic effects by complexing with cholinesterase enzymes which are present in human blood. Over-exposure to these pesticides results in a decrease in cholinesterase activity, detected via blood test.

All clients complete a questionnaire supplying demographic details, occupational information, pesticide usage data and high-risk factor information (eg smoking and hygiene whilst working), which is added to a data base of client records.

All results are forwarded to clients with an interpretation and safety advice. In the case of an unsatisfactory result, further action is recommended based on a "decision tree" devised by the Australian Agricultural Health Unit (AAHU), with the assistance of laboratory specialists and a medical doctor.

2. Identification of Occupationally "At-Risk" Groups

The cholinesterase blood testing service allows the AAHU to obtain a clearer picture of who is being exposed to pesticides. Following identification of an occupationally at-risk group, industry is notified and subsequent study with industry assistance allows for further identification of the problem. Research results are taken back to industry, to address recommendations.

"Pesticide Exposure in Cotton Chippers in the Gwydir Valley, 1991-1992".

The study was undertaken to investigate potential pesticide exposure of cotton chippers in North West NSW. Cotton Chippers are field workers who manually hoe or "chip" at weeds to remove them. The study was funded by the Cotton Industry (research and development group).

The study was undertaken in 2 parts:
Part 1 estimated the degree of pesticide exposure experienced by cotton chippers in the course of a growing season, using depression of erythrocyte cholinesterase as an organophosphate exposure indicator.

Part 2 estimated the distribution of exposure to pesticides over different parts of the body by recovery of pesticide residues deposited on clothing in the course of chipping work.

Demographic, occupational details and initial blood samples were collected in the field from 417 cotton chippers (401 were subsequently used). Follow-up blood samples were collected from 115 of the chippers.

In Part 1, results showed a 6% decline in the mean cholinesterase enzyme activity in those chippers who were followed up. This is highly statistically significant. No decline would be expected in an unexposed population.

Part 2 revealed that it is possible to recover significant amounts of endosulfan and profenofos pesticide residues from clothing worn while chipping. Cotton chippers have traditionally worn minimal clothing during their work, an observation confirmed by this study. Most pesticides used in cotton agriculture are readily absorbed through the skin. Therefore there appears to be considerable opportunity for dermal exposure of cotton chippers to pesticide residues in cotton plants after aerial spraying.

3. Establishment of a Resource Centre

Since the program's inception, resource information related to pesticides and health has been collected and catalogued by the AAHU. Currently, the Unit holds over 200 journal articles covering "Pesticide Health Effects" (studies, commentaries), and has an extensive library covering a wide range of related topics such as "Pesticide Toxicology", "Pesticides in the Environment", "Pesticide Screening", "Pesticide Safety - General Reports", "Pesticides & Cancer" and "Pesticide Education & Training Packages".

All resources (including text books and videos) and information held by the AAHU are available to other organisations and health workers, community members and students, upon request.

4. Education of Rural Health Workers

(i) The **"Pesticides & Health" newsletter** is produced by the AAHU. The newsletter is seasonal, and provides information for health workers on pesticide issues, pesticide health effects, current programs and resource material. It provides health workers across NSW with a network of information and contacts.

(ii) "Pesticides & Health" home study packages are available for rural health workers and doctors. The packages contain information on pesticide toxicology (the doctors package contains detailed information), pesticide health effects, how exposure occurs, ways to prevent the risk of exposure, community perspectives and fears, the role of the health worker and the use of pesticides in agriculture.

The home study packages also contain an educational resource kit, which may be used by the health worker/doctor for further education of others.

5. Education of Agricultural Workers and Farmers

(i) "Farmsafe Australia" assists in the education of agricultural workers and farmers via it's communication network. Farmsafe Australia was formed in 1989 as part of a national strategy designed to improve the occupational health and safety of all people involved in the farming industry.

The strategy centres on community involvement, with activities for improving occupational health and safety centred around Farm Safety Action Groups (FSAGs) formed within local communities. FSAGs meet regularly to discuss farm safety issues and plans for improvement of farm occupational health and safety at a local level.

Information on safe use and handling of pesticides and agricultural chemicals is filtered out to farmers and rural workers via the Farmsafe network. The AAHU "Pesticides and Human Health" facilitates information distribution.

(ii) The AAHU participates wherever possible in local field days and agricultural trader exhibitions. Participation involves manning a display site, with poster and pamphlet displays/information available to the public. Local events present an ideal opportunity for direct communication with farm workers and farm families about the problems and issues of importance to the rural worker.

Locally organised information evenings are proving a great success, providing an opportunity for the rural community to benefit from the knowledge of the guest speaker, whilst also providing local health workers with an insight into pesticide problems being faced by their community.

(iii) A "National Farm Chemical Users Training Course" is being actively promoted within the "Pesticides & Human Health" program. The course is available through Department of Agriculture, and local educational institutions.

6. Use of the Media

Currently, pesticide issues and chemical health effects are featured frequently in the media. They are topical issues. The AAHU circulates a media release for every new promotion that the "Pesticides and Human Health" program is involved in. Most often, these types of promotions coincide with the commencement of the cotton pesticide spraying season in North West NSW. Due to this timing, North West newspapers, radio and television stations are supportive of local initiatives, whilst state-wide media will also often follow-up a story.

OUTCOMES
Pesticides & Human Health Program

1. Pesticide Screening Program

The blood pesticide screening service has been well utilised. The service is available all year, but attracts most of it's clients during the cotton spraying season (October to March). During the 1992-1993 spraying season:

- 56 individuals were screened over the season. 36% of these presented themselves for at least one follow-up test (79 tests were performed).
- The main agricultural occupations tested include farmers & farm labourers (51.8%) and agronomists & bug checkers (19.6%). In approximately half those tested (50.8%), the test was performed within 7 days of their last pesticide exposure.
- 25.5% of the respondents felt that they had experienced "some form of chemical exposure" in the past. Reasons for past exposures included:
  - eye splashes whilst working
  - repairs of chemical machinery/equipment
  - handling of equipment/empty drums
- Of the 79 tests performed over the season, 3 resulted in a lowered cholinesterase or unsatisfactory result. These individuals were found to be working in relatively high-risk industries (pest control, agronomy/bug checking).

The AAHU has developed a policy and procedure booklet for the operation of the service, and has assisted the establishment of other services through provision of this booklet.

2. Identification of Occupationally "At-Risk" Groups

The AAHU, with assistance from the Department of Agriculture, has devised a list of Australian agricultural industries associated with high pesticide usage . These industries are:

Cotton
Greenhouse Cultivation
Vegetables/Orcharding
Rice
Sheep
Grain and Summer Crops (lucerne/hay)
Bananas

Within each type of agricultural industry there exist specific groups who are most at risk to pesticide exposure, simply through the nature of their work:

manufacturers (production workers)
loaders
formulators
applicators/operators
vendors
pickers
transporters
growers
mixers
markers

Identification of these industries and groups has resulted in more occupational-specific educational material and resources (such as a pamphlet designed for cotton chippers, detailing health and safety measures). At present, the AAHU has performed or co-ordinated studies into pesticide exposure in cotton chippers, cotton agronomists/bug checkers, and vegetable & fruit growers and workers. It is envisaged that pesticide exposure in sheep handlers (those exposed to organophosphate dips, licicides and fly treatments) will be investigated during 1994/1995.

3. Pesticide and Human Health Resource Centre

The resource centre is continually expanding, with new journal articles and information being catalogued everyday. The resource centre provides information and promotional material to health workers on a regular basis.

4. Education of Rural Health Workers

(i) The **"Pesticides and Health" newsletter** was first produced in January 1994 (Summer Edition). Since that time, requests for addition to the mailing list have been received from across NSW. The newsletter has resulted in better utilisation of the AAHU resource centre, through increased awareness of information availability. "Pesticides and Health" is fast becoming recognised for it's "networking" capabilities, with government bodies now submitting items and articles on new developments within their organisations, for inclusion.

5. Education of Agricultural Workers and Farmers

(i) The 'Farmsafe Australia' movement provides a network of FSAGs through which information on current pesticide health issues can be distributed. In many cases community health workers are members of a local FSAG, and any resources or information they hold can be utilised by the Group (this may include the "Pesticides & Health" newsletter).

(ii) The AAHU receives many requests for information and display material featuring pesticide safety messages and health issues. It seems that increasingly, the community in general is looking for ways in which to reduce their risk of exposure and pesticide poisoning. In many cases it is the female members of the farming family who are most interested in written material and "take home" messages.

The development of guidelines for holding locally organised information evenings has resulted in this type of event being planned for numerous centres around NSW. The guidelines were developed following an extremely successful "Pesticides & Human Health" information night, held in a small NSW town. The guidelines are forwarded to interested parties upon request.

(iii) The "National Farm Chemical Users Training Course" is currently offered across Australia, each State having their own management committee and key providers of the course. As at December 1993, approximately 13,000 chemical users in 5 Australian States had successfully completed the course and gained accreditation. The Course continues to be promoted by the "Pesticides & Human Health" Program.

FUTURE DIRECTIONS
Pesticides & Human Health Program

Many of the following for the "Pesticides & Human Health" Program were developed for the publication "Human Health and Pesticides in Agriculture in NSW. Issues, Programs and Future Directions for Health Workers" (1993). Below are listed the areas which the Program hopes to target and further develop in the future.

Pathology Services for Agricultural Health Workers.

Rural people exposed to pesticides require access to timely and accurate cholinesterase and other pesticide testing facilities with advice regarding tested levels and safe work practice.

Identification of significant groups in the rural community at risk of health effects from pesticide exposure.

Support will continue to be given to programs investigating health outcomes of occupational groups exposed to pesticides. Support has been given by the AAHU in the past, in the form of advice and assistance with data collation and report writing.

Population Monitoring.

Collaboration with officers of the NSW Health Department will continue, to develop a program of monitoring communities associated with high pesticide usage in adjoining agricultural systems in regards to:

congenital abnormalities
a range of cancers
asthma admissions to hospital
admissions due to pesticide poisoning
quantification of environmental exposures.

Education and Information Dissemination.

Information resources will continue to be collated and supplied via the AAHU resource centre. The "Pesticides & Health" newsletter will continue to be produced, assisting the establishment of an 'information network' for rural health workers.

Water Monitoring

The testing of public water supplies will be reviewed to ensure that clear guidelines to Local Government Council are available, that a revised timetable of testing is prepared to take into account high pesticide usage, that currently used pesticides are included in the testing regime, that results of the testing are published on a state-wide basis.

Air Monitoring

Further development work will be undertaken to standardise air monitoring equipment and methods used by Public Health Units so as to make available air monitoring facilities to those communities at risk of significant air pollution with pesticides.

Appendix 4

MOREE PLAINS HEALTH SERVICE
AGRICULTURAL HEALTH UNIT

Blood cholinesterase Test

Pesticide Exposure Survey

1.ID No☐☐☐☐ 2. Site Location☐☐☐☐ 3. Date☐☐☐☐☐☐

4. Surname _____ Other Name _____

Postal address _____

Town _____Postcode _____

Day time phone _____

Date of Birth ____/____/____

5. Gender Male ☐1 Female ☐2

6. Occupation _____

Main Agricultural Industry in which you work

cotton	☐	orcharding	☐
sheep	☐	vegetable growing	☐
cattle	☐	wheat/grain	☐

other _____

7. Employer name _____

Employer phone no. _____

8. No. of days since last contact with pesticides ____ ____ days

No. of hours in contact with pesticides per day ____ ____ hours

Pesticides in use _____

9. Do you feel to have been exposed? Yes☐1 No☐2

If Yes, how did the exposure occur?_____

_____

Do you feel this exposure has affected your health?

Yes ☐1 No ☐2

If Yes, list symptoms_____

Procedure for the Review of Cholinesterase Screening

Is result 20% below baseline
or
Is plasma cholinesterase
< 3.84 U/mL (females)
< 4.98 U/mL (males)

Advise client of result and safe work practices

Yes — No

Check questionnaire symptoms.
Repeat cholinesterase test.

No further action.

Is plasma cholinesterase < 3.84 U/mL (females) or <4.98 U/mL (males) Check RBC cholinesterase

Yes — No

Advise : Significant exposure has occurred.
Suggest safer work practices, protective clothing.
Recommend further testing.
Check Dibucaine Number

No further Action.

Is % inhibition normal ?

Yes — No

Check Liver Function (LFT)

Low cholinesterase may be individuals normal level

Is Liver Function normal ?

Yes — No

Check for symptoms of toxicity.
Advise : Significant exposure has occurred. Most likely via work habits and work practices.
Advise re: Hygiene (shower after shift, launder daily).

Low cholinesterase may be result of liver function.
Refer abnormal LFT to Medical Officer

Retest in 2 weeks or as advised by Medical Officer. Removal from exposure may be necessary.

Appendix 5

Protective Equipment: Modifying Farmer's Behavior

J.Ivory, M. Hill RN,BS, L. Marvel BSN, P. Jenkins PhD, J. May, MD New York Center for Agricultural Medicine & Health, Cooperstown, NY, USA

ABSTRACT

OBJECTIVE This study was done to determine the effectiveness of a strategy designed to modify farmers' behavior regarding the use of appropriate protective equipment (PE).

METHODS We designed a strategy for use at agricultural shows that employs screening followed by individual teaching of farmer/spouse. The effectiveness of this method was tested in two independent programs (hearing protection-H and respiratory protection-R) over a three year period. Participants completed a detailed pre-screening questionnaire. Audiometric screens (H) and spirometry (R) were used to screen farmers-participants. All screenings were performed by certified technicians. Each was followed by a five minute teaching session complete with written instruction and samples of the PE. Information on the use of approved PE was gathered by mail at six weeks and three years, with phone calls to a sample of the non-responders. Data was analyzed in SAS using chi square.

RESULTS A total of 690 farmers participated in the programs (H=277 R=413). Positive behavior change (PBC)is defined as use of approved protection by previous non-user. At six weeks mail and phone surveys confirmed PBC's of 35% (H) and 20% (R). Three year data showed PBC's of 47% (H), 40% (R). The likelihood of PBC was unrelated to the results of the screening.

CONCLUSION This strategy appears to induce PBC with regard toprotective equipment. This PBC persisted over three years. PBC was independent of screening results in both cases. The use screening provides an effective teachable moment.

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Administrator

NYCAMH

BACKGROUND

* Farmers are known to have increased rates of high frequency hearing loss

* Farmers are exposed to potentially hazardous noise levels from childhood to old age

* Studies indicate that only 9-25% of agricultural workers in the U. S. routinely use hearing protective devices

* Farmers who work in barns are at risk of occupational asthma and hypersenstivity pneumonitis

* There is increasing evidence that daily exposure to agricultural dust is a risk factor for airway disease

* Previous studies show that 13% of New York farmers routinely used appropriate respiratory protection

* "The rural health fair" has been highly ranked as technique for motivating behavior change

PURPOSE

This study was done to determine the effectiveness of a strategy designed to modify farmers' behavior regarding the use of appropriate protective equipment (PE).

METHODS

* Two separate programs (hearing protection-H and respiratory protection-R)were presented at a series of agricultural events over a two year period

* Each participant completed a questionnaire detailing exposures and current PE usage

* Participants then underwent audiometric screening or spirometry by certified technicians

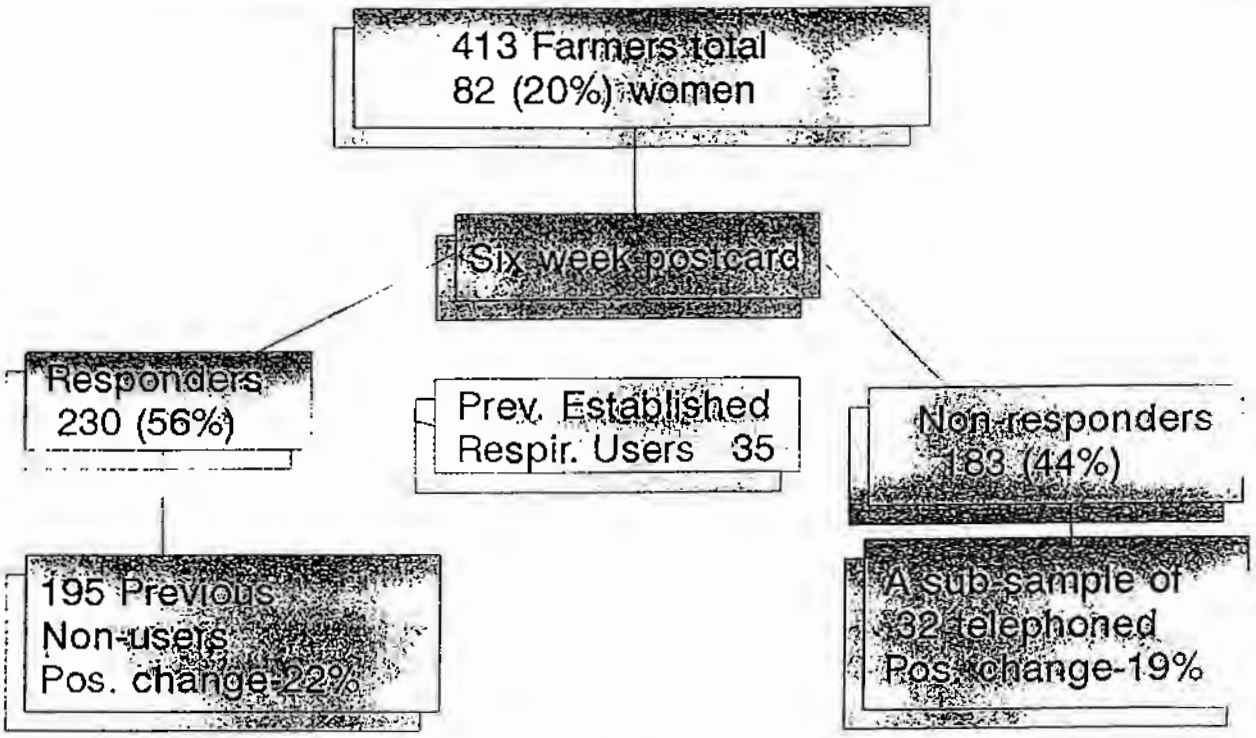
* We took advantage of the "Teachable Moment" following each screening to instruct farmer and spouse, distribute approved samples of PEand lists of PE distributors

* Mail questionnaire at 6 weeks and 3 years, phone calls to a subsample of non-responders

* Analysis in SAS using chi square

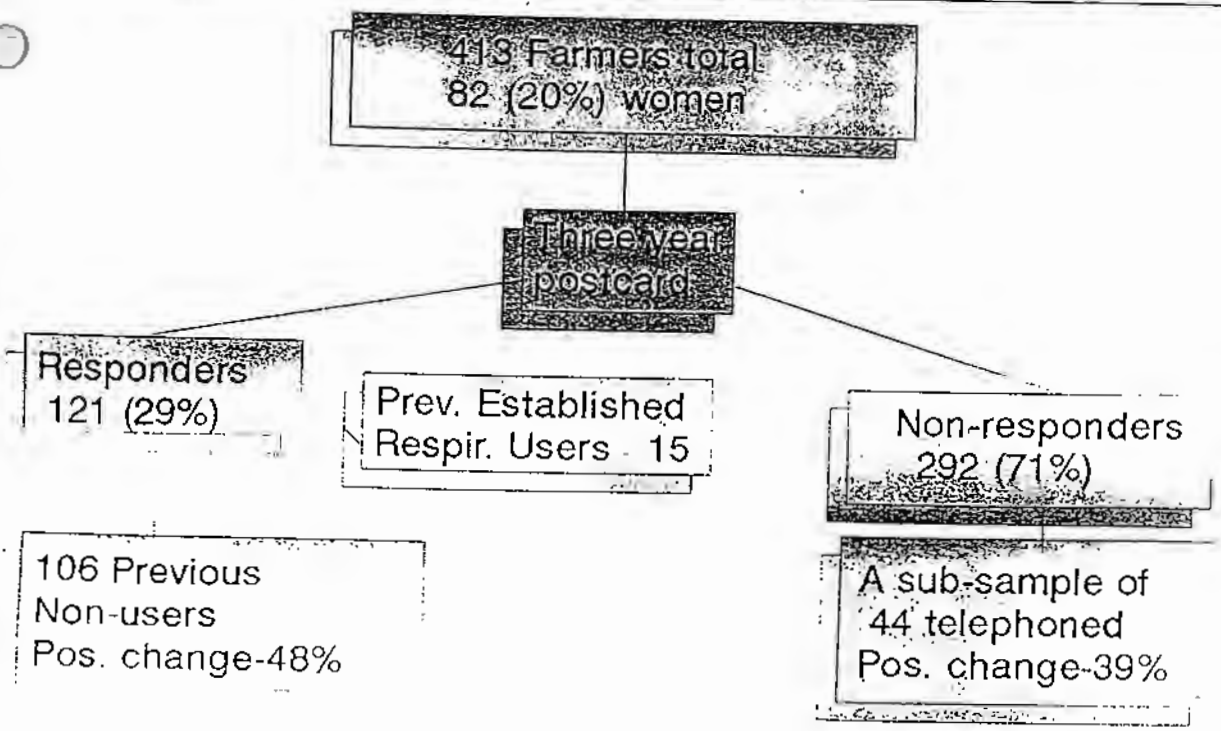
Respiratory Results - 6 Weeks

Weighted Average Change = 20%



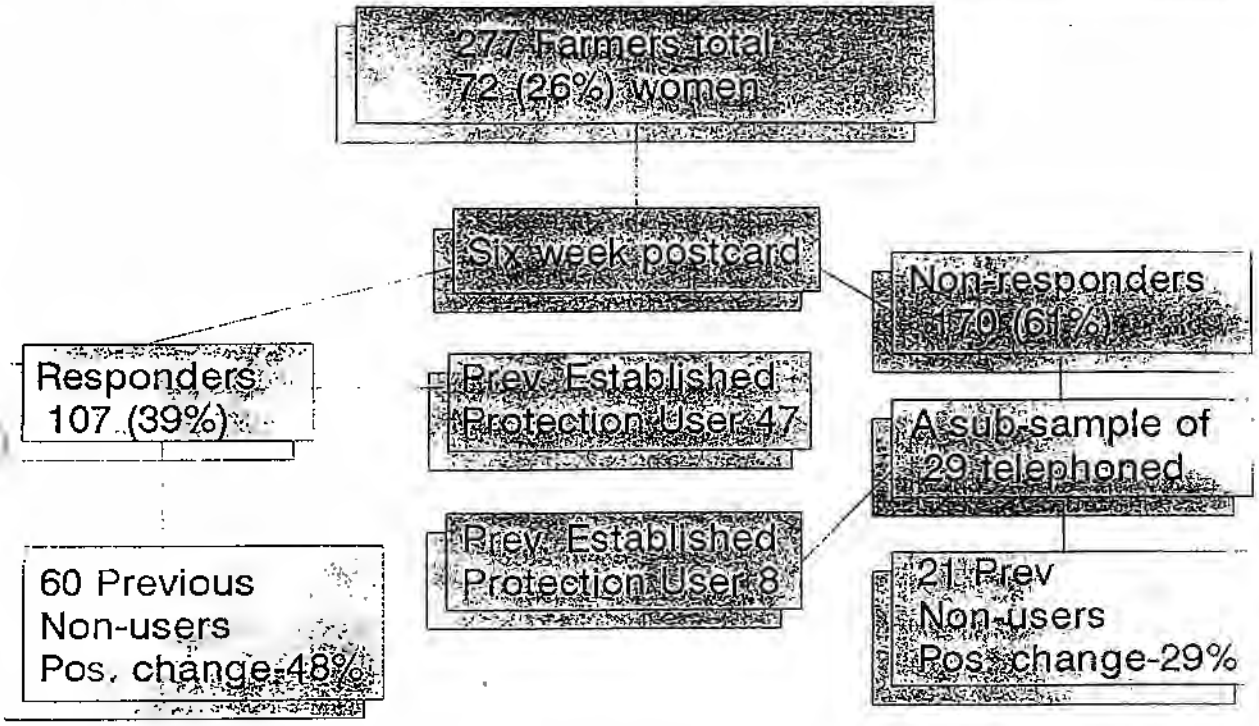
Respiratory Results - 3 Years

Weighted Average Change = 40%



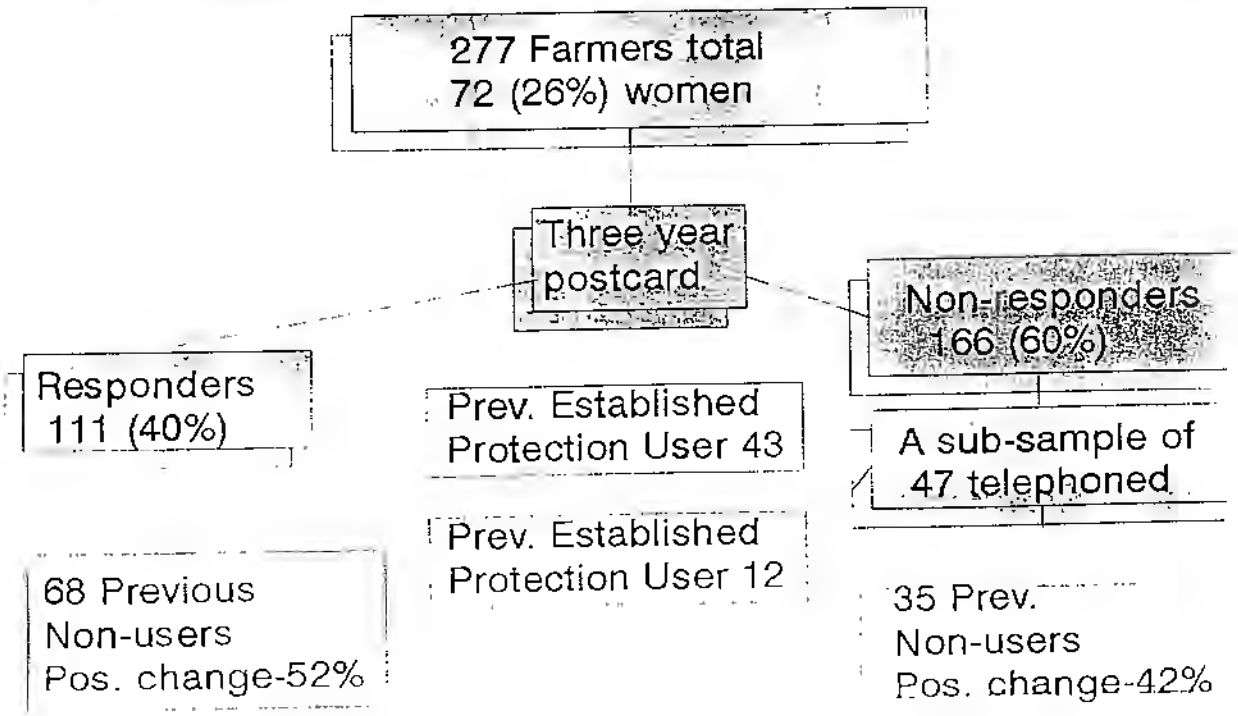
Hearing Results - 6 Weeks

Weighted Average Change = 35%



Hearing Results - 3 Years

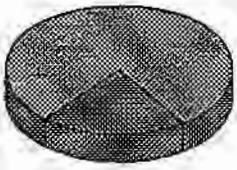
Weighted Average Change = 47%



Behavior Change at 6 Weeks is Independent of Screening Results

THOSE WITH NORMAL AUDIOMETRIC SCREENING

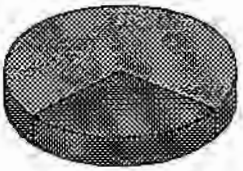
NO CHANGE 79.0%



POS. CHANGE 21.0%

THOSE WITH ABNORMAL AUDIOMETRIC SCREENING

NO CHANGE 71.0%



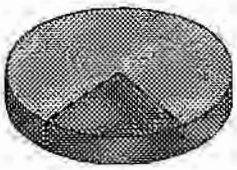
POS. CHANGE 29.0%

* N.S. by Chi square

Behavior Change at 3 Years is Independent of Screening Results

THOSE WITH NORMAL AUDIOMETRIC SCREENING

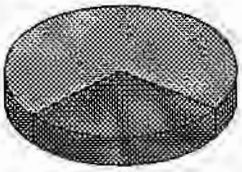
NO CHANGE 79.0%



POS. CHANGE 21.0%

THOSE WITH ABNORMAL AUDIOMETRIC SCREENING

NO CHANGE 71.0%



POS. CHANGE 29.0%

* N.S. by Chi square

CONCLUSIONS

- This approach appears to motivate positive behavior change with regard to use of protective equipment
- The behavior change persists over three years
- The behavior change is independent of the screening results
- Screening programs can provide an effective "teachable moment"

Glove Donors

Ansell Edmont Industrial
1300 Walnut Street
Coshocton, Ohio 43812
Telephone: 1-800-800-0444
Fax: 1-800-800-0445

Best Manufacturing Company
Edison Street
Menlo, Georgia 30731-0008
Telephone: 706-862-2302
Fax: 706-862-6000

Mapa Pioneer corporation
512 East Tiffin Street
Willard, Ohio 44890-1594
Telephone: 419-933-2211
Fax: 419-933-2710

Safety 4
P. O. BOX 238
Lundtoftegaardsvej 95
DK-2800 Lyngby
Denmark
Telephone + 45 45 93 09 57
Fax: 45 45 93 15 18

Farm Show Participants' Perceptions of Chemically Resistant Gloves

Janis Stone, Textiles & Clothing Extension Professor
Steven Padgitt, Extension Sociology Professor
Wendy Wintersteen, Extension Entomology Associate Professor, and
Mack Shelley, Professor, Department of Statistics
Iowa State University, Ames, IA 50011-1120, USA
12th International Congress of Agricultural Medicine & Rural Health
Stockholm, Sweden July 10 - 13, 1994

Table 1. Glove use schedule

	Black/blue	Grey	Green
Day 1	ChemMaster Neoprene/latex Best Manufacturing	4H Barrier laminate Ansell Edmont & Safety 4	Nitri-Solve Nitrile Best Manufacturing
Day 2	Neoprene rubber Mapa Pioneer	4H Barrier laminate	Stansolv Nitrile Mapa Pioneer
Day 3	Neoprene Best Manufacturing	4H as liner Ansell Edmont doubled with Blue/green Nitrile/rubber Mapa Pioneer	Solvex Nitrile Ansell-Edmont

Figure 1. Perception of gloves for changing spray nozzles - total 3-day sample

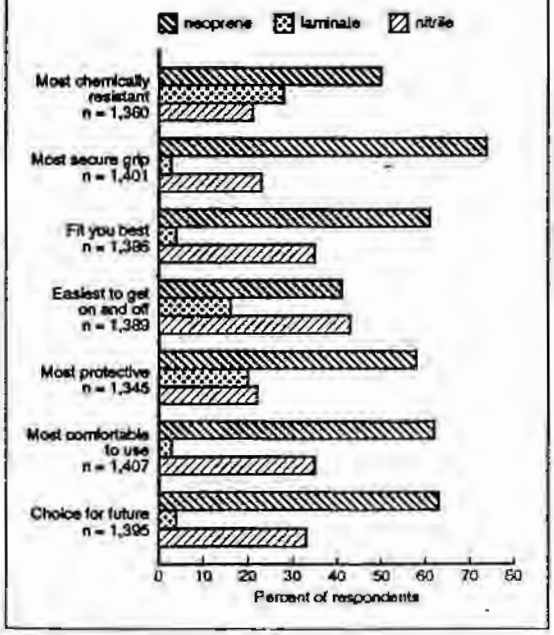
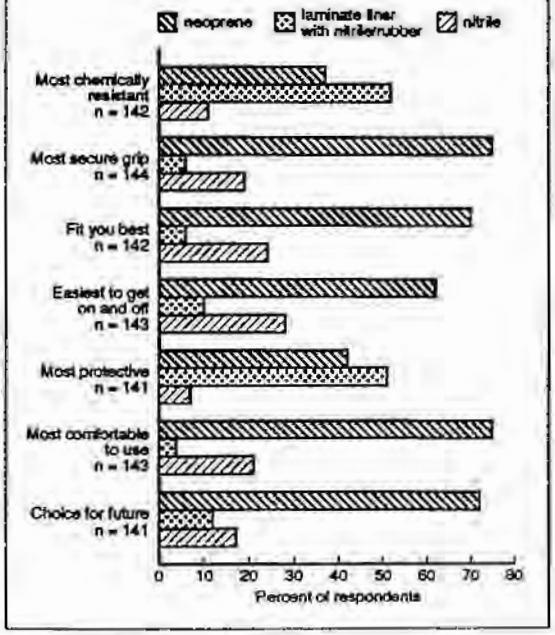


Figure 2. Certified applicators' perceptions of gloves - day 3, with laminate as liner



IOWA STATE UNIVERSITY

University Extension

Textiles and Clothing
1053 LeBaron Hall
Ames, Iowa 50011-1120 U.S.A.
515 294-1555
515 294-0712
FAX 515 294-0304

September 28-30, 1993

Memo to: Farm Progress Show Glove Exhibit Visitor

From: Janis Stone Janis Stone, Extension Specialist Textiles & Clothing

Pesticide safety is very important. Use of chemically resistant gloves is one way that you can reduce pesticide exposure. Farmers often complain about gloves because they don't fit or seem clumsy. This is your opportunity to find out your hand size and compare three types of gloves to see which might please you most. There are no chemicals used in this exhibit, and wearing the gloves should cause you little or no discomfort. Your participation should take no more than three minutes, but you can have as long as you need to finish. All information gathered in this exhibit will be held confidentially and your responses to the questionnaire will not be identified with you personally in public releases of the data summaries. To participate you may do the following:

1. Have your hand measured to determine your glove size.
2. Use each of three pairs of gloves (nitrile, neoprene, and barrier laminate) to change the spray nozzle tip on a "pretend" spray rig.
3. Complete the survey form. Then, pick up a free fact sheet and a free pair of gloves.

We are interested in collecting the opinions of as many participants as possible. But, if you decide at any time that you do not wish to continue, you may turn in the gloves and this survey form to one of the Extension staff and withdraw. The benefits to this research are: 1) you may be able to identify a glove type to help with your work and reduce your pesticide exposure and 2) your opinions may help manufacturers develop better gloves. If you have further questions about this project at any time, please contact me at the above address. Thank you very much for agreeing to participate in this exhibit.

Which gloves did you like most?

1. For changing spray nozzles, **circle** which gloves...

...seemed most chemically resistant?	black	green
...gave the most secure grip?	black	green
...fit you best?	black	green
...were easiest to get on and off?	black	green
...seemed most protective?	black	green
...were most comfortable to use?	black	green
...would you choose in the future?	black	green

Please check:

2. Do you regularly use and apply pesticides?
   ____ YES, mainly in farming for crop management
   ____ YES, mainly for garden & ornamentals
   ____ YES, mainly around the house
   ____ NO, never use pesticides
3. If you farm, how many acres do you farm?
   ____ up to 200 acres ____ 201 to 600 acres
   ____ 601 to 1500 acres ____ over 1500 acres
   ____ do not farm
4. Are you a certified pesticide applicator? ____ YES ____ NO
   IF YES, are you? ____ private ____ commercial
5. Currently, when changing nozzles, do you usually...
   ____ wear chemically resistant gloves
   ____ wear cotton or leather gloves
   ____ wear no gloves
   ____ do not ever change nozzles

Write number:

6. How many people help you handle or apply pesticides?
   ____ family members
   ____ non-family hired helpers
   ____ check if do not handle or apply pesticides
7. Your hand size is: ____ inches 8. Your age is: ____ years

Professional Agricultural Health And Safety Education And Training Needs And Preferences

Joseph J. Mazza, MD, Barbara Lee, RN, MSN, Paul Gunderson PhD, and Dean Stueland, MD, of National Farm Medicine Center, Marshfield, Wisconsin, United States

GOAL

To improve the diagnosis, treatment, and consultation for individuals with agricultural exposures by providing timely, state-of-the-art disease, injury, and environmental information and training to rural practitioners by:

- characterizing agricultural health and safety educational needs;
- assessing options for integrating professional and patient materials across different disciplines; and
- developing and disseminating advanced education and training materials and programs focused on the unique aspects of caring for individuals exposed to agricultural hazards.

METHODS

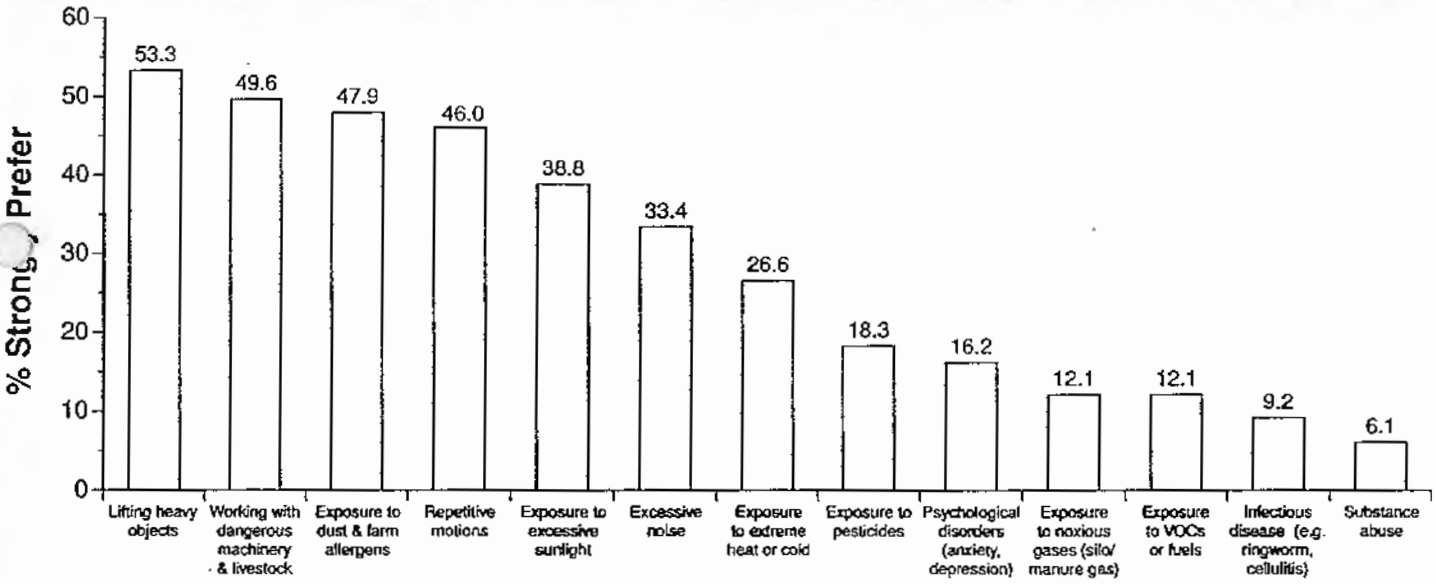
This descriptive, correlational survey research utilized mail surveys to collect data from a systematic sample of physicians, nurses, physician assistants, chiropractors, and veterinarians who practice in rural settings in six midwest states of the United States. Data were collected on perceived professional competence, availability of resources, and barriers to continuing education in agricultural health.

Demographics of Sample

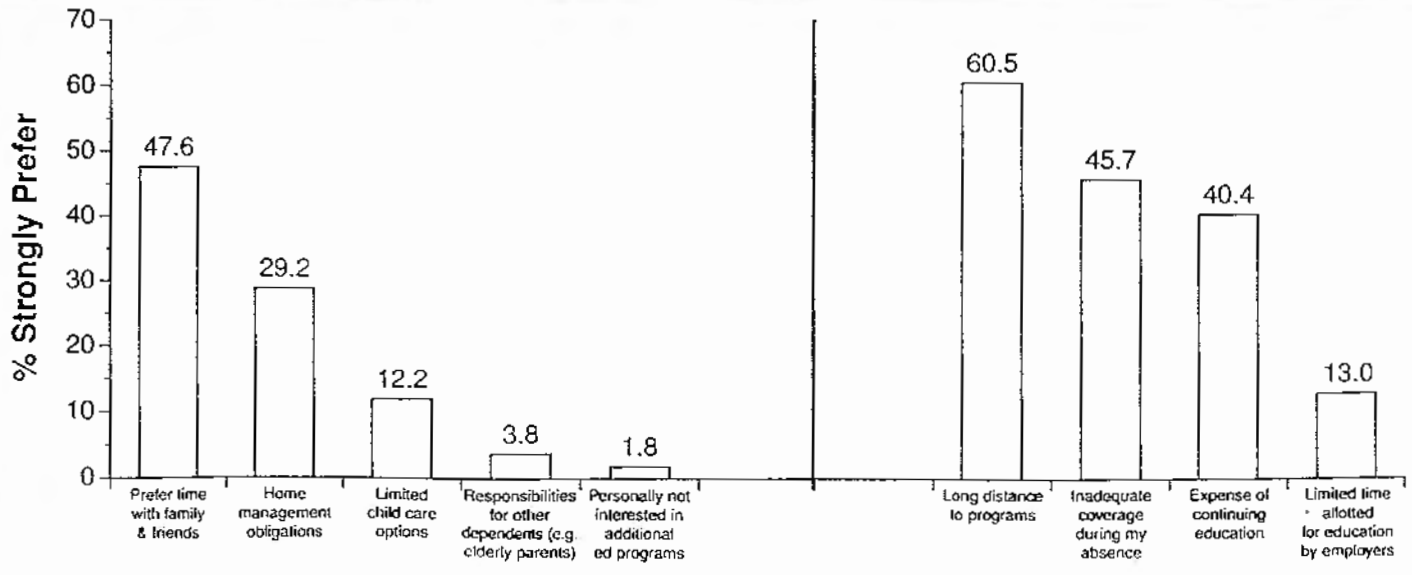
	MDs	RNs	PAs	DCs	DVMs
n=	355	137	70	287	388
% male	89. 5	28.6	60.0	88.4	83.4
% age 30-49 years	57.7	73.6	73.8	66.2	65.8
% solo practice	39.0	--	19.7	78.9	33.4
% full time	86.6	69.2	86.2	90.8	83.3

Key	
MD	Physicians
RN	Registered nurse
PA	Physician assistant
DC	Chiropractor
DVM	Veterinarian

PRACTITIONERS' PERCEPTION OF AGRICULTURAL EXPOSURES OF PATIENTS

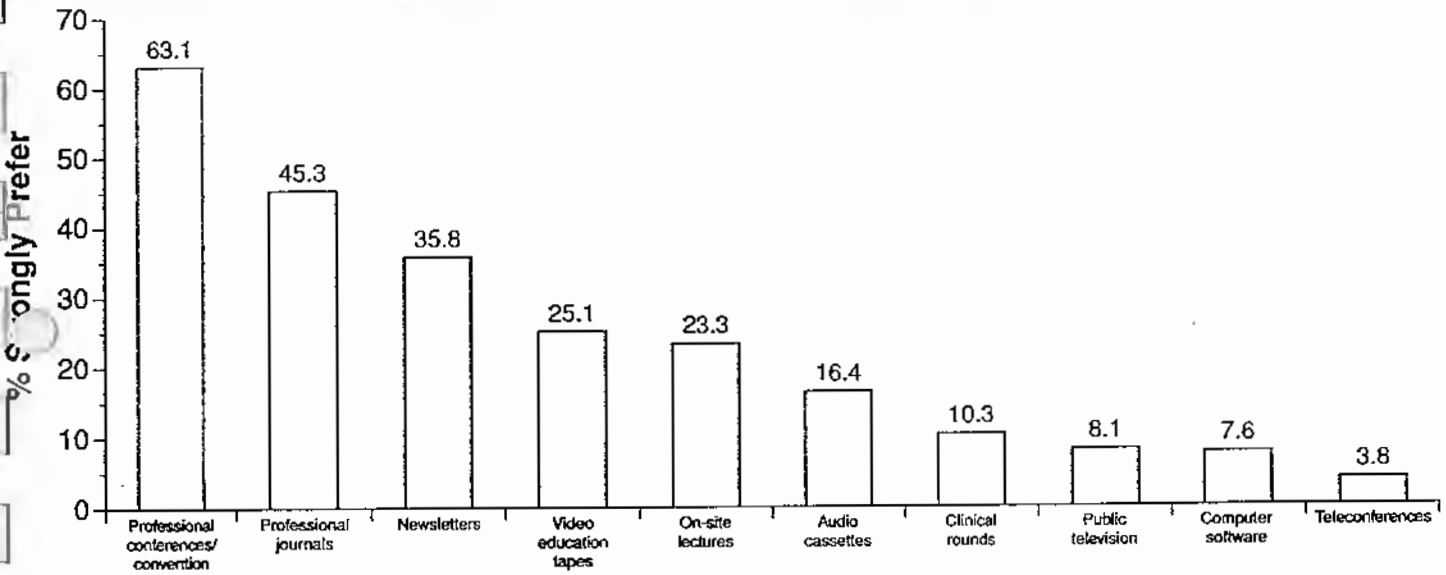


PERSONAL AND PRACTICE BARRIERS TO CONTINUING EDUCATION



(Results continued)

CONTINUING EDUCATION PREFERENCES OF RURAL HEALTH PRACTITIONERS



CONCLUSIONS

Rural health care practitioners assess and treat clients with a wide spectrum of illnesses and injuries associated with agricultural exposures. Survey results revealed variations in professional competency and availability of educational resources. The most notable deficits in competency involved less frequent exposures such as pesticides, volatile organic chemicals, and zoonoses. Several options for enhancing professional and public education can be explored.

ACKNOWLEDGMENTS

This study was conducted with support from the National Institute for Occupational Safety and Health Cooperative Agreement (#U07/CCU507126) Center for Agricultural Research, Education, and Disease and Injury Prevention.

Acknowledgement is given to staff of the National Farm Medicine Center, Marshfield Clinic, and the University of Minnesota for their support in the planning and implementation of this project. We are especially grateful to Karen Lappe, RN, SallyJo Lee, Douglas DeLong, MD, Ian Greaves, MD, and Gerald Ogdahl, MS.

National Farm Medicine Center
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Marshfield, Wisconsin, 54449
United States

This handout was prepared for the XII International Congress of Agricultural Medicine and Rural Health, Stockholm, Sweden, July 10-13, 1994, Joseph J. Mazza, MD, Marshfield Clinic, Marshfield, Wisconsin, United States

PENNSTATE

College of Agricultural Sciences • Cooperative Extension

Agricultural and Biological Engineering Fact Sheet

Safety-35

Personal Protection From Pesticides

Dennis J. Murphy, Professor of Agricultural Engineering
Cathleen M. LaCross, Technical Writer

Imagine battling a fire without a flame-resistant coat, scaling a cliff without climbing ropes, or playing pro football without a helmet.

In our daily lives, at work and at home, we put ourselves at risk—often unnecessarily. Equipment that could help protect us, we complain, is too hot, heavy, cumbersome, silly-looking or just plain uncomfortable. In agriculture, with the use of increasingly concentrated pesticides, personal protective equipment is becoming even more important. While claims that farm pesticides cause higher cancer rates remain controversial, there is growing concern about the effects of long-term exposure. Nevertheless, according to one survey only 44% of farmers always wear gloves when working with pesticides, 22% always wear eye protection, 8% always wear respiratory protection, and 4% always wear coveralls.

The First Step: Read the Label

The first step to ensuring your safety when working with pesticides is determining what personal protective equipment to wear. By law, that information must appear on every pesticide label. Pesticide labels are legal documents, and information on them is the result of years of research and lots of money spent by the manufacturer. Take the label seriously!

Other information you'll find on the label include: the brand name, directions for mixing and applying the pesticide, poisoning symptoms, first-aid and antidote instructions, and hazards to humans, domestic animals, and the environment.

Every label also displays one of three signal words: CAUTION for slightly toxic chemicals, WARNING for moderately toxic chemicals, and DANGER—POISON in bright red lettering for highly toxic chemicals. DANGER is usually, but not always, accompanied by a skull and crossbones. These words tell you at a glance what kind of substance you're dealing with. To protect yourself, wear the proper safety equipment.

Personal Protective Equipment

As many pesticides are sold in concentrated form it's crucial that you wear the proper protective equipment when mixing or loading them. Protection is just as important out in the field, where pesticide particles are suspended in the air, making skin contact likely. Unless a tractor cab is equipped with special filters approved for respiratory protection against pesticides, the cab *will not* block out dangerous vapors and dusts or mists and wearing complete personal protective equipment is necessary.

Gloves. While the ear canal, forehead, crotch, and abdomen absorb pesticides faster than any other body part, hands are the most likely to be exposed. Gloves, which can reduce exposure by up to 99%, may be the most important piece of personal protective equipment.

There are many types of chemical-resistant gloves available. The best ones are synthetic, such as nitrile and neoprene. Nitrile, perhaps the most commonly used glove, offers excellent chemical protection, durability, and dexterity. They're about $2-2.50 per pair. Neoprene gloves, a little higher-priced than nitrile at $7-8 per pair, provide excellent chemical protection and moderate dexterity. PVC, latex, and natural rubber gloves also work well, although PVC lacks dexterity, natural rubber gloves are expensive, and latex gloves will only protect you from diluted chemicals. Some gloves, such as the 4H® glove and Silvershield® gloves, are made especially for use with chemicals. Generally, they don't resist punctures and tears well, so it's recommended that they be worn under another pair of more durable gloves. Paper, leather or fabric gloves can absorb and retain liquids and should not be worn for chemical protection. All gloves should be unlined because linings can absorb chemicals as well.

Glove manufacturers are beginning to test their products for degradation and permeation. The degradation rate is determined by immersing gloves in a chemical for certain periods of time and measuring any effects the chemical has on the glove material, such as changes in weight or texture. Gloves are tested for permeation by immersing them and recording how long it takes for the chemical to pass through the glove material; this time is referred to as the breakthrough time (BTT) and is measured in minutes. A good glove has a BTT greater than 240 minutes. Manufacturers have only recently begun testing their products against pesticides, so you might not be able to find test data for all farm chemicals.

Periodically test your gloves for leaks by filling them with water and squeezing. Tuck shirt sleeves inside gloves and fold the glove ends over to form a cup that will catch any liquid running down your arm. But, when working with hands and arms overhead, sleeves should be tucked into the gloves with the cuff of the gloves turned up to catch any material that might run down the gloves. Wash off chemicals with soap and water, before removing the gloves, to avoid contaminating your hands while removing the gloves.

Respirators. Pesticides can enter the body via inhalation, skin absorption, and swallowing. Inhalation is the quickest and most direct route to the circulatory system. Respirators protect your lungs from dust, mists, fogs, and vapors. They *will not* protect you in places that may be considered immediately dangerous to life and health (IDLH), such as manure pits or silos. They don't offer protection from fumigants, either. Fumigants are highly penetrating and can penetrate the rubber and plastic on respirators. In addition, some are colorless and odorless and give no warning of exposure.

Before using a respirator, make sure you're fit enough to wear one. People with heart conditions or respiratory impairments should not wear respirators. If you're not sure if you should wear one, check with your doctor. Also make sure that the respirator you've chosen is approved by the Mine Safety and Health Administration (MSHA), or National Institute for Occupational Safety and Health (NIOSH). If the respirator is stamped with a number preceded by the prefix "TC," you can be sure that it's approved.

Perhaps the most common type of respirator used on the farm is the mechanical respirator, which has filtering devices to purify inhaled air. One type of mechanical respirator, the chemical cartridge or cannister respirator, uses special screw-on cartridges containing absorbants that filter out specific gases and vapors. The pesticide label will tell you what kind of cartridge you need for the chemical(s) you're using.

If you'll be exposed to dusts or mists, chemical cartridges alone will not protect you. You'll need a chemical cartridge respirator with an added dust/mist particulate prefilter approved for pesticides. The common dust masks found in hardware stores are not approved dust/mist respirators; they are used only as nuisance dust masks. Some dust/mist masks have been approved by MSHA/NIOSH as respirators because they have two elastic straps in back for a better seal, but they do not offer suitable protection from pesticides,

Half-mask mechanical respirators start at about $20; full-face ones are between $100 and $160. If you'll be exposed to dusts or mists *and* vapors, you can buy replaceable cartridge/particulate filter combination for about $5.00. If you buy them in quantities, they're even less.

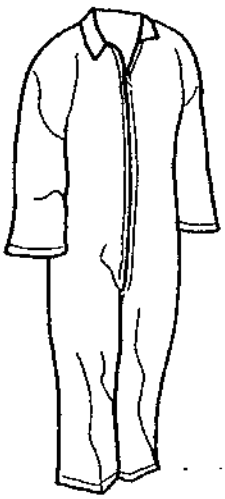
Chemical cartridges should be replaced if you begin to smell or taste the chemical; experience eye, nose or throat irritation; or if breathing becomes noticeably harder. Every time you replace a cartridge, if you're using a filter, replace it also. If you're only using a particulate filter, replace it when breathing becomes noticeably harder. If you ever experience nausea, dizziness or respiratory distress, get fresh air immediately.

To ensure that you have a well-fitting respirator, perform a fit *check* by blocking the two filter inlets with your palms and inhale. The mask should collapse onto your face. Then block the exhale hole (located in the chin area) and exhale. The mask should pop off of your face. DO THIS EVERY TIME YOU PUT THE RESPIRATOR ON! Annually and before using a new respirator for the first time, have a professional give you a fit *test*. During the test, you'll be asked to move your head around and recite something (the alphabet, for example) while an irritating smoke or strong, odorous substance is waved around your head. If you can't detect the substance, your respirator is sealed tightly. You should also have a fit test done if you gain or lose more than 15 pounds or if you receive an injury or have surgery to your face. For information on where to get a fit test, contact the respirator manufacturer.

Facial hair (even stubble), bushy sideburns, tobacco or gum chewing, or glasses may prevent your respirator from sealing properly. If you must wear prescription glasses, special wire adaptors are available for securing lenses safely inside a full-face respirator.

After each use, clean your respirator in warm, soapy water. (Be sure to remove cartridges and filters first!) Rinse it thoroughly, then allow it to air-dry in a clean, well-ventilated area. After it is perfectly dry, store your respirator and cartridges in a clean, dry plastic bag tied shut with a twist tie. For more detailed information on respirators for pesticides, see Agrichemical Fact Sheet #1, *Respiratory Protective Devices for Pesticides.*

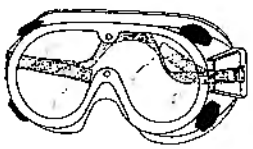
Chemical-protective clothing. When working around low toxicity pesticides, jeans and a long-sleeved cotton shirt are recommended for minimum protection. Apply a layer of starch spray to jeans for another barrier. Cotton coveralls reduce exposure even more. Better yet, as pesticides can penetrate clothing, wear a chemical-resistant suit. Make sure the suit is large enough so that it won't rip when you stretch or bend. Disposable chemical-resistant suits cost about $5; non-disposables are between $8 and $16. Add a chemical resistant apron during periods of high exposure, such as during mixing and loading. Aprons range in price from $3 to $12. New materials such as Comfort-Gard II™ breathe as well as cotton for comfort in warm weather, but can still keep liquids out. The suits are washable, but at about $50 per suit they're considerably more expensive, and none are good for protection against vapors. If you're worried about aesthetics, many suits are now available in a non-conspicuous denim blue.



When wearing a suit, if the neck opening is loose, drift and dust can settle on your shoulders, back or chest and contaminate the clothing you're wearing underneath. Don't leave contaminated clothing lying around the house—you could expose your family. Shake and hang the clothing outdoors to air, and check pockets and cuffs for dust before bringing the clothing inside.

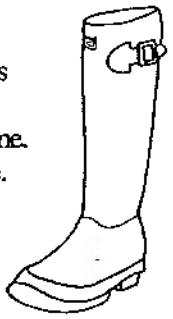
With the exception of TYVEK® and other disposable chemical suits, launder protective clothing and clothing worn under it after every time you work with pesticides. Wash it three times, separate from your family's clothing, in a heavy-duty detergent and hot water at the full water level. Residues can remain in washers, so flush them out by running an empty cycle with detergent. Hang the clothing to dry rather than put it in the dryer, where rubber parts can absorb and retain residue. Replace all protective clothing annually.

Eye protection. To protect your eyes from splashes and drifting dust, wear protective glasses with side and brow guards or, preferably, chemical splash goggles. If you wear protective glasses, a good fit is crucial. Both glasses and goggles should be anti-fog so they don't interfere with your vision, but they don't have to be impact-resistant. If you wear prescription glasses, wear a face shield or prescription protective glasses instead of goggles. Never wear contact lenses where potential for eye contamination exists. In case you do splash something in your eyes, keep a jug of potable water on hand so you can flush them immediately. Flush for at least 15 minutes and seek medical attention.



Like most other protective equipment, eye protection isn't expensive; goggles and glasses range from $5 to $10 and shields cost anywhere from $10 to $20.

Protective boots. Don't wear leather or canvas shoes around pesticides as they can soak up chemicals and retain them for long periods of time. They are virtually impossible to decontaminate. A good pair of rubber protective boots should only cost you approximately $10. Wear pant legs over the boots.



In Case of Accident: Be Prepared!

By wearing personal protective equipment when working around pesticides, you're significantly reducing your chances of being poisoned. Protective equipment won't *prevent* accidents, however, so you should know what to do before you, a family member or a co-worker needs help. Consult the pesticide container label—it'll give you valuable first-aid and antidote information specific to the chemical you're using.

Generally, signs of pesticide poisoning include: headache, sweating, weakness, dizziness, blurred vision, vomiting or nausea, diarrhea, darting eyes or pinpoint pupils, loss of muscle control, and chest pains. When poisoning is severe, the victim may convulse, fall into a coma or ultimately die.

If you or anyone working around you experiences one or more of these symptoms, call a doctor *immediately*. (Poisoning symptoms may take from 4 to 12 hours to appear.) When you go to a doctor, hospital, or the phone to call for help, take **the pesticide label** with you so you can give the doctor the information he/she needs. To save time, always keep a card with phone numbers for a doctor, hospital, fire/rescue/EMS station, poison control center, and police near the phone.

If your clothes are contaminated with a concentrated, highly toxic chemical, remove them immediately, put them in a plastic bag, and dispose of them with used pesticide containers. Don't try to wash off the spill—a uniform with spilled parathion concentrate on it may still contain enough residue to make someone seriously ill after being washed 5 or 6 times!

For more detailed information on pesticide poisoning, see Agrichemical Fact Sheet #7, *Toxicity and Potential Health Effects*, available from the Pesticide Education Office, 114 Buckhout Laboratory, University Park, PA 16802; 814-863-0263.

Revised Standard Protects Agricultural Workers

The U.S. Environmental Protection Agency has published a worker protection standard for agricultural workers who are exposed to pesticides. Some portions of the regulations take effect April 21, 1993 with the remaining provisions becoming effective on April 15, 1994. Employers will have to abide by a more strict standard that has been expanded to include both workers who handle pesticides directly and workers who may be exposed to pesticides on farms, nurseries, greenhouses and forests. General requirements of the standard include:

1. **PPE.** Pesticide handlers must wear the personal protective equipment (PPE) specified on the pesticide container label. Employers' responsibilities include:
   - •Providing PPE to each worker.
   - •Cleaning and maintaining PPE.
   - •Ensuring that each worker wears and uses PPE correctly.
   - •Preventing heat stress if the work and PPE could cause it.
2. **Restricted-Entry Intervals (REIs).** Employers must ensure that all employees abide by these intervals, which are found on the product label. Re-entry intervals range from 12 to 48 hours.
3. **Notification.** To prevent inadvertent exposure, employers are required to warn workers about pesticide-treated areas. Notification can be oral or via signs; if highly toxic chemicals are used, notification must be both oral and via signs.
4. **Decontamination.** Employees must be provided with water for washing off splashed or spilled pesticides or for general washing when they're done working.
5. **Medical Emergencies.** In emergencies, employers are responsible for providing the following:
   - •The name and location of the nearest medical facility.
   - •Transportation to a medical facility.
   - •Information about the pesticide(s) involved in the accident.
6. **Training.** Employers must:
   - •Provide pesticide safety training, including training on the use of PPE.
   - •Post a pesticide safety poster at a central location.
   - •At a central location, provide access to label information and information about what pesticides have been used on the establishment.

All safety warnings, information, and training must be given in "a manner the worker can understand." That is, if some workers speak Spanish, safety literature and training must be in Spanish as well as English. For more information on the EPA Workers Protection Standards (WPS), contact the Pesticide Education Office, 114 Buckhout Laboratory, University Park, PA 16802; 814-863-0263.

PSU/93

For a copy of our Fact Sheet Listing contact:
Agricultural and Biological Engineering Department
246 Agricultural Engineering Building
University Park, PA 16802
Telephone: 814-865-7685
FAX Number: 814-863-1031

Safe Farm

Promoting Agricultural Health & Safety

Keep gloves handy for pesticide work

Field studies show that wearing gloves reduces pesticide contamination on your hands. But do you find that gloves are:

- clumsy for adjusting equipment,
- uncomfortable or hot,
- difficult to get on and off,
- seldom handy when needed, or
- hard to keep clean?

To address these common complaints, this publication looks at your options for choosing, using, cleaning, and disposing of gloves.

Choosing the right glove

Precautionary statements on pesticide labels state if chemically resistant gloves are needed. However, it's up to you to choose the glove material, design, fit, and thickness best suited to your work.

Materials. Cotton, canvas, and leather gloves are easily penetrated and hard to clean so they are not recommended for work with pesticides. Chemically resistant gloves are made with different **rubbers:** natural, butyl, chloroprene, nitrile, and fluorocarbon (Viton®); or various **plastics:** polyvinyl chloride (PVC), polyvinyl alcohol, and polyethylene. These materials can be blended or laminated for better performance. Silver Shield® and 4H® have good chemical resistance and are barrier laminates.

In testing gloves for comparison, scientists measure "chemical break-through" time. This is the amount of time needed for a specific pure chemical to permeate (soak) through the glove. The longer the time, the better the protection, but an 8-hour break-through time is common. When selecting glove materials, consider not only the pesticide's active ingredient, but also its formulation. Most rubbers and plastics are resistant to dry and/or water-based pesticides. However, for other pesticide formulations, such as emulsifiable concentrates, the glove material must also resist the solvent. Common solvents are xylene, fuel oil, petroleum distillates, and alcohol. If the pesticide label does not specify a glove material, select a butyl, nitrile, or a barrier laminate glove.

If the material is not resistant to your pesticide, you will probably notice some glove damage right away. If so, discard them and try a different glove material.

Design. Gloves are made two ways: 1) die-cut into a "handprint" from film layers that are heat-sealed together at the edges, or 2) formed over a hand-shaped mold that is dipped into the polymer solution. Handprint gloves fit either hand loosely. Examples are polyethylene, Silver Shield®, and 4H® gloves. The latter two have better chemical resistance compared to rubber materials despite their thinness, crisp, slick, and stiff feel. The fit and slick texture may reduce your grip. Molded gloves differ in thumb placement and finger length. If the fingers are too long or short or the thumb is wrong, try a different brand for a better fit.

Fit, size, and length. When a glove fits, it seems less clumsy and is more comfortable. To find your size (7 to 12), measure around your hand (palm and back). If your hand measures 10 inches, get size 10. Some gloves are sized S-M-L and XL, "men's" and "women's," or "one size fits all." If so, try them on. Remember, as a glove stretches to fit, it gets thinner and will be harder to get on and off. Your hands may tire more quickly in tight gloves. If gloves are too big, you may have less dexterity and increased likelihood of getting them caught in machinery. For most tasks, use a glove that is 12 inches long and extends half-way to your elbow. If you need to reach into chemicals, you can get gloves that extend above the elbow.

Pesticide safety

How much do you know ?

1. Chemical resistance of gloves depends on:
   a) glove material.
   b) pesticide formulation and contact.
   c) thickness of gloves.
   d) all of the above.

2. Gloves with linings or cotton cuffs are not recommended for pesticide use at all because they're difficult to clean. True or false?

3. You should always wear your gloves over the sleeves. True or false?

4. If your glove seems too clumsy, you could:
   a) get a different size.
   b) get a different thickness.
   c) get a different brand.
   d) all of the above.

5. It's always obvious when gloves need to be replaced. True or false?

See answers on back.

IOWA STATE UNIVERSITY
University Extension
Ames, Iowa

Pm-1518c | May 1993

Thickness. Glove material thickness is measured in mils or gauge. With both measuring systems, bigger numbers usually mean thicker gloves and greater protection, but more stiffness. For example, "surgeon's" natural rubber gloves are 4 to 9 mils in thickness (1 mil = 0.0001 inch), and are not sturdy enough for pesticide work. Gauge is measured in inches. For example, Silver Shield® is 0.004-inch and one Viton® design is 0.036-inch. Uniformity in thickness is difficult to produce, and the thinnest points in a glove will fail first. In general, thicker gloves are more resistant to chemicals, tearing, and puncture but are more bulky and clumsy. Thinner gloves let you manipulate tools and equipment easily, but also puncture, rip, and tear easily.

Linings. Cotton knit, woven, or flocked glove linings or fabric cuffs are comfortable to wear and absorb sweat, but are not recommended for pesticide use because they are difficult to clean.

Using gloves

Gloves cannot help you unless you wear them. Keeping several pairs of gloves handy and free of pesticide soiling, but not in your way, is a challenge. One idea is to seal clean gloves in one-gallon zip-close plastic bags. After you handle or mix pesticides and before you take off the gloves, wash your gloved hands with water (and soap, if possible). Put the gloves back into the plastic bag until they can be washed more thoroughly. Avoid leaving used gloves on the floor of your pick-up truck or in places where family members might touch them. You may not see any pesticide on them, but tests with fluorescent dyes prove it is there and can rub off onto other clothing.

Most of the time you'll probably want your gloves over your sleeve cuffs. But if you are working in a drenching spray from above, put gloves under your sleeve cuffs so the chemical doesn't run down your arm and into your glove.

To take off gloves, peel one glove off by holding the cuff, then hold it wrong-side out in the ungloved hand as you peel off the other glove. Both gloves will be wrong-side out, with the contaminated surface to the inside, ready for washing or disposal. Never pull gloves off with your teeth.

Cleaning gloves

Wash gloves the same day they are soiled if you intend to use them again. Fill a bucket or tub with warm water and a strong detergent, submerge the gloves and stir them around with a long dowel or yardstick. Fish them out with tongs, then hang them on a line by the fingertips with clothespins to drip dry. Never put gloves in an automatic dryer; they melt with heat.

Deciding about disposal

No matter which gloves you choose, they probably won't last long. Watch for these signs to tell you when to replace gloves:

- staining or color change, inside and/or outside the glove;
- softening, swelling, or bubbling;
- stiffening, cracking, or surface change;
- dissolving or becoming jelly-like, or
- leaking at any time.

Remember that pesticides can soak through glove materials or contaminate the inside without changing the glove's appearance or texture. Therefore, replace gloves when there is:

- direct glove contact with highly toxic chemicals for a short time, or
- repeated contact over a longer period.

Routine replacement on a regular schedule may be a good idea, depending on your exposure situation. Dispose of gloves as you would empty containers or bags. Cut them up so no one will ever use them again if they are discarded with your trash.

Written by Janis Stone, extension textiles and clothing specialist, and edited by Laura Miller, extension communications.

For more information

A good source of information about pesticide safety is the *Private Pesticide Applicator Study Guide*, PAT-1, available at your local Extension office. The guide also provides a current list of suppliers that offer gloves. This publication is based on this and other research articles:

■ Schwope et al, "Resistance of glove materials to permeation by agricultural pesticides." In J.P. McBriarty and N.W. Henry (Eds.), *Performance of Protective Clothing, ASTM STP 1133*, American Society for Testing Materials, Philadelphia, 1992.

Pesticide safety

What can you do?

Wearing the right kind of gloves and caring for them properly can protect your hands from contamination whenever you work with pesticides. Consider these tips as you select and care for gloves:

- ☐ Read your pesticide label's precautionary statements regarding glove use.
- ☐ Choose glove materials considering both the pesticide's active ingredient and formulation.
- ☐ Always keep several pairs of clean gloves handy.
- ☐ Keep contaminated gloves stored safely until cleaning or disposal.
- ☐ Replace gloves frequently.

Answers to quiz: 1-d; 2-True; 3-False; 4-d; 5-False

Safe Farm

Safe Farm promotes health and safety in agriculture. It is funded by the National Institute for Occupational Safety & Health, Iowa State University, and a network of groups that serve Iowa farm workers and their families.

Cooperative Extension Service, Iowa State University of Science and Technology and the United States Department of Agriculture cooperating. Robert M. Anderson, Jr., director, Ames, Iowa. Distributed in furtherance of the Acts of Congress of May 8 and June 30, 1914

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COMPUTER USAGE IN AGRICULTURAL HEALTH-SAFETY EDUCATION AN INTERRACTIVE APPROACH

B.S. Boylan,RN,MS,L.Peavler,ADCS
Traumatic Farm Injury Surveillance Program in Kentucky
Lincoln Trail District Health Department,
Elizabethtown,KY.,USA

Objective. A user friendly computer based safety/ health education program for the Agricultural Community sponsored by The National Institute For Occupational Safety And Health, an Occupational Health Nurses In Agricultural Communities' Project.

Methods. Linkway Live! And Harvard Graphics were used to develop simplified programs requiring minimal instruction.Test Your Farm Safety IQ From Successful Farmer was computerized to ascertain how people in the farming community respond to various types of farming accidents.Immediate feedback was provided by on screen prompt and the number of correct answers was given at the end of the program.A laptop computer allowed for better portability of program to various sites in the target area.Age of user range was 12-60 years.All users required 2-3 minutes of instruction on the computer.Materials provided included computerized information,a graphic slide show,and take-home information for the re-enforcement.The program,which was completed in 10 minutes,was tested at six rural sites.

Results. The program's success was most evident in the 12-18 year age group.Response by this group indicated high interest levels in the subject area of farm safety.Also of note was potential for liason between educators and health professionals combining to enhance student education.

Conclusion. The future of computer usage as a teaching tool in agricultural safety and health demonstrates great promise and deserves further study.

EXECUTIVE SUMMARY

by James B. Houlahan, 1993 Churchill Fellow
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The Swire Group Churchill Fellowship to review health and safety in agriculture, with particular emphasis on pesticides and human health effects in the cotton industry - U.S.A.

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Although the problem has only recently been recognized, and although data are inadequate to properly define the nature and extent of the problem, farming represents one of the most dangerous occupations in Australia; second only to mining.

No other major industry in Australia has to accept the common presence of children of all ages. The peculiar nature of most farms in that they are not only workplaces but places where the farmer and his or her family lives means that the hazards to health and safety associated with production agriculture may and often do impact on the well being of other farm family members, hired help and visitors to the farm.

The past few years has seen an increasing interest and awareness of farm health and safety hazards; farming community based action groups supported by government departments are being established across rural Australia as part of a national strategy to improve conditions of health and safety on farms in Australia, through the provision of promotional/ informational/educational programs and a review of existing legislation with the aim of providing the appropriate supporting role to the education model. The poor status of occupational health and safety in agriculture is not unique to Australia, rather, most free market countries rank agriculture as one of their most hazardous industries. The difference is that in many of those same countries comprehensive health and safety programs are established to assist farm workers and their families avoid unnecessary farm illness and injury.

The Swire Group Churchill Fellowship provided sponsorship and timely opportunity to undertake a review of farm occupational health and safety programs in the USA over a 12 week period during the American summer of 1993.

During the fellowship which comprised of an extensive tour of farming operations, agricultural research centres, universities and safety engineering/government departments a wealth of information, ideas, reports and programs were gathered and considered on their merit for possible application into the Australian Farmsafe movement.

The author greatly appreciates the opportunity given by the Swire Group and The Winston Churchill Memorial Trust for their generous sponsorship of the Fellowship. *Discussions have since commenced with the Farmsafe Australia Committee, State Farmers Associations, the Federal Government and associated peak bodies with the view to initiate some innovative and supportive projects focussing on improving life and work on our farms.*

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THE PARLIER POST

VOL 9 NO 42 PARLIER (FRESNO) CA 93648 1 section, 6 pages Wednesday, July 14, 1993

Australia picks up ideas from UHC

Australian James Houlahan stopped at United Health Centers in Parlier last week during his twelve week review of agricultural health and safety programs in the United States.

Houlahan is the Agricultural Health and Safety Extension Officer for the Australian government. He met with Domingo Zapata, UHC's coordinator of the Ag. Safety and Health Education/Training Program.

Houlahan said the U.S. and Australia share numerous safety problems in the operation of farm machinery and vehicles. He explained that mechanical devices contributed to most accidents on Australian farms. He also said handling animals resulted in a significant number of injuries.

"Pesticide problems and safety hazards to farm children are also of major concern," said Houlahan.

The Australian Agricultural Health Unit is based in a hospital in a small farming town. The Unit provides specific health services to farm workers and their families. Service includes hearing screenings, pesticide testing, respiratory assessments, etc.

They also provide education and training opportunities to improve farm worker safety.

Houlahan was overwhelmed with the many studies and programs that exist in the U.S. He has visited universities, farms and training institutions throughout Georgia, Pennsylvania, Iowa, Washington, and Idaho.

After his 12 week tour of the U.S., Houlahan will incorporate similar programs back in Australia.

His studies are sponsored by the Winston Churchill Fellowship.

Spon lot to the heroes

Australian Agricultural Health and Safety Officer James Houlahan (left) with United Health Center's Domingo Zapata. Houlahan is researching U.S. farm worker health and safety programs to duplicate in Australia.

ACKNOWLEDGMENTS

This report has relied heavily on the knowledge accumulated by many dedicated individuals working to improve the health and safety status of farmers, farm workers and their families.

The opportunity to visit the United States of America (U.S.A) and undertake a review of agricultural health and safety programs, was made possible only through the generous support and co-operation of many people and organisations, who with I accept that agriculture must not lose sight of protecting its most valuable resource - its people. I therefore, acknowledge with pleasure my debt to the following: **The Winston Churchill Memorial Trust for honouring me with a Churchill fellowship and giving me the opportunity to undertake this important project.**

Mr. Edward Scott, Chairman and Chief Executive of John Swire & Sons Pty. Ltd. for his continuing support of this fellowship and for the Swire Groups outstanding generosity in sponsoring my fellowship.

Many other people and organisations both in Australia and the U.S.A. have assisted me throughout this project; Dr. Lyn Clarke and staff of the Agricultural Health Unit, the Moree Plains Health service and the many agri-businesses and safety organisations who provided me with financial support and useful contacts during my fellowship overseas.

CONTENTS **PAGE**

INTRODUCTION

The common belief of farming as a safe and healthy occupation may be far from true. Although the problem has only recently been recognized, and although data are inadequate to properly define the nature and extent of the problem, agriculture represents one of the most dangerous industries in Australia; second only to mining.

The peculiar nature of most farms in that they are not only workplaces but places where the farmer and his or her family lives means that the hazards to health and safety associated with production agriculture are not only confined to the worker, but may and often do impact upon the health, safety and well being of other farm family members, hired help and visitors to the farm.

The poor status of occupational health and safety in agriculture is not unique to Australia, rather, most free market countries rank agriculture as one of their most hazardous industries. The difference is that in many of those same countries comprehensive health and safety programs have been established to assist farm workers and their families avoid unnecessary farm illness and injury.

The Australian farm safety movement officially began back in 1988 following the first National Conference (**Farmsafe '88**), held to discuss occupational health and safety issues in Australian agriculture.

Farmsafe '88 brought together a broad range of people, including farmers and representatives of National, State and Territory farmers' organizations, rural community groups, farm consultants, suppliers and producers of agricultural chemicals and machinery, and Commonwealth, State and Territory government in the interests of creating safer working and living environments for Australian farms.

The conference made recommendations on a number of issues, including:

* a national network for occupational health and safety service and information delivery;
* nationally coordinated training and education programs;
* collection of better statistics; and
* review of relevant legislation.

A Ministerial Advisory Group on Farm Safety (**MAGOFS**) was established to progress the recommendations and propose a national strategy designed to improve the occupational health and safety for those people living and working on farms, including women and children, students in rural areas or studying farm-related courses, professional workers and others with an advisory role in relation to farming matters.

Community involvement is the key to this strategy under which activities to improve occupational health and safety are centered around **Farm Safety Action Groups** (FSAG) formed in local farming communities. This approach is in keeping with the views expressed by the farming community that efforts to provide healthy and safe working environments and the reduction of the incidence and severity of occupational injury and disease should be tackled at a farm level, not by Government regulation.

The Agricultural Health Unit was established in 1985 and is based at the Moree Plains Health Service in North West New South Wales. The Units role is to assist rural people to attain improved levels of health and wellbeing, through action to reduce the incidence and severity of injury and illness associated with life and work in agriculture.

"Farmsafe Australia" is the name given to a consortium representing Federal Government, National Farmers Association, Country Womens' Association, Australian Workers Union, Worksafe Australia, Rural Training Council of Australia and the Agricultural Health Unit. Its' role is one of coordinating farm safety activities across Australia and supporting the network of farm Safety Action Groups which continues to increase.

The philosophy which underlies the whole farm safety movement in Australia accepts the premise that farmers and their families themselves are the best suited to solving the current problems of health and safety on farms. To this end (FSAG's) can play a vital role in helping to identify local problems and mobilizing those individuals and organizations to advance health and safety on our farms. Increased access to relevant information and greater safety training opportunities and education programs are believed to be the answer to the long term solution of improving farm safety. Legislation's role is seen as supporting or supported by appropriate education programs.

With the unprecedented increase in interest and awareness of farm health and safety issues in Australia in recent years there has also been a growing frustration relating to the lack of data available to better define the nature and extent of Australia's farm safety problem, added to this, limited and ad hoc research has prevented an evaluation of all risks to human health for farm workers and others who live and work on Australian farms. As a result large information gaps remain that would help to facilitate technical solutions and assist in designing innovative education and training programs responsive to the needs of our farmers.

America has advanced further than Australia in addressing these and many other issues targeting safety on farms. A timely review of occupational health and safety programs for American agriculture provides some clues and lessons to strengthen our bid to make work and life much safer and healthier on Australian farms.

FELLOWSHIP STUDY PROGRAM

LOCATION/ CONTACTS	NATURE OF REVIEW OR STUDY	DURATION
Atlanta (Georgia) - international safety professionals - Centre for Disease Control - Georgia Agricultural Bureau	The 2nd World Conference on Injury Control - attend agricultural health and safety track workshop presentations and delivered a paper relating to farm safety in Australia.	7 days
	Discussions relating to the National Program for Occupational Health and Safety in Agriculture and Funding arrangements. Farm health and safety problems and preventative programs.	5 days
PENN State University (Pennsylvania) - Prof. Winand Hock & Dr. Dennis Murphy	Pesticide education programs, farm machinery safety - education and training programs.	7 days
University of Iowa (Iowa) - Prof. Kelley Donham	Farm injury surveillance, child safety on farms, farm safety outreach programs.	7 days
Cour d'Alene (Idaho) - USA/Canada Farm Safety experts	"National Institute of Farm Safety" Summer meeting. Latest innovations and priorities for safety on American farms.	5 days
U.C. Davis (California) - Dr. Patrick Marer, Mr. Lupo Sandoval, Prof. James Grieshop, Prof. William Steinke, Dr. Robert Lawson, Prof. Z. Weinbaum, Prof Steve Sutton	Pesticide applicator training, IPM program, overview of Ag' Safe program, -pesticide exposures to agricultural workers. -Attitudes by workers to farm safety. -developing a farm safety program -industrial hygiene perspective/farm safety -health studies relating to pesticide us- Personnel Management perspective of ag safety	8 days.
Tulare County (California) - Dr. John Rodriguez	Agricultural safety outreach programs in rural communities	2 days
Kings County (California) - Mr. Bernie Roberts	Safety training for cotton harvest workers	1 day

Parlier Research Station (California) -Mr. Peter Goodell -Mr. Brian Barrett	Integrated Pest Management approaches to reducing pesticide use and improving worker safety	4 days
Kearney Ag' Centre (California) -Mr. Tony Stapleton- Mr. Prather	Safety training of farm managers	2 days
United Health Centre Parlier (California) - Mr. Domingo Zapata	Outreach programs for farm workers and their families. Health screening services for non English speaking farm workers and their families	5 days
"Boswell Farms" Corcoran (California)	Cotton farm and cotton gin safety programs	4 days
San Joaquin Valley (California)	Pesticides and human health effects - community concerns to health from production agriculture	6 days

Farm Health and Safety programs in the United States of America.(USA)

The Bureau of Census and the United States Department of Agriculture (1987) paint a portrait of the farm population and the American farm. Over five and one quarter million people, translating into just over 2% of the U.S. population, claimed farm residence in 1986. Half all farm residents live in the Midwestern states of Illinois, Indiana, Iowa, Kansas, Michigan, Montana, Nebraska, the Dakota's, and Wisconsin. Overall, 43.6% of the land in the United States is devoted to raising food and fibre. The average American farm covers 180 hectares. However, the range of farm size is vast. For example, the average farm size in New Jersey is $4^1/_2$ hectares, while the average size of a Wyoming farm is 1,531 hectares.

While farms are geographically dispersed throughout a large portion of the country, farming involves only about 2% of the total U.S. population.

The small number of U.S. citizens directly involved in farming makes focussing national attention on the problems of U.S. farmers difficult. The dispersion and accompanying seclusion of individual farmers makes safety consultation and continual exposure to safety education and the enforcement of safety legislation impractical, if not impossible.

With some obvious exceptions the portrait of farms and farm residents in Australia is not that dissimilar to our American counterparts. The health and safety status of agriculture too has many similarities when you compare the U.S. to Australia. Agriculture in the U.S. ranks as the most dangerous industry, whilst in Australia agriculture is the second most dangerous industry behind mining.

In 1990, the American National Institute for Occupational Safety and Health **(NIOSH)** initiated a program in agricultural safety and health. This program is dedicated to preventing Leading Work-Related Diseases and Injuries among Americans engaged in agricultural work.

BACKGROUND

About NIOSH. NIOSH is the national public health organization responsible for the occupational safety and health of all the nation's workers. NIOSH is responsible for protecting and promoting the health and safety of workers and is dedicated to "primary prevention", which is targeted at controlling the root cause of a problem. When Congress created NIOSH in 1970 by enacting the Occupational Safety and Health Act, one of the priorities of the new Institute was to launch a national initiative to improve the health and safety of agricultural workers and their families. This program consists of several components:

1. **Survey** — NIOSH undertook a Farm Family Health and Hazard Survey to develop more complete information on the circumstances of agricultural injury and disease problems. Based on this information, informed priorities were able to be set for prevention and a baseline for measuring improvement could be established.

2. **Research** — To ensure that preventive actions are taken based upon scientific findings, including the etiology of injuries and diseases, NIOSH conducted research both intramurally and through university-based Centers for Occupational Safety and Health in Agriculture.

3. **Intervention** — To actively promote and implement the research findings, NIOSH established a national Agricultural Health Promotion System (APHS) in collaboration with land grant universities. Funds were provided for training traditional occupational safety and health professionals in agricultural safety and health.

4. **Surveillance** — To monitor results, NIOSH established an Agricultural Health Nurse Program, in which rural hospitals would provide ongoing responsive surveillance (focused at intervention) to identify agriculture-related disease and injury problems through the support of nurses in rural hospitals.

5. **Demonstration** — NIOSH also devised an early detection strategy to reduce the number of cancer deaths among farmers through Cancer Control Demonstration Projects for Farmers.

In 1983, to help establish priorities for the field of occupational safety and health, NIOSH suggested a list of leading work-related diseases and injuries and proposed national strategies to prevent each of them. In 1990, Congress targeted agricultural workers as a particular population at risk that NIOSH should address with its program. Farms have become fewer and larger and agricultural production concentrated. Farm operators and

their unpaid family members continue to provide the major portion of labor in agriculture, though hired workers have gradually displaced family workers on farms, increasing from 23 percent in 1950 to 35 percent in 1989. In 1990, NIOSH launched a program in agricultural safety and health dedicated to preventing work-related diseases and injuries in the industrial category of agriculture, whether rural or urban. This also includes the activities of timber and commercial fish harvesting. Diseases and injuries among agricultural workers and their families that are addressed by the NIOSH program are:

1. **Occupational Lung Disease.** These include hypersensitivity pneumonitis (farmers' lung), asthma, chronic bronchitis (hog lung), organic dust toxic syndrome ('silo loaders' syndrome, grain fever), and mucous membrane irritation.

2. **Occupational cancers** These are leukemia, non-Hodgkin's lymphoma, multiple myeloma, soft-tissue sarcoma, and cancers of the brain, skin, lip, stomach, and prostate.

3. **Musculoskeletal injuries.** These include carpal tunnel syndrome, tenosynovitis, epicondylitis, peritendinitis and tendinitis, milker's knee, and tractor drivers' syndrome.

4. **Severe occupational traumatic injuries** These include machine-related fatalities, electrocutions, suffocation, suicides, amputations, and eye injuries.

5. **Occupational cardiovascular diseases.** This includes heat stroke.

6. **Disorders of reproduction** Included are miscarriages and infertility.

7. **Neurotoxic disorders.** These include dementia, neurologic dysfunction, etc.

8. **Noise induced hearing loss** Peculiar to agriculture is unidirectional hearing loss.

9. **Dermatological conditions.** In addition to dermatitis, this includes burns and lacerations.

10. **Psychological disorders.** These include dementia, depression, stress and suicide.

11. **Infectious diseases** Some of these are zoonosis, tuberculosis and rabies.

NIOSH GRANTS The National Institute for Occupational Safety and Health issued five Federal Register notices in 1990, inviting various organizations to develop projects related to agricultural safety and health matters. These projects ranged from setting up studies of farm hazards and pesticide-related health problems to developing centers for longer range work with education involving farm families. Different grants were specifically directed to universities, medical staff, or agricultural extension workers. The five basic types of projects for which grants were available were: (1) Farm Family Health and Hazard Surveys (FFHHS); (2) Centers for Agricultural Disease and Injury Research, Education, and Prevention (CADIREP); (3) Agricultural Health Promotion Systems (AHPS); (4) Occupational Health Nurses in Agricultural Communities (OHNAC); and (5) Demonstration Cancer Control Projects for Farmers (DCCPF). there were numerous responses and those awarded grants represented 24 states.

NIOSH PROJECTS In addition, NIOSH Divisions in Cincinnati, Ohio, and Morgantown, West Virginia, undertook 25 projects. These projects address the five basic types of projects and generally deal with surveillance, research, or intervention.

THE AGRICULTURAL WORKFORCE (USA)

Major changes have occurred in American agriculture during the last 40 years, farms have become fewer and larger and agricultural production has become increasingly concentrated on the bigger farms.

The greater availability of machinery, chemicals, water, improved seed and livestock, and public financing have led to a greater substitution of capital for labor. As a result, the number of agricultural workers has declined by over 70 percent since 1950 and the activities and working conditions of U.S. farm workers have changed dramatically.

As a broad statement it could be said that these changes have raised serious questions about the health and safety of agricultural workers. Like Australia, the agricultural workforce in America is a diverse group of workers who perform a wide variety of activities on the farm. This diversity complicates generalizations about farm safety problems and solutions and is common to both countries.

Of a greater consequence for occupational health and safety in U.S. agriculture is that associated with the significant number of migrant farm workers and non english speaking farm workers including illegal aliens. The U.S. still wrestle with the question of not only how to help these workers, but also how to count them. It is believed that the hired component of the agricultural workforce will continue to grow in importance as hired workers increasingly replace family workers on farms and as the number of large, labor-intensive commercial farms continue to increase.

Components of the agricultural workforce include farm operators, unpaid workers, domestic hired farm workers, legal and illegal foreign workers , migrants and children. Farm safety intervention programs in the U.S. are attempting to accommodate the special needs of these sub groups.

SURVEILLANCE FOR AGRICULTURAL HEALTH AND SAFETY

In Australia one of the problems still hindering efforts to achieve a better status of occupational health and safety in agriculture is due to the lack of a nationally uniform system which provides sufficient data to clearly define patterns of farm injury together with incidence and severity. Whilst information pertaining to agricultural **fatalities** is accessible; and alone ranks farming as one of our most dangerous occupations, the current paucity of data being generated and analyzed relating to morbidity on farms has important implications from a prevention perspective and is a matter for priority action.

A summation of farm injury and illness surveillance in the U.S. may hold some ideas for improving the existing 'ad hoc' and limited programs here.

Surveillance is a french word originally meaning, "keeping a close watch over an individual or group of individuals in order to detect any subversive tendencies". This historical perspective provides a basis for the negative perception of "surveillance" in the general population that can seriously affect data collection efforts.

For America, a major barrier to progress in the prevention of agricultural injuries has been not only a lack of knowledge about the magnitude of the problem but also a deficiency in knowledge about the specific causes or risk factors due to the lack of analytical studies.

Through ongoing, systematic data collection, with consequent analysis and interpretation, epidemiologic surveillance enables the identification of the magnitude of the morbidity and mortality problem, injury epidemics, new injury problems, and potential risk factors. Of particular importance is that it can provide a scientific basis for analytic research to identify specific risk factors that are critical to the development of intervention strategies for the prevention and control of agricultural injuries.

Meaningful injury surveillance requires data that will allow the calculation of population-based morbidity and mortality rates. This requires complete numerator and denominator data for the population from which the data are drawn.

Based on recommendations published from the American National Academy of Sciences Committee there are essential data elements for injury surveillance.

TABLE 1. Essential Data Elements for Injury Surveillance.

INJURY CASE ELEMENTS

* TIME OF EVENT
* PLACE OF OCCURRENCE
* DEMOGRAPHIC CHARACTERISTICS OF THE INJURED PERSON (e.g. age, gender, education, socioeconomic status, occupation).
* CHARACTERISTIC OF THE INJURY (including body location affected, type of injury, severity)
* AGENT CAUSING THE EVENT (e.g., mechanical, chemical, electrical energy)
* SOURCE OF THE EVENT (e.g., machinery, tractor, gun, animal)
* MECHANISM OF THE EVENT (e.g., fall, struck by/against)
* CIRCUMSTANCES SURROUNDING THE INJURY EVENT (actively involved, equipment failure, weather, surface, or other environmental conditions)
* MEDICAL/HEALTH CARE PROVIDED TO THE INJURED PERSON
* HEALTH OUTCOME OF THE EVENT (e.g., complete recovery, persistent disability involving limitation of activities)

. Necessary to facilitate International Classification of Diseases (ICD) External Cause Coding (E-coding).

Adapted from Ing, 1985: Committee on Trauma Research, Commission on Life Sciences, Natural Research Council and the National Institute of Medicine, 1985

A variety of efforts in the surveillance of agriculturally related injuries have been undertaken in the U.S. to ascertain the magnitude of the problem, with vary degrees of success. The data sources for these efforts are presented in (Table 2).

TABLE 2. Data Sources Utilized in Agricultural Injury Surveillance: Advantages and Limitations

DATA SOURCES	AGENCIES/ AUTHORS	ADVANTAGES	LIMITATIONS
Occupational Safety and Health Administration	*Bureau of Labor Statistics		*Approximately 95% of all farms are not covered under OSHA, i.e., those with 10 or less employees.
Workers' Compensation			*Limited proportion of farms included.
Fatal Accident Reporting System (FARS)	*National Highway Traffic Safety Administration *Gerberich, Robertson, Gibson et al, 1991[27]	*Detects roadway farm vehicle-related fatalities	*Off-roadway vehicle events not included. *No identification of specific type of vehicle.

DATA SOURCES	AGENCIES/ AUTHORS	ADVANTAGES	LIMITATIONS
Death Certificates	• Welsch et al., 1989[12] • Gunderson, et al., 1990[5]	• Easily accessible. • Includes intentional and unintentional events.	• Fatality rate less that 1/100 of 1% assuming no more than one farmer per farm. • Extremely difficult to assess accurate count—occupation, frequently misclassified. • Information inadequate on death certificate relevant to primary/secondary causes of death. • "at work" box infrequently checked. • Source/mechanism of injury information limited and/or missing.
	• National Institute for Occupational Safety and Health—National Traumatic Occupational Fatalities (NTOF), Myers, 1990[39]		• Excludes individuals under 16 years of age. • All limitations, identified above, apply.
Newspaper Clipping Services-National/State Newspaper Clipping Services	• Welsch et al., 1989[12] • Gunderson et al., 1990[5]	• May facilitate recognition of emerging as well as persistent injury problems. • Authors included death certificates for verification. •Detects fatal events not readily accessed through death certificate data	• Identifies agricultural-related fatalities and catastrophic injuries. • 50% of fatalities may be missed as well as a large proportion of non-fatal injuries. • Reporting is biased according to gender/other variables.

DATA SOURCES	AGENCIES/ AUTHORS	ADVANTAGES	LIMITATIONS
Hospital Records	• Gerberich et al., 1989, 1990, 1991 (Used to validate telephone interview)[15, 18]	• Identification of specific diagnosis and treatment.	• Confidentiality makes records difficult to access. • Bias—only most severe injury cases included. • Inadequate data on circumstances of event. • Non population-based. • Oriented toward diagnosis, treatment and, possibly, rehabilitation. • Long-term consequences not identifiable. • very few persons are hospitalized; only 8% of all farming-related injury cases. • Miss those who die before reaching hospital or are transferred elsewhere. • Biased due to type of insurance, if any.
Hospital Records—All hospitals (n=25) in 15 county sample	• Fuortes et al., 1990[37]	• Active system employed.	• Selection of sample not identified. • Occupation-related injuries only. • Procedures regarding confidentiality not identified—cases were followed up by investigators with no apparent consent procedures. • No indication of participation rate of either hospitals or patients.
Emergency Room Cases U.S. Consumer Product Safety Commission (CPSC), National Electronic Injury Surveillance System (NEISS)	• McKnight, 1984[38]	• Provides national estimates.	• Product-related injuries only . • Sample of emergency rooms is not representative of those in the United States. •Identification of manufacturer not released.
Emergency Room Cases Part of project to develop systems for continuous and periodic injury surveillance	• Jansson, 1987[39] • Jansson and Svanstrom, 1989[40]	• May facilitate recognition of emerging as well as persistent problems.	• Descriptive data on injured cases only • No exposure data collected.

DATA SOURCES	AGENCIES/ AUTHORS	ADVANTAGES	LIMITATIONS
Emergency Room and Urgent Care Cases	• Stueland et al., 1991[41]	• May facilitate recognition of emerging as well as persistent injury problems	• Descriptive data on injured cases only • No exposure data collected.
Outpatient Facilities		• Potential to detect greater range of severity.	• Diagnosis may not be ascertained initially. • No denominator information.
Primary Care Practitioners		• Potential to detect greater range of severity.	• No denominator information (age/gender composition is overestimated, Eylenbosch and Noah, 1988).[2] • Typically a passive system. • Quality of classification underestimated.
In-Person Interviews	• National Safety Council	• Contact reportedly every three months—minimized recall bias.	• Sample selection unclear • Use of local volunteer interviewers.
Telephone-Based Interviews-Olmsted Agricultural Trauma Study (OATS); Provided basis for Regional Rural Injury Study adn Subsequent Surveillance (validation with medical records)	• Gerberich et al., 1991[15]	• Population-based, enabling. • Utilized U.S. Department of Agriculture's (USDA) Master Sampling Frame to identify all farms in Olmsted County. • Ensured qualification as an operating farm during period of study. • Collected demographic and farm exposure injury data on all participating farms in the county. • Overall participation rate = 82%, full interview participation = 75%. • Provided a basis for the following multiple sub-studies, including: 1) Case-Control Study of Farmwork-Related Injuries. 2) E-Coding Study. 3) Follow-up site visit, machinery-related studies.	• Confidentiality of records necessitates access through USDA office resources only.

DATA SOURCES	AGENCIES/ AUTHORS	ADVANTAGES	LIMITATIONS
Telephone-Based Interviews-Regional Rural Injury Study (RRIS) Provides a basis for national surveillance	• Gerberich et al., 1989-1992[35]	• Population-based, enabling identification of specific rates. • Utilized USDA Master Sampling Frame to select stratified random sample of farms in five states. • Ensured qualification as an operating farm during period of study. • Collected demographic and farm exposure injury data on participating farms in five states. • Participation Rate-78%. • Data are entered directed into the Computer Assisted Telephone Interview (CATI) system, enabling efficient monitoring, data management, and analysis. • Provides a basis for multiple studies, including the following: 1) Case-control study of tractor rollovers. 2) Case-control study of animal related injuries.	• Confidentiality of records necessitates access through USDA office resources only.
Mailed Questionnaires 545 dairy farms in Otsego County	• Stallones, 1986[42]	• Ease of contact.	• Response rate 45% • Self-selected sample.
Mailed Questionnaires	• Fuortes et al., 1990[37]	• Ease of contact.	• Response rate 41%. • Biased populations of hospitalized individuals. • Identification of occupation relatedness and event characteristics in medical records are notoriously poor. • No control for days of hospitalization. • High potential for misclassification.

To summarize, U.S. agricultural safety professionals feel surveillance is essential to prevention; and the role of surveillance in prevention has four main objectives:

* the ability to recognize and identify problems,

* defining the scope of the problems,

* to target interventions and,

* to evaluate the efficiency of interventions.

TRACTORS AND FARM MACHINERY HAZARDS

No other farm machine is so identified with the hazards of production agriculture as the tractor (Murphy, 1992). Tractors and other powered farm machinery contribute to more deaths on U.S. farms than any other agent, a statistic common to Australian agriculture.

Hazards associated with tractors may be grouped in the following way: stability/instability, runovers, PTO stub, and miscellaneous. Aged tractors warrant special attention (Murphy, 1992).

In Australia legislation exists to provide safe operation and guarding of farm tractors, yet tractors still remain a major cause of death and permanent disability in rural industries despite the fact that to a large extent the action required to eliminate such tragedy is known and well established in many places (McDonald, 1993).

Tractor rollovers or overturns are the leading cause of fatalities on farms in both U.S.A. and Australia. Roll-Over Protective Structures (ROPS), are commonly accepted to be the most effective defence to protecting the driver in the event of a tractor roll-over. Whilst ROPS are now mandatory for all farm wheeled tractors in Australia a significant number of older tractors are still being operated on farms absent of ROPS despite the legislation and the over whelming evidence of their effectiveness.

Legislation in Australia also provides for the protection of passengers on tractors, with specifications for approved passenger seating. This has special relevance for children who make up an all too alarming percentage of victims of tractor fatalities.

During September of 1991 '**Farmsafe Australia**" staged a National Tractor Safety Conference at University of New England Orange Campus, the recommendations from that conference to the appropriate federal Ministers appears in the appendix to this report

In the U.S.A., manufacturers, farmers, safety engineers, safety specialists, and government are targeting a number of key areas in a bid to reduce injuries associated with tractors and associated farm machinery.

Key issues being targeted include:

* **Behavioral Research** - the manner of use of the machinery was a significant factor in accidental injury. behavioral research is also needed to guide engineers on how equipment can be designed for safer operation and maintenance.

* **Injury Data Collection** - to develop a uniform national reporting system and database.

* **Lighting and Marking of Equipment**- alternative ways of effectively identifying slow-moving vehicles; extremity lighting and marking of equipment that travels on roads and highways, and turning indications.

* **Air Filtration Systems**- tractor cabs now have effective filtration systems for most particulate matter. Additional research is required to determine whether a reliable system is feasible to reduce to acceptable levels concentrations of fine pesticide dusts, aerosols, vapors and gases.

* **Whole Body Vibration Reduction**- with the assistance of human factor specialists improving tractor seat design.

* **ROPS**- to establish the efficiency of ROPS designs for small and older model tractors and to determine major problems contributing to farmers resistance to retrofit ROPS on older tractors.

* **Tractor Stability Indicator**- numerous variables involved in tractor overturn have been identified, plans are to develop instrumentation that will give the operator instantaneous cues concerning the tractor stability as it is operated.

* **Training and Education** continue to develop resources and programs for training of new tractor operators.

OTHER FARM MACHINERY HAZARDS

In addition to the high injury rate on farms as a result of tractor accidents, harvesting equipment, slashers, mowers, balers, rotary hoes etc, are common agents of farm injury. . The farm truck or pick up and increasingly A.T.V. (farm bikes) are appearing in accident data as a frequent agent of injury on U.S.. farms.

PESTICIDE HAZARDS

Perhaps no other issue raises such controversy and debate when talking farm safety than that of the use of agricultural chemicals, in particular pesticides.

Clearly, chemicals in agriculture have played a major role in bringing about the high yields in food and fibre currently obtained by farmers world wide. But the increase use of farm chemicals has brought with it a growing concern by the community in general of the potential adverse health effects from pesticide exposure, not only occupationally but also for families living in or near farming communities and for the community at large who consume the agricultural produce.

Australia certainly has not escaped the great chemical debate, in fact the cotton industry (for which this study project has had a particular emphasis), has long been associated with a high dependance on pesticides, primarily insecticides for sustaining high levels of cotton fibre production. Whilst other farming enterprises in Australia do currently rely on significant inputs of pesticide to obtain economical results and maintain viability, the cotton industry being such a high profile industry and perceived as a major user of pesticides, continues to be a focus for close attention by government and non government bodies concerned with existing and potential adverse effects to the environment and human health from pesticide exposure.

Like Australia, America takes very seriously the issue of pesticides and human health effects, and together with the industry many programs have been developed to both reduce the dependence on farm chemicals and to minimize the risks of accidental pesticide exposure. Unlike Australia however, much research has taken place to better define the health problems and clearly identify the risks of exposure to the pesticides.

Previous and existing research studies attempt to analysis quantitive and qualitive data pertaining to pesticide exposure and adverse human health effects; acute and chronic. This report only attempts to highlight some of the major issues where research efforts are being focussed in the U.S. and provides yet another perspective to moderate the debate.

What are the potential adverse health effects from pesticide exposure?

Adverse health effects from exposure to pesticides are commonly grouped as acute (based on a single, short-term exposure) or chronic (may be from a single exposure or from repeated exposures over a period of time).

Acute Health Effects:

Effects from acute exposure to pesticides are well established, but as is the situation in Australia; for America also, statistics on injury and death from acute exposures are incomplete for the United States as a whole.

Pesticide toxicity is a measure of its capacity to cause injury, and severity of adverse health affect relates (whilst not exclusively) to the level of unprotected exposure. The effects or influence a pesticide has on humans depends on various factors such as: physical and chemical properties (toxicity, degradation, volatility, ect) of the pesticide; the dose or concentration of the pesticide; the duration of the persons' exposure; susceptabilty of exposed person and the type of exposure (inhalation, ingestion, dermal).

Acute exposures may result in immediate serious illness or death. More common are minimal over exposures that lead to headache, sweating, diarrhea, dizziness, fatigue, muscle ache, nausea, and other common human maladies. These symptoms mimic many other illnesses and incorrect diagnoses has led to a under reporting of mild pesticide exposures.

Chronic health effects:

Of growing concern are chronic health outcomes that do not occur immediately after exposure, including carcinogenic, developmental, immunological, reproductive and neurological effects.

The lengthy interval between exposure and chronic effects makes risk assessment for these outcomes more difficult to evaluate than acute effects.

What evidence or research supports the concern for pesticide safety?

Experimental and epidemiologic investigations indicate that pesticides can cause a variety of adverse health effects including carcinogenicity, immunotoxicity, neurotoxicity and reproductive toxicity.

Contemporary testing procedures are a vast improvement on earlier research efforts in America, and today significant efforts are devoted toward experimental and epidemiologic evaluation of pesticides. The quantity and quality of the data available, however, vary by disease outcome.

Establishment of a formal testing program by the American National Cancer Institute (NCI) in 1968 and continued by the National Toxicology Program (NTP) in 1978 provide scientific evaluation of the risks to health from chemicals used in agriculture.

Who are the at risk groups from exposure to pesticides?

Both Australian and American research and health surveillance concludes that occupational exposure (i.e. manufacturing, mixing, application, handling, etc) user, present the greatest risk. Farm workers therefore, are considered to be at significant risk of pesticide exposure when less than adequate safety protective measurers are taken. The wider community has been assessed to be at a lesser but still significant risk, the level of risk determined by numerous factors, not the least being adherence to pesticide safety and usage controls.

What Safety Controls or protection measures are in place?

Legislation relating to the registration, sale and use of agricultural chemicals, including their disposal exists in both Australia and America. While there currently exists established measures to help reduce risk of adverse health effects from pesticides, including industry initiated programs for Australian farmers, a review of pesticide safety control measures for the United States would be useful for future considerations in enhancing safety.

United States Environmental Protection Agency (EPA) is the authority responsible for the registration of all pesticides. EPA promulgates regulations making it "unlawful for any person to use any registered pesticide in a manner inconsistent with its labeling", civil and criminal penalties exist for violations of these regulations. Revised provisions have augmented EPA's authority to protect humans and the environment from unreasonable adverse effects of pesticides.

The Worker Protection Standard for Agricultural Pesticides (WPS) has recently been revised by the Environmental Protection Authority (EPA) with expanded scope and requirements. A summary of the main provisions are:

* Labels of agricultural pesticides will require compliance with the WPS. The labels will contain statements referring to the revised WPS.

* The revised WPS expands the scope of the regulation to include not only - workers performing hand labor operations in fields treated with pesticides but also workers in forests, nurseries, and greenhouses, and employees who handle (mix, load, apply ect) pesticides for use in these locations.

* Personnel Protective Equipment (PPE) - all pesticide handlers must wear the PPE required on the pesticide labeling for the handling task being performed.

* Notice about applications - orally warn workers and post treated areas if required on the pesticide labeling. Warning signs should be at entrances to treated areas. Orally warn workers of location and description of treated area; restricted-entry interval, and not to enter during restricted-entry interval.

* Display of information at a central location, including WPS safety poster, information about the location of emergency medical facilities, and a list of recent pesticide applications.

* Training - all agricultural workers must have basic pesticide safety training. (this may be given by employer, manager, supervisor, etc or external body). All handlers must have basic pesticide safety training on the handling of pesticides,and training on the use of PPE. A poster summarizing the elements of basic pesticide safety must be posted at a central location on the agricultural establishment to reinforce the safety training. NOTE: Training must be in the spoken language of the worker and should be specific to each pesticide used.

* Decontamination sites - water, soap and single-use towels are to be made available during any work activity where there is a potential employee contact with concentrated or diluted pesticides or with surfaces that have been treated with pesticides.

* Emergency Assistance - including transportation to medical care and information to medical personnel or your employees.

* Monitoring of handlers - who are using highly toxic pesticides.

* Equipment Safety - including inspection and maintenance.

* Restrictions associated with applications - including provisions for vacating treated areas, and eliminating problems of chemical drift and off target contamination.

* Disposal of used containers, packages ect and contaminated waste.

In addition to the WPS, other safety control strategies are in place. Other government agencies are responsible for administering and enforcing legislation designed to minimize pesticide safety risks.

The United States government through the Occupational Health and Safety Administration (OSHA) has issued the hazard communication standard to help assure safety and health is not put at unnecessary risk in handling chemicals on the job. This standard applies to all work places including farms. Very basically the standard says that employees have "The Right to Know" what potential hazards exist with chemicals in the workplace and how they can protect themselves.

Components of the standard include provisions for:

* **Instruction** - regarding the Hazard Communication Standard;

* **Written Program** - the employer must develop, implement and maintain a written program;

* **Provide access to MSDS sheets;**

* **Special Protection and Special Precautions Information**, including first aid information.

Numerous universities, extension officers and other government and non-government organizations have developed and promote pesticide education and training programs. An extensive range of training resources including publications, videos, slide sets, audio sets and even pesticide safety training games for non-english speaking workers are available throughout the United States.

Recognition and management of pesticide poisonings has been given priority attention by the EPA, and publications targeted at rural doctors and other health professionals are now available to assist in diagnosis and treatment of pesticide poisonings throughout the United States.

Integrated Pest Management (IPM) is seen as the rational approach to addressing the concerns of pesticide usage and public safety. A significant amount of research continues to be a catalyst for creative activities in pest management and pesticide safety. The United States has been successful in the IPM program and Australia would be well advised to make a more rigorous approach in this area for the following reasons:-

* to reduce the pesticide load in the environment

* to increase the predictability and thereby the effectiveness of pest control techniques;

* to develop pest control programs that are economically, environmentally, and socially acceptable;

* to marshal agencies and disciplines to integrated pest management programs;

* to increase utilization of natural pest controls.

What Health Surveillance exists for Pesticide Poisoning?

In addition to the National Toxicology Program, University based research projects are involved in health surveillance of farm workers which include testing for pesticide poisoning. In the State of California reporting of pesticide illness is mandatory, this is not the case in most other states and the level of surveillance is also variable across the United States generally.

Australia undertakes pesticide poisonings surveillance through State Cancer Councils Registers, poisons information centres, state and territory Work Health Authorities and Department of Health. The Moree Agricultural Health Unit has an ongoing pesticide screening program which is being utilized by farm workers in the North West of New South Wales.

Conclusions and Issues for future consideration (pesticide safety)

Given the evidence for potential adverse health outcomes from exposure to pesticides, enhanced efforts are needed to control exposures in agriculture and elsewhere. More thorough evaluations (experimental and epidemiologic) are needed to more fully characterize the potential adverse effects that may occur from pesticide exposures. Epidemiologic investigations must focus on exposures to specific pesticides. This will require detailed exposure assessment procedures to characterize the type and intensity of exposures.

Studies of farm populations should receive a high priority given the widespread use of pesticides in agriculture and for the potential for exposure among farmers and farm workers and their families. Further, public and occupational health experts should begin to evaluate the risks that a growing agricultural biotechnology industry poses to farm workers.

Health surveillance for those exposed to agricultural pesticides needs to be expanded to assist in defining risks and evaluating preventative strategies.

Training and education on safe use of pesticides should be expanded and continuous throughout the farming industry and specific consumer education programs on the use of pesticides in agriculture need to be more vigorously promoted.

OTHER MAJOR FARM HEALTH & SAFETY HAZARDS

The leading cause of farm work-related deaths in the United States is tractor accidents. This statistic is common to Australian agriculture.

NIOSH (U.S.A.) has identified key areas for farm health & safety intervention and these have been previously mentioned in this report.

Other major hazards to health & safety on farms which are common to Australia and the U.S.A. include: Ag. bike safety, animal handling safety, farm noise, respiratory hazards, solar radiation and skin cancer. A listing of farm health & safety resources gathered during the Churchill- U.S.A. farm safety study tour appears in the appendix to this report, and relates to other major health & safety problems in agriculture.

FARMSAFE AUSTRALIA document:- A proposed strategy for improving health & safety on Australian farms (April 1993) provides further information detailing priority interventions for the Australian farm safety movement, and is included as an addendum to this report.

INTERVENTIONS FOR AGRICULTURAL HEALTH & SAFETY

The need for surveillance and research to guide injury control efforts in agricultural safety and health presents many challenges and society will judge our success by how effective our intervention methods are in protecting agricultural workers and helping create the change in their behaviour necessary for their success.

The American approach provides some ideas for Australia and our own farmsafety movement, conversely, the community development style of the Australian farm safety strategy is generally accepted to be less threatening and directed towards better collaboration than many of the intervention programs in the U.S.A..

Various approaches to health & safety intervention have been applied to agriculture. However, limitations exist for the effectiveness of injury control strategies in the agricultural workplace. What new methods emanating from the public health approach and human factors engineering will be required to solve these problems? How do we educate to achieve behavioural changes toward better agricultural safety & health? How do we educate people to change accident-causing or otherwise risky behaviour?

Building meaningful people-involvement into problem identification, program development, and program delivery is essential. Failure to involve the real stake holders (the farmers and farm workers) dooms even the most outstanding programs to failure. Fortunately the era of unshared decision making is generally behind us.

The collaborative efforts of government, industry, unions and engineers, ergonomists, safety professionals, industrial hygienists, experts in biomechanics, behavioural sciences are needed to address the most compelling problem areas by studying what makes up workplace systems on farms and the process, tasks and tools involved. We need to identity potential causal mechanisms, opportunities for intervention, and possible prevention strategies. No less important, we must be conscious of the other factors which may impinge upon the farmer and farm workers' attitude and ability to improve conditions of safety on farms, and we must address these important issues also, to the best of our ability.

CONCLUSIONS

Production agriculture has several unique characteristics that impact upon its safety and health problems. Among these include: children in the workplace, young and untrained workers, aged workers, a working class that has a relatively low economic status; and a culture that has traditionally not supported the type of safety and health interventions used on other industries.

Clearly, there exists an unacceptably high injury and illness rate on Australian farms; this is recognized by the agricultural industry, and initiatives have commenced with the industry to address major problems and develop strategies aimed at eliminating or reducing hazards to health & safety for farmers, farm workers and their families.

FARMSAFE AUSTRALIA has proposed a national strategy for improving health & safety on Australian farms and integral to its development and implementation has been the active involvement of farmers and their representative bodies.

America has focused a significant amount of research in the area of farm health & safety and various intervention programs and resources have been developed to address farm safety issues. Australia can advance its efforts toward improving safety on farms through the review and utilizaiton of many farm safety programs from overseas including the U.S.A..

Following the FARMSAFE '88 conference a Ministerial Advisory Group on Farm Safety (MAGOFS) was established to progress the recommendations of the preceding national occupational health & safety conference for Australian agriculture. The group met on 20th January and 21 February, 1989 to discuss the FARMSAFE '88 recommendations and in accordance with its terms of reference agreed that the most effective method of implementing the FARMSAFE '88 recommendations was through the development of a national strategy. This strategy would establish the action necessary to address the issues raised, the organizations involved and mechanisms for co-ordinating the activities.

After reviewing occupational health & safety programs in agriculture for the United States of America it confirms my belief that the Australian model and its modus operandi holds the best chance for a marked and sustained improvement in health &safety on our farms and reducing risk of accidents to farmers, farm workers and their families.

What is needed however, is a more concerted effort and commitment from industry, government and other stake holders in further progressing the recommendations from (MAGOFS), and to this end the research work and preventative strategies developed in other, but similar free market countries like America, where agriculture as a major industry is having to address its problems relating to occupational health & safety, provide timely lessons and valuable clues to how we involved in farm safety in Australia might find some solutions to issues currently unresolved.

My recommendations therefore, relate to more specific areas to build on our existing strategic approach and augment our focus to better understand what has been a complexity of issues impacting on farmer and farm family health & safety.

The proposed dissemination of this report and accompanying recommendations is primarily through "FARMSAFE AUSTRALIA" and the Australian farm safety network.

RECOMMENDATIONS

1. The uniqueness of agricultural health & safety problems need to be clearly communicated to both agricultural and non-agricultural populations as a way of encouraging more creative injury intervention strategies.

2. Farmers, Farmers Associations, agricultural industry; associated industries, government, unions, universities, training institutions, medical and rural health workers etc, need to become more visible in their support of agricultural health & safety as a way to create a culture and value system among farm workers and families that includes farm health & safety practices.

3. Priority attention toward long term funding support for Australian farm safety activities is recommended. Industry, Government and Corporate sponsorship options needs to be pursued.

4. University based and industry based research efforts to better evaluate farm safety risks should be expanded and co-ordinated through 'FARMSAFE AUSTRALIA'; emphasis on practical research for the development of intervention programs should be encouraged.

5. Agricultural safety professionals and researchers should become more familiar with the concepts and foundations of applied behavioural analysis.

6. Assistance for those collecting and analysing agricultural injury data through the development and wide utilization of minimum data set for recording farm injury and illness.

7. Farm safety action groups should be provided with a wide variety of print and visual mediums to communicate farm health & safety information.

8. Young people (children) should remain a target for farm safety awareness education and training. Children are impressionable and receiving health & safety concepts at school and by their parents re-inforces the need for safety first.

9. A review of current legislation for occupational health & safety for farmers is required and this review must have involvement from the farmers themselves.

10. Manufacturers, distributors and agricultural expert advisors should become more pro-active in their activities targeting safety in agriculture. Farm machinery manufacturers and distributors should support safety engineering research initiatives commensurate with the number and seriousness of agricultural machinery injuries.

11. Farming commodity groups and grower groups should take on a more visible role in promoting safety in their industry. Grower newsletters should be used to disseminate safety information and industry should assist in identifying key health and safety problems and developing safe solutions.

12. Peak bodies including National Farmers Federation (NFF) and insurance companies should investigate incentive schemes to both enhance attention to safety on farms and provide monetary rewards or savings to farmers and farm workers for effective safety interventions.

FARM SAFETY U.S.A. RESOURCE LIST

B	*	Papers and proceedings of the Surgeon General's Conference on agricultural safety and health. (NIOSH), 1991
B	*	Proposed National strategies for the prevention of leading work-related diseases and injuries Part 2 (NIOSH), 1988
B	*	1992 Project facts - The National program for occupational safety and health in agriculture (CDC, NIOSH), 1992
B	*	Agricultural Safety and Health Bibliography (NIOSH), 1992
B	*	Video tapes catalogue (NIOSH)
B	*	National Occupational Exposure Survey - Sampling methodology (NIOSH), 1990
B	*	Occupational injuries in California Agriculture, 1981-1990 (U.C. Berkeley)
B	*	National Institute of farm safety, conference Proceedings - 1991, 1992, 1993 (NIFS)
B	*	Safety and health for Production agriculture (Dennis J. Murphy), 1992
F/S	*	Farmstead Safety -a family activity (Cornell University)
P	*	How farm parents make decisions about their children's activities: implications for injury prevention (Cornell University)
P	*	Realities of Safety Education (ASSE), 1985
P	*	Interactive video - An effective strategy in agricultural safety training (University of Iowa), 1992
B	*	Reducing farm injuries: Issues and methods (University of Illinois)
B	*	Annual Report University of California Statewide IPM Project, 1992
R	*	Health effects of Pesticides: An overview (California Health Dept), 1990
B	*	Pesticides: Health aspects of exposure and issues surrounding their use (California Dept of Health), 1988
B	*	Pesticide Safety for non-certified mixers, loaders and applicators. (EPA), 1986
R	*	Proceedings of the U.S. EPA workshop on cholinesterase methodologies (EPA), 1992

R	*	Strategies of education, enforcement and engineering to improve pesticide management and safety (U.C. Davis), 1984
R	*	Transfer of Cypermethrin from carpeting to apparel fabrics (U.C. Davis), 1993
P	*	Successful Implementation of Integrated Pest Management for agricultural crops
R	*	Use and care of clothing worn for pesticide application (Iowa State University), 1989
R	*	Chronic neuropsychological sequelae of occupational exposure to organophosphate Insecticides (American Journal of Industrial Medicine), 1990
P	*	The worker protection standard for agricultural pesticides (EPA), 1993
F/S	*	Handling pesticides safely (Penn State University)
F/S	*	The fate of pesticides in the environment and groundwater protection (Penn State University)
B	*	Recognition and management of pesticide poisonings, fourth edition (EPA), 1989
B	*	The illustrated guide to pesticide safety (University of California)
B	*	Pesticide Education manual (Penn state University) 2nd edition
F/S	*	Right to know (OSHA)
F/S	*	OSHA machine guarding standard (Penn State University)
F/S	*	The extra rider hazard on farm vehicles (Penn State University)
F/S	*	Slow-moving vehicle emblem (Penn State University)
F/S	*	OSHA ROPS and operator instruction requirements (Penn State)
F/S	*	Tractor overturn hazards (Penn State)
F/S	*	A summary of laws relating to agricultural machinery safety
F/S	*	Power take-off (PTO) safety
P	*	Tractor stability indicator
R	*	Operator limitations in tractor overturn-recognition and response
R	*	Agricultural machine safety research: fatality prevention targeting

R	*	Trends in twenty years of tractor accident statistics
B	*	Used farm equipment - assessing quality, safety and economics
F/S	*	Farm respiratory hazards
F/S	*	Agricultural respiratory hazards and protective devices
B	*	Guide to Industrial Respiratory protection
B	*	Respiratory decision logic
B	*	A practical guide to effective hearing conservation programs in the workplace
B	*	NIOSH publications on noise and hearing
P	*	"Farm Safety 4 Just Kids" chapter manual
B	*	Childhood agricultural injury prevention
P	*	Farm stressors: The hazards of agravian life
F/S	*	Ladder safety in the citrus orchard
R	*	Breaking new ground - help for disabled farmers
R	*	Rural rescue and emergency care
B	*	Farm accident rescue
B	*	First on the scene
B	*	Extinguishing silo fires
R	*	Farmer's Caps and Hats: skin cancer prevention project
F/S	*	Farm animal safety
F/S	*	Back injury avoidance for the agricultural worker
B	*	Health hazards of storing, handling and shipping grain
B	*	Occupational exposure to hot environments
V	*	Pesticide safety training
V	*	Farm safety facing the challenge
V	*	Agricultural equipment operator safety programs composite 1-7

V	*	Farm safety for kids
V	*	Kids talk farm safety stuff
V	*	Farm safety a second chance
V	*	Farm safety family style

KEY:

B - Book or manual

F/S - Fact Sheet

P - Pamphlet

R - Research Report

V - Video

Appendices 1

PROCEEDINGS OF THE FIRST NATIONAL CONFERENCE ON TRACTOR SAFETY HELD AT UNIVERSITY OF NEW ENGLAND (ORANGE CAMPUS)

17-18 SEPTEMBER 1991

Edited by Ian Mitchell

9. TOWARD AN ACTION PLAN

Ian S. Mitchell

PROCEEDINGS OF THE WORKSHOP

Whereas Tuesday was devoted to the formal presentation of papers, Wednesday was given over to a Workshop in which a strategy for reducing tractor accidents and an Action Plan for achieving it, were debated.

Bill Brown introduced these objectives by identifying a number of issues that had been thematic throughout the previous days presentations.

In doing so, he drew from a model outlined in a Discussion Paper entitled "Safer Workplaces, a National Approach", circulated in December 1989 by the Federal Minister for Industrial Relations.

The model identifies criteria for safety promotion in any field:

a) knowledge of responsibility
b) knowledge of standards
c) access to information about hazards and solutions
d) access to information and expertise about prevention and problem solving
e) trained representatives
f) continuous training in safe practices
g) skills in re-designing jobs
h) access to statistics

Mr Brown challenged participants to keep those critical elements before them as they designed a strategy for improving the safety record of tractor use. He summarised the papers presented the previous day in the light of the model.

Workshop participants then divided into four groups each of which addressed the same two questions:

1) What are the key problems to be overcome to reduce significantly the risk of damage to people using tractors?

2) Where should the major collective effort be directed in order to reduce the risk of damage to people using tractors in Australia?.

MAJOR ISSUES

Participants were required to identify the problem areas and then to decide which four warranted priority.

After each syndicate had reported back to the plenary, the group as a whole discussed and voted on the major issues.

Through this process it was found that the most prominent issues in regard to tractor safety could be classified under the following four categories:·

1) Engineering-related problems, including:-

* vulnerability of older tractors
* removal or absence of ROPS
* run-overs
* lack of regular preventive maintenance
* design difficulties - e.g. access, ergonomics, attachment and hitching
* passengers - need for second seats, seat-belts, care of children on tractors, etc.
* lack of guards over moving parts on tractors or their attachments

2) Farmer/consumer-related problems, including

* available information is diluted
* undesirable practices are reinforced when parents teach their children
* lack of formal training at the point of sale
* because home and work are the same place there is greater resistance to the enforcement of any legislation or regulation
* an antagonistic attitude to legislation because farmers are fiercely independent
* the psycho-socio-somatic, value systems of the farming community which reinforced incorrect behaviour patterns in using tractors
* familiarity - farmers believed they had been driving for many years and did not need any further instruction
* hobby farmers who generally bought old tractors, were not experienced drivers and had no training
* compulsory training and licensing such as required in the industrial scene with forklift trucks.

It was noted in this category that Victoria had offered a small inducement for farmers to attach ROPS but very few accepted the offer notwithstanding the nature of the grant.

3) Information and support services problems:

* lack of uniform legislation; needs to be reviewed regularly and specifically

* publicity including TV advertising; to be put in plain English with seasonal and industry variations
* point of sale information
* exchange of ideas, communication feedback between all agencies
* the need to address barriers to communication.
* dealer training
* the problem of a rural culture

4) Defining the problem

* need for reliable and predictable data including accurate assessments on the damage to people
* government responsibilities to ensure safe behaviour
* national perspectives and the need for uniform Codes of Practice, regulations and interpretation
* evaluation of present situation including feedback from the farming community
* enforcing the existing legislation and regulations which were generally seen to be reasonable adequate.

At the conclusion of the plenary discussion, Geoff MacDonald recalled his matrix and noted that even in discussion, participants had focussed on a relatively small part of the problem. The conference like most other safety programs were concentrating on the Category A1 issues and even then mostly on the fatal accident segment of that cell.

This was probably because it was the only real data available but he urged that we give consideration to other cells as well. He noted that accidents were not caused by one segment. Behavioural, desigu and environmental factors were all important.

From this framework it was decided that each of the four syndicates would take one of the areas listed above. They would then address more specific questions and highlight the need for follow up action. The groups considered:

1. Old tractors - ROPS - preventive maintenance
2. Runovers - access
3. Attitude - awareness - familiarity - culture
4. The definition of the problem and the need for a database that defines uniformity and provides evaluation and feedback

Each of the groups then considered four questions, viz -

1. What precisely is the problem to be addressed?
2a. What caused the problem specifically?
2b. What other contributing factors played a part?
3. What action is required and who should carry it out?

The Syndicates defined the following key factors.

Syndicate No 1 OLD TRACTORS, ROPS & INSUFFICIENT MAINTENANCE

1. Statement of the Problem:

Since the introduction of ROPS legislation in 1973 there has been no known fatality in NSW in a tractor roll over where an approved ROPS was fitted. National and international experience support this record of ROPS saving lives and injuries. It is, therefore, imperative that all tractors in Australia be fitted with an approved ROPS.

2a. The problem is/has been caused by:

- complacency: most tractor users do not believe that accidents will happen to them
- cost: the cost of fitting ROPS to older machines is (incorrectly) considered uneconomic
- inconvenience brought by fitting ROPS, spending maintenance time, and so on

2b. Other Contributing factors are:

- the legislative barrier - where tractors built before a certain date are not compelled to fit ROPS
- economic downturn means less money to install ROPS and to take other safety measures
- geographic isolation with less likelihood of sharing experiences and the absence of threat of prosecution
- the law is not policed very carefully anywhere in Australia

3. We recommend the following action:

- promotion of absolute need for ROPS should be implemented via community groups (FSAGs or equivalent) and funded as a National Project
- publicity/education/demonstration should use case studies of accidents and their impact on the family farm.
- legislative option (5 year review to assess compliance).

Syndicate No. 2 RUNOVERS AND ACCESS

1. Statement of the Problem:

A significant number of people are injured or killed by being driven over or crushed by a tractor while alighting, mounting or working with it.

2a. The problem is/has been caused by:

- crushing when operator attaches implements
- people thrown from moving tractors
- tractors moving when operator opens gates, etc
- people slipping as they mount or alight
- people running beside to regain control
- standing alongside such as when jump starting
- passengers

b. Other contributing factors are:

- age of farmer: there is mounting evidence that older (and even experienced) farmers lose co-ordination skills with age
- age of machines: the majority of accidents occur on older machines
- condition of machinery: there is a direct correlation between tractor accidents and the amount of maintenance afforded the machine
- fatigue
- climatic conditions

3. We recommend the following action:

- modification of early model machinery to current safety standards by industry manufacturers
- national support and funding be given to local Farm Safety Action Groups for safety programs to be directed to farm families.

Syndicate No 3 ATTITUDE AND CULTURE

1 Statement of the Problem:

There is inadequate recognition in the farming community and in other segments of Australian society that tractors and machinery are a major cause of personal damage.

2a. The problem is/has been caused by:

- lack of farmer/user awareness

- the traditional view of farmers as independent and isolated people who are being left to their own devices results in few people promoting safety
- inadequate training at the point of sale

b. Other contributing factors are:

- lack of data and poor communication of what data is available
- familiarity
- false sense of security
- isolation of farm worker, dispersed industry

3. We recommend the following action:

- ask the National Farmers Federation to raise the priority and profile about the need to eliminate tractor deaths and injuries.
- ask Federal and State Governments to provide funds to ensure that the problem is tackled realistically and positively (e.g. publicity training and education, safety programs developed for the whole farming family, incentives to farmers)
- public institutions, e.g. hospitals and schools, should be asked to raise awareness through the application of their expertise, the provision of meaningful statistics and the promotion of safety in programs
- the private sector (e.g. retailers, manufacturers, etc) should be provide better information, with their agents being trained to provide sound advice on safe tractor operation
- improved co-ordination to gain uniformity on legislation across Australia

Syndicate No 4 DEFINITION OF THE PROBLEM

1. Statement of the Problem:

There is insufficient data collected or published showing the damage to persons and property. The research shows that tractor accidents reduce effective and efficient production and result in unacceptable levels of human and financial cost to the nation

2a. The problem is/has been caused by:

- fragmented and inappropriate reporting systems (The Ministerial Advisory Group Report had also identified this as of primary concern)
- insufficient recognition of the issue by the nation.

2b. Other contributing factors are:

- the national lethargy means that there is little demand for data

3. We recommend the following action:

One authority should be charged with the responsibility of providing uniform data on damage caused to people and property. That authority should be the National Injury Surveillance Unit.

CONFERENCE RESOLUTION

Alarmed by the extent of the problem, the apathy of the nation to resolving it, and the need to take urgent action, the Conference resolved that:

1. Letters of concern be addressed to leading political leaders;

2. The Ministerial Advisory Group on Farm Safety be reconvened together with representatives from the Tractor Safety Conference and tractor dealers in order to consider the specific issues and recommendations of the Conference, and to identify how resources should be directed to reduce this major problem.

Adopted Unanimously,
18th September, 1991.

Conference Representatives

The conference elected the following representatives to meet with the Ministerial Advisory Group

Tractor and Machinery Association - Greg Haydon
Primary producers - Des Waldron
Safety Consultants - Geoff MacDonald
State O.H. & S. Departments - Keith Ferguson
Farm Safety Action Groups - Ronnie Hazelton
Rural Educational Institutions - Wayne MacPherson

Appendices 2

FARMSAFE AUSTRALIA

A PROPOSED STRATEGY FOR IMPROVING HEALTH AND SAFETY ON AUSTRALIAN FARMS

APRIL 1993

1. Background

The Profile of Farm Health and Safety prepared for Farmsafe Australia details the key injury and illness problems associated with farming in Australia. Although information is at this stage piecemeal, and attention is required to improved data systems to support prevention programs, a number of priorities for action have been identified. These are:

PRIORITY	BASIS FOR PRIORITY STATUS
Tractor safety	The leading cause of work related death
Farm machinery safety	A major cause of death and injury on farms
Agbike safety	A leading cause of injury and disability resulting in hospital admission
Horse handling safety	A leading cause of injury and disability resulting in hospital admission
Hearing conservation	Currently about 60 percent of farmers have significant noise induced hearing loss
Agricultural chemical safety	A major cause of concern to the community, and many farmers do not use appropriate safety precautions
Prevention of child drowning on farms	The leading cause of accidental death of children on farms
Solar radiation and skin cancer	Farmers and farm workers are at high risk of skin cancer

In addition, the following agricultural industries are considered by Farmsafe Australia to be priority industries for development of effective occupational health and safety programs. The inclusion of these industries is based on value of production, and the number of workers associated with the industry.

Sheep production
Wheat and grain production
Beef production
Sugar production
Dairy industry
Cotton industry
Orchard and fruit production
Vegetable production

Further investigation and research in the areas of animal injury and zoonoses, respiratory disease and manual handling is required, and management of farm stress and change has subsequently been identified as a priority issue.

2. A strategic approach to farm health and safety

It is proposed that a strategic approach to addressing Australian farm health and safety should:

1. Build on the goals and strategy proposed by the Ministerial Advisory Group on Farm Safety in its report of May 1989. ie

    - Encourage and support Farm Safety Action Groups at local level
    - Develop a mechanism for education and training in farm safety
    - Improve data collection systems in support of farm safety programs
    - Improve communication and promotion of farm safety in the rural
    - sector
    - Establish a national information resource, with overseas linkage
    - Improve coordination
    - Review existing legislation between states to ensure consistency

2. Aim to increase awareness and skills of farmers in hazard identification, assessment and control to improve farm safety

3. In line with (2) above, assist and support farmers in meeting their legislated obligations in occupational health and safety

4. Address the priority problems identified above by Farmsafe Australia

5. Involve the priority industry groups in addressing farm safety issues

6. Be achievable with the limited resources identifiable to Farmsafe Australia

7. Permit states to "specialise" on behalf of other states in developing Australia-wide resource material

With these principles in mind, a number of limited programs have been agreed and adopted by Farmsafe Australia.

Farmsafe Australia Programs

1. Support to the Farmsafe network
2. Information systems program
3. Education and training in farm safety
4. Equipping farmers for improved farm health and safety
5. Tractor and farm machinery safety in Australia
6. Child safety on farms
7. Safe use of agrochemicals
8. Hearing conservation on farms
9. Agbike safety
10. Horse safety
11. Farm Stress Management
12. Working with agricultural industries
13. Research support

PROGRAM	ACTION REQUIRED	CURRENT STATUS	PROPOSED ACTION :	COMMENT
1 Support to Farmsafe Network	1. Continued linking of network via Newsletter 2. Funding support 3. Guidelines for programs/promotions 4. Farmsafe Week programming 5. Guidelines for data collections and surveys	1. Newsletter being produced 2. Guidelines material available, but needs development and wider distribution 3. Funding a major problem in most areas	operations Centre program: Newsletter Guidelines Funding sources identified and advised	

PROGRAM	ACTION REQUIRED	CURRENT STATUS	PROPOSED ACTION	COMMENT
2. Information systems	1. Standardise data systems 2. Guidelines for local, state and national collections 3. National data base/ repository 4. Maintain national farm injury profile	1. Agricultural Health Unit has contacted overseas agencies and: 1.1 Defined systems for agent, context and production system for farm injury data system 1.2 Piloted hospital separations farm injury data by agricultural zone 1.3 Application for RIRDC grant for further development under consideration 2. Queensland Farmsafe has special survey being undertaken 3. NSW Agcost Centre has survey underway 4. SA Health Department interested in farm injury data 5. Several rural centres using NISU system in A&E Departments	Agricultural Health Unit to: 1. Formalise Information System Working Group 2. Set goals and targets 3. Maintain National Profile of Farm Health and Safety	Achievable with current and anticipated resources

PROGRAM	ACTION REQUIRED	CURRENT STATUS	PROPOSED ACTION BY;	COMMENT
3. Education and training in farm safety	1. Set national farm OH&S competencies and criteria for training programs 2. Review syllabus and curriculum of education and training institutions 3. Develop courses, resources for training institutions 4. Run Train-the-trainer programs as appropriate	1. Worksafe has proposed national OH&S competencies for guidance 2. SA TAFE has produced a home study module on Rural Safety taking these competencies into account 3. Reviews of High School Education Agriculture syllabus being undertaken in NSW 4. A range of activities occurring in schools and colleges with local FSAG input	Rural Training Council of Australia to establish a Working Group to : 1. Set national competencies 2. Recommend action by state RTCs and education authorities	Should be possible in association with current activity

PROGRAM	ACTION REQUIRED	CURRENT STATUS	PROPOSED ACTION	COMMENT
4. Equipping farmers for improved farm health and safety	The following resources should be available to all farmers in Australia: 1. Farm safety checklist 2. farm safety induction manual and records system for employees 3. Specific commodity farm safety manual 4. Clear and relevant requirements established under any Codes of practice 5. Accessible and affordable First Aid courses	1. Making Your Farm Safer has been piloted and is ready for review and reprint 2. Queensland has developed an Induction Manual 3. The Red Cross is working in some areas to develop a suitable course	Agricultural Health Unit to establish Review Committee 1. To review Checklist and arrange reprint 2. Review Queensland Induction Manual and print as pilot for national usage 3. Recommend commodity manuals Special Farmsafe meeting to address legislative issues	Final reprints for manual should be user-pays on a cost recoup basis only Thereby feasible with current resources

PROGRAM	ACTION REQUIRED	CURRENT STATUS	PROPOSED ACTION BY:	COMMENT
5. Tractor and machinery safety in Australia	Implementation of recommendations of Report of Ministerial Advisory Group on Tractor Safety 1. Design initiatives 2. Research and improved data 3. Standards and legislation 4.Awareness and information 5. Education and training	The report is before the Minister for Industrial Relations and the Minister for Primary Industries and Energy	Worksafe Australia to assist the Operations Centre to prepare appropriate submission for funding of programs as recommended in Report	Funding support would be optimal If funding not available, Worksafe to develop alternative program with Operations Centre and state Occupational Health and Safety Authorities.
6. Child safety on farms	1. Identification of major child safety on farms issues 2. Strategy for child injury prevention developed 3. Effective programs implemented	1. NSW Farmsafe Working Group has developed discussion paper based on major causes of death and injury 2. SA OH&SC has circulated Discussion paper for comment 3. Paediatricians and child safety experts have interest	1. Operations Centre seek interest of Child Accident Prevention Foundation of Australia in participating in / sponsoring national child safety on farms program 2. NSW Farmsafe to coordinate future action if	

PROGRAM	ACTION REQUIRED	CURRENT STATUS	PROPOSED ACTION BY:	COMMENT
7. Safe use of agrochemicals	User training program implemented in all states	National competencies set Courses available	RTC to set specific targets for participation	Achievable with current resources
8. Hearing conservation on farms	1. Baseline of hearing status of farmers in all states 2. Hearing screening services for farmers 3. Promotion of hearing conservation practice	The National Rural Health Conference has recommended development of a national approach to farmer hearing conservation with Farmsafe Australia input NSW program strategy well developed	Agricultural Health Unit to liaise with National Department of Health (Rural Health) over national screening services and with OH&S Departments over appropriate action Set national goals and targets	A grant for this program should be sought
9. Agbike safety	1. Identification of cause of injury problems associated with agbikes 2. New standard for agbike helmets 3. Training program for agbike riders	1. North West Farmsafe Committee (NSW) has Agbike Action Group working on problem and developing training program 2. Other FSAGs have training programs and promotions	NSW Farmsafe through North West FSAG 1. develop goals and targets and 2. Contact SAA for development of standard	Agbike suppliers may be interested in sponsorship

PROGRAM	ACTION REQUIRED	CURRENT STATUS	PROPOSED ACTION BY:	COMMENT
10. Horse safety	1. Identification of preventable factors in horse related injury 2. Education programs in schools and ,equestrian network 3. Promotion of helmet use to reduce risk of head injury and death	Gloucester FSAG undertaking further research and piloting programs in areas in 2 states.	NSW Farmsafe through Gloucester FSAG develop goals and targets, develop recommendations and programs	
11. Farm Stress Management	1. Identification of key resource people and agencies 2. Identification of nature and extent of problems 3. Strategy to improve stress management, reduce impact of stressors	1. Increasing young male suicide rates observed in rural NSW 2. Meeting held NSW Farmers on 10.5.93 between agencies, and initial action proposed 3. Worksafe material available	To be proposed	

PROGRAM	ACTION REQUIRED	CURRENT STATUS	PROPOSED ACTION	COMMENT
11 .Working with agricultural industries	Liaison with each commodity group to determine interest and current status of OH&S 1. Identification of key hazards associated with each commodity production system 2. Development of relevant and effective control recommendations 3. Development of a manual for each industry	1. Agricultural Health Unit and other surveys developing injury profile for industries of dairy, sheep, cattle, cotton, grains 2. Queensland Farmsafe developed Induction Manual with Cane Growers 3. AgHU working with Cotton Industry to develop injury profile and prevention program 4. Gloucester FSAG working with dairy industry 5. SA and AgHU involved in SAA with wool presses 6. AgHU working with Orcharding and Vegetable Growers for exposure to pesticides	Operations Centre to formally contact each commodity group on behalf of FSA to elicit level of current interest, and suggest source/s of assistance. Recommend: 1. Cane Growers - Queensland Farmsafe 2. Sheep - SA Farmsafe 3. Dairy - NSW and Victoria 4. Grain - NSW (AgHU) and WA 5. Cotton - AgHU 6. Orchard 7. Vegetable	These programs should be developed in an "opportunistic" basis, as interest is generated and resources are available. R&D Corporations are possible sources of grants funds for OH&S development work
12. Research support	Register of current research activity and support to ongoing research	1. Agcost (NSW Agriculture) study into costs of farm injury 2. Rotary Health funded stud into injury of young men on farms (AgHU) 3. Qld Farmsafe Survey	Operations Centre contact all states, funding bodies for identification of research activity	Ongoing