

# Injury Prevention Programming for Aged Tractor Operators

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## Abstract

Farm tractor safety and health education programs for adults have often assumed a relatively homogenous population. Our prior research findings suggest significant differences exist among young adults, middle-aged adults, and aged farm tractor operators in their formal education, years of experience, beliefs, attitudes, and behaviors regarding tractor safety issues and physical fitness to use farm tractors safely. The authors suggest that it is important to consider these differences and to encourage active participation by tractor operators in program development, implementation, and evaluation to enhance the success and effectiveness of programs.

*Keywords.* Injury prevention, Tractor safety, Education, Program development, Aged tractor operator.

In recent years, several authors have noted that traditional farm safety educational efforts have been relatively ineffective (Aherin, Murphy and Westaby, 1992). According to Baker (1984), the idea that people can be educated to be safe may not be the best method for promoting safety. However, Aherin et al. (1992) and Murphy (1992) suggest that safety education will remain a primary intervention methodology.

In production agriculture, safety educational programs for farm workers, farmers, and their families generally have been offered by tractor manufacturers, extension safety specialists, vocational agriculture programs, and insurance companies. These safety education programs consist largely of safety information about hazards and how to avoid them. This approach has succeeded in creating safety awareness, but seems to have had relatively little effect on changing behavior associated with safety. Recent studies that suggest farmers do not follow recommended tractor safety practices include: farmers (78%) not having fire extinguishers on their tractors (Oskam and Barfield, 1992); parents (80%) feeling it was safe for their children to ride on farm tractors (Aherin and Todd, 1989); and respondents (93.5%) who indicated that at least one or more tractors on their farms were not equipped with rollover protective structures (ROPS) (Ogilvie, 1990). According to Elkind (1993), assumptions that attitudes and behavior change can be accomplished simply by providing information is simplistic and perhaps not valid.

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## Aged Farm Tractor Operators

Compared to other age groups, aged (65 and over) farm operators have injury rates two to three times higher than other workers (Aherin et al., 1990). In Pennsylvania, from 1985 to 1989, aged farmers comprised 32.6% of farm fatalities with 68% of these representing tractor-related incidents (Murphy, 1991). A descriptive survey of Pennsylvania farm tractor operators was conducted during 1992, and a preliminary analysis of the data was presented by Ambe and Murphy (1993), with a more detailed analysis reported by Ambe (1994). The survey subjects were adult farm tractor operators, ages 18 and over. This article's foci are on data associated with those survey respondents who were 65 years of age and over (hereafter referred to as aged tractor operators) and the data's implications for tractor safety education with this age group. While this study may be generalized only to tractor operators who are members of the Pennsylvania Farmers' Association (who may be more involved in farming and have more access to safety information than non-members), we believe the findings and our discussions may also be very pertinent to the majority of aged tractor operators.

### Methods and Procedures

A 106-item questionnaire was developed and refined through consultation with an advisory committee consisting of land-grant-university agricultural safety specialists, a product safety engineer, a National Institute for Occupational Safety and Health (NIOSH) safety specialist, and agricultural extension educators. The questionnaire was pretested with a random sample of 60 farm tractor operators who were members of the Pennsylvania Farmers' Association. Those selected for the pilot test were excluded from the larger study.

Using computer-generated random numbers, a single random sample of 557 individuals was selected from a frame of farm tractor operators (adult Pennsylvania Farmers' Association members). The 557 individuals, who were stratified by age, were composed of 270 farm tractor operators between the ages of 18 and 64 years selected at 5% degree of accuracy and 287 farm tractor operators age 65 years and older selected at 3% degree of accuracy according to methodology used by Krejcie and Morgan (1970). Farm tractor operators eligible for the study were encouraged to voluntarily participate in the study.

The questionnaire along with a self-addressed, stamped envelope was mailed on 18 August 1992. Reminder postcards were mailed on 25 August and a follow-up letter and questionnaire were mailed on 9 September. The deadline for receiving completed questionnaires was 15 October. By that date, 419 questionnaires had been received; a 75% return rate. Of the total received, 288 questionnaires were complete and usable, resulting in an effective response rate of 52%. As a group, 78% (224) of the aged tractor operators responded to the survey. However, of those 224 responses, only 123 (55%) were complete. On several of the non-complete returned forms, survey respondents had written that they no longer operated a tractor. Twenty percent of the initial non-respondents were contacted by telephone in a follow-up survey. A comparison of the telephone respondents with the mail respondents indicated no significant differences between the two groups. In addition, because not every subject responded to each question, there are some variations in the n reported against each statement in the tables of the findings.

## Findings

Thirty-eight percent of aged tractor operators were full-time owners and operators of their farms, while 35% were retired and occasional farm workers. About 62% of the aged tractor operators had attained above the ninth grade level of formal education. On average, aged tractor operators had 48.8 years of experience using farm tractors, with 68% indicating that their most frequently used tractor was manufactured on or before 1976. All tractor operators indicated that the strength required of them to operate farm tractor controls was adequate. Practically all aged tractor operators (99%) learned to operate tractors on their own or while riding with a parent or other person.

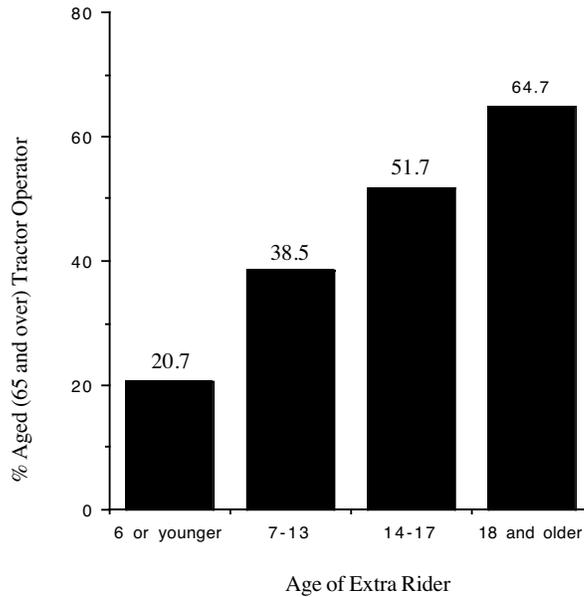
Aged tractor operators were asked how they felt about the usefulness of a variety of tractor safety-related features such as rollover-protective-structures (ROPS), the power-take-off (PTO) shield, slow-moving-vehicle (SMV) emblem, warning lights, etc. In cases where a respondent felt that the survey question was not applicable to his or her situation, the response was excluded from the analysis of the data for that question. For example, not all operators use tractors equipped with ROPS; these operators were excluded in the analysis of data regarding the usefulness of ROPS, seatbelt use, etc. Of those responses analyzed, 63% of farmers operating ROPS equipped tractors felt a ROPS was a consistently useful safety device, with the percentage increasing to 68% for an enclosed cab with ROPS. Only 10% felt a ROPS was never useful, and even fewer (6%) felt an enclosed cab with ROPS was never useful.

When asked if the tractor they most frequently operated originally had a ROPS and seatbelt, 32% indicated yes. The operators were then asked if the originally installed ROPS was still in place. Nearly one-half (43%) indicated it was not. When asked about how frequently they used their seatbelt, only 5.7% indicated that they consistently used the seatbelt. Aged tractor operators also had an increasing tendency to allow extra riders on farm tractors as the age of the extra rider increased. For example, 21% indicated that they allow extra riders age 6 or younger, with the percentage increasing to 39% for riders age 7 to 13 years, 52% for riders age 14 to 17 years, and 65% for riders age 18 years and older (fig. 1).

The busiest months for overall farm work and tractor operation for aged tractor operators have been summarized in table 1. May, June, and July are by far the three busiest months for overall farm work and for tractor operation by aged tractor operators. April, August, and September are the other months of significant activity. There was none or only negligible activity reported during the winter months of November through February. This indicates that the months often associated with good weather are when aged tractor operators have the greatest exposure to farm tractor operation.

The farm work activities involving the use of a farm tractor by aged tractor operators during the busiest months included tillage, planting, applying fertilizers or chemicals, and harvesting. About 44% of aged tractor operators routinely used their tractors six days per week (fig. 2), and nearly 54% indicated that they operated their farm tractor between five to eight hours per day (fig. 3). Together, these data suggest that approximately 50% of aged farm tractor operators average 30 to 48 h of exposure to farm tractor operating hazards per week during the busiest months of farm tractor operation.

Table 2 shows that no other group of persons appears to have much of an influence on aged tractor operators regarding how they operate their tractors. Immediate family members, farm equipment dealers, and neighboring farmers have "some influence" with approximately one-third of the aged tractor operators.



**Figure 1—Percent of aged tractor operators allowing extra riders by age group.**

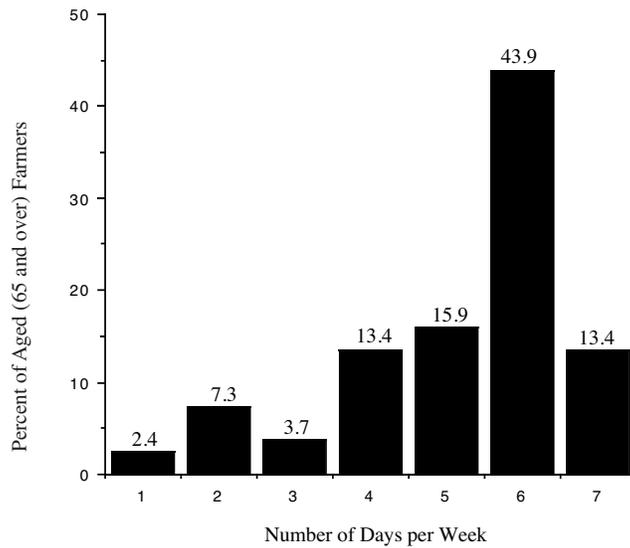
Spouses and agribusiness/service personnel also have “some influence” with about 25% of the respondents. Spouses, immediate family members, and parents were all identified as having a “strong influence”, but together these groups have a strong influence, on the average, with only 13% of the aged tractor operators.

Table 3 shows the attitude of aged tractor operators on the issues of tractor inspection and certification, and a license for tractor operation. There was a high percent of disagreement (92%) regarding a government agency being assigned the

**Table 1. Percentage of aged (65 and over) tractor operators and their first, second, and third busiest months for overall farm work and operating a farm tractor**

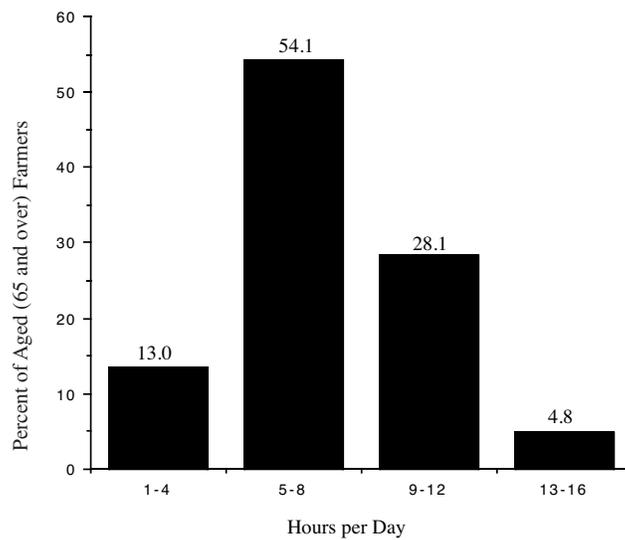
| Statement  | N  | Months |       |     |        |     |        |     |        |     |        |     |        |     |        |     |        |
|--|----|--------|-------|-----|--------|-----|--------|-----|--------|-----|--------|-----|--------|-----|--------|-----|--------|
|  |    | Mar    |       | Apr |        | May |        | Jun |        | Jul |        | Aug |        | Sep |        | Oct |        |
|  |    | n      | (%)   | n   | (%)    | n   | (%)    | n   | (%)    | n   | (%)    | n   | (%)    | n   | (%)    | n   | (%)    |
| My first busiest month for doing overall farm work   | 55 | 2      | (3.6) | 11  | (20.0) | 18  | (32.8) | 15  | (27.3) | 4   | (7.3)  | -   | -      | 2   | (3.6)  | 2   | (3.6)  |
| My second busiest month for doing overall farm work  | 55 | -      | -     | 3   | (5.5)  | 12  | (21.8) | 16  | (29.1) | 11  | (20.0) | 4   | (7.3)  | 6   | (10.9) | 2   | (3.6)  |
| My third busiest month for doing overall farm work   | 55 | -      | -     | 4   | (7.3)  | 5   | (9.1)  | 7   | (12.6) | 9   | (16.4) | 9   | (16.4) | 9   | (16.4) | 10  | (18.2) |
| My first busiest month for operating a farm tractor  | 50 | 1      | (2.0) | 9   | (18.0) | 19  | (38.0) | 13  | (26.0) | 4   | (8.0)  | -   | -      | 1   | (2.0)  | 2   | (4.0)  |
| My second busiest month for operating a farm tractor | 50 | -      | -     | 4   | (8.0)  | 11  | (22.0) | 15  | (30.0) | 11  | (22.0) | 3   | (6.0)  | 4   | (8.0)  | 1   | (2.0)  |
| My third busiest month for operating a farm tractor  | 50 | -      | -     | 2   | (4.0)  | 3   | (6.0)  | 6   | (12.0) | 10  | (20.0) | 10  | (20.0) | 10  | (20.0) | 7   | 14.0)  |

Table excludes months of January, February, November, and December for which no or negligible activity was reported.



**Figure 2–Number of days per week during the busiest month and percentage of aged farmers who operate farm tractors.**

responsibility for farm tractor safety inspections and certification, but aged tractor operators were evenly divided (51%) between themselves and others (e.g., farm equipment dealers, insurance agents) about who should conduct tractor inspections and certification if inspection and certification became mandatory. About one-half (52%) disagreed that the cost of certification be shared between farmers and the



**Figure 3–Number of hours per day during the busiest month of tractor operation and percentage of aged farmers who operate farm tractors.**

**Table 2. How aged (65 and over) tractor operators feel they are influenced by specified person(s) toward safe tractor operation**

| Persons                    | N  | Level of Influence and Percentage |                |                    |                  |
|----------------------------|----|-----------------------------------|----------------|--------------------|------------------|
|                            |    | No Influence                      | Some Influence | Moderate Influence | Strong Influence |
| Spouse                     | 75 | 41.3                              | 26.7           | 16.0               | 16.0             |
| Parents                    | 36 | 55.6                              | 19.4           | 13.9               | 11.1             |
| Immediate family           | 65 | 32.3                              | 36.9           | 18.5               | 12.3             |
| Neighboring farmers        | 56 | 64.3                              | 32.1           | 1.8                | 1.8              |
| Other friends              | 58 | 81.0                              | 17.3           | 1.7                | -                |
| My doctor                  | 55 | 92.7                              | 7.3            | -                  | -                |
| County extension agent     | 61 | 75.4                              | 19.7           | 3.3                | 1.6              |
| Vo-ag teacher              | 51 | 76.5                              | 21.5           | 2.0                | -                |
| Farm equipment dealer      | 65 | 46.2                              | 35.4           | 16.9               | 1.5              |
| Minister, priest, or rabbi | 53 | 92.5                              | 5.7            | 1.8                | -                |
| Agr. business/service      | 59 | 66.1                              | 23.7           | 8.5                | 1.7              |

government. They were opposed to the idea of having a tractor operator's license (74%) and to a two-year renewal requirement of operator licenses for tractor operators 65 years and over (76%).

In table 4, less than half (45%) of aged tractor operators disagreed with the statement that ROPS should be mandatory (with an exception for low clearance situations). Approximately 40% agreed and nearly 20% were undecided about this issue. A majority (59%) of aged tractor operators were opposed to retrofitting all farm tractors that were manufactured without ROPS between 1970 to 1985. Aged tractor operators were also opposed (65%) to bearing the major cost of retrofitting.

Data were also analyzed to estimate aged tractor operator physical capability to safely operate farm tractors. Several tables of the data are reported in Ambe and Murphy (1993) and in Ambe (1994). A brief summary of the most important findings are presented here because the data form the basis for the discussion in the next section of this article.

Sixty-three percent of aged tractor operators indicated that their eyesight was normal only with glasses; approximately 10% of operators who should be wearing glasses during farm tractor operation were not doing so. Approximately 40% of aged tractor operators indicated that they had been told by their friends that they had a hearing problem. Approximately 40% indicated that they themselves had become suspicious that they had a hearing problem. Only 27% had been told by their doctor that they had a hearing problem, and only 12% were wearing hearing aids.

About 40% of aged tractor operators experienced difficulties in the knees when mounting or dismounting a farm tractor. Thirty-two percent experienced pain, stiffness, weakness, or limited joint movement after operating a farm tractor. Twenty-six percent specifically identified pain and stiffness either in the neck or in

**Table 3. Attitudes of aged (65 and over) tractor operators toward tractor safety inspection and certification, and operator licenses**

| Statement  | N  | Disagree (%) | Uncertain (%) | Agree (%) |
|--|----|--------------|---------------|-----------|
| All farm tractors should be given an annual safety inspection.   | 92 | 51.1         | 14.1          | 34.8      |
| Tractors should be certified as being safe before being sold or traded between farmers.  | 89 | 40.5         | 18.0          | 41.5      |
| If certification becomes mandatory, farmers should be allowed to certify their own tractors as being safe before selling/trading.    | 90 | 31.1         | 17.8          | 51.1      |
| If required, certification of tractors as being safe should only be done by someone else (farm equipment dealers/insurance persons). | 90 | 51.2         | 24.4          | 24.4      |
| If required, certification of tractors as being safe should only be done by a government agency.                                     | 90 | 92.2         | 5.6           | 2.2       |
| If certification of tractors as being safe becomes mandatory, the cost should be shared by farmers and the government.               | 87 | 51.8         | 24.1          | 24.1      |
| Tractor operators should have a tractor operator's license, similar to an automobile license, to operate a tractor on public roads.  | 93 | 74.1         | 12.9          | 13.0      |
| If the tractor operator's license is required, it should be renewed every two years for operators over 65 years of age.              | 92 | 76.1         | 19.6          | 4.0       |

the back in relation to operating the farm tractor. Less than 11% of aged tractor operators experienced difficulties in the joints of their hands, forearms, and arms after operating a farm tractor. These findings agree with literature which indicates that flexibility at the joints decreases with age. Decreased flexibility is partly caused by physiological changes in the tendons, ligaments, muscles, synovial fluid, and cartilage which make up the joint.

### **Implications for Injury Prevention Programming**

In the introduction of this article the marginal success of safety and health education in production agriculture was mentioned. In this section, limiting factors to the effectiveness of safety and health education programs for aged farm tractor operators are identified. We suggest that current traditional farm tractor safety education programs are inappropriate for meeting the safety and health needs of aged farm tractor operators. Professionals developing tractor safety programming for adults have assumed a relatively homogenous population. This is contrary to the research findings of Ambe (1994), which suggest significant differences in formal education, years of experience, beliefs, attitudes, and behaviors regarding tractor safety issues and physical capability to operate farm tractors among young adults, middle aged adults, and aged farm tractor operators (Ambe and Murphy, 1993). These differences have important implications for injury prevention programming. Finally, we will suggest injury prevention programming considerations for aged

**Table 4. Attitudes of aged (65 and over) tractor operators towards retrofitting tractors with ROPS**

| Statement  | N  | Disagree (%) | Uncertain (%) | Agree (%) |
|--|----|--------------|---------------|-----------|
| If a roll-over protective structure is not already in place, all tractors manufactured between 1970 and 1985 should be retrofitted.      | 91 | 58.3         | 18.7          | 23.0      |
| If roll-over protective structures are required, farmers should bear the major cost of the retrofitting.                                 | 94 | 64.9         | 16.0          | 19.1      |
| If roll-over protective structures are required, the government or tractor manufacturer should bear the major cost of the retrofitting.  | 90 | 28.9         | 24.5          | 46.6      |
| It should be mandatory that tractors, except those used in low clearance situations, have a roll-over protective structure and seatbelt. | 92 | 44.5         | 17.5          | 38.0      |

tractor operators which incorporate the literature on aging with the results of this study.

Traditionally, farm tractor safety education programs have been based primarily on general, mass-appeal-type programs, often in the form of films, slide sets, general handouts, lectures, etc. This approach provides general information about operating a tractor when hazardous situations arise, but is unable to take into account extenuating circumstances which often make each case a unique situation (Murphy, 1992). From the perspective of the individual in a hazardous situation, the general safety information often is of little or no use. Twenty years ago, Simonds (1973) wrote:

“The mass media can be effective in giving individuals correct knowledge, but personal contacts, especially those that reach individuals in small groups, help actualize the next step by providing the setting and stimulation for individuals to change old health practices or to adopt new ones. Believing that the mass media alone can do the job...is very unrealistic and simplistic...(Pearson, 1981, p. 270)”.

Other factors which limit the effectiveness of safety education programs for aged tractor operators include:

1. Difficulty in making an initial contact with aged operators.
2. Limited financial resources for hazard reduction expenditures.
3. A tendency to operate older, less maintained farm tractors with fewer safety features (e.g., ROPS).
4. Deeply ingrained mind sets and behavioral patterns concerning most safety and health issues.

These practical limitations, along with the limitations of general, mass-appeal approaches, suggest that a fresh approach is needed for the development of injury prevention programming for aged tractor operators.

#### Understanding the Target Audience

Kernaghan and Giloth (1983) identified three rules for starting and managing a successful program.

“The first is to find out if there is a need for the program and if the potential users know they need it. A second is to find an advocate for the program who enjoys the trust and respect of those

users. And a third is to tell the potential user group about the program's benefits and qualities, in as many different ways as is appropriate, until the program's services become an accepted part of their practice (p. 32)".

Ambe's (1994) study suggests that a majority of farm tractor operators have low perceptions of the usefulness of farm tractor safety features and are not particularly supportive of the idea of farm tractor safety inspections and certification. In addition, a significant percentage of aged tractor operators occasionally allow extra riders on farm tractors even though current safety programs discourage this practice. Furthermore, in spite of their having attained a ninth grade level of formal education or higher, almost no aged tractor operator learned how to operate a farm tractor during a structured educational program.

How aged tractor operators operate their tractor is largely up to the individual. There are only a few regulations pertaining to the operation of tractors on farms and public roads, and even those are relatively unenforced. From this perspective, the promotion of safe tractor operation becomes largely a "persuasive effort". That is, safety educators must try to persuade aged tractor operators to follow safe operating recommendations. It follows that the literature of persuasive communications may be useful in explaining why safety and health knowledge often does not translate into safety and health behavioral practice. Recent research by Witte et al. (1992 to 1993) with farmers in Texas suggests that effective farm safety persuasive messages should increase farmers' perceptions of their: (a) individual susceptibility to farm equipment accidents; and (b) efficacy toward safety measures. In other words, many farmers believe they are relatively immune to accidents and that safety measures are not always effective or are difficult to implement. There is no reason to think that the beliefs of the aged tractor operators in this study differ greatly from those farmers studied by Witte et al. (1992 to 1993).

### **Content Selected**

According to Somers (1988), when aged subjects were asked, "Do you think that health care services in your area have the right balance between treatment and prevention, or should we be giving more emphasis to treatment or prevention?", 42% suggested the need for more emphasis on prevention compared to only 14% who wanted more emphasis on treatment. This finding is important in designing injury prevention programs for the aged because it suggests a positive attitude toward prevention on the part of aged persons. According to Ventura and Worthy (1982), aged learners typically prefer content that is specifically designed to satisfy personal and social needs. For a given farmstead community, such needs may be identified through a judicious selection of an ad-hoc committee to ensure planning that reflects the interests of aged farm operators in the community.

Our study suggests that farm tractor safety and health education content that would meet the needs of aged tractor operators may need to include:

1. Farm tractor safety features and persuasive evidence of their effectiveness.
2. Alternative appeals/solutions regarding extra riders on farm tractors other than the "no extra rider" appeal.
3. Identification and description of the exposure characteristics of aged tractor operators and their positive and negative implications.
4. Identification and description of how to avoid/reduce farm tractor hazards.
5. Identification and description of age related eyesight, hearing, and musculoskeletal impairments, sources of such impairments, and their affect on safe tractor operation.

6. Identification and description of age related physiological factors influencing reduced reaction time and how it affects safe tractor operation.

### **Program Development**

Farm machinery manufacturers, insurance companies, safety specialists, agricultural educators, etc. should elicit the input of aged tractor operators from the beginning and at several points in the process of program development. Encouraging the involvement of aged tractor operators in the planning of tractor safety education programs results in a more accurate prioritization of their needs and preferences. It also enhances the acceptability and effectiveness of the programs.

The families and the institutions which serve and are supported by aged tractor operators also should be encouraged to contribute to farm tractor safety education program development, implementation, and evaluation. Establishing consistent avenues for communicating program information through these groups is an essential element in building long-term family and community support. In this regard, the value of family members, influential medical professionals, farm equipment dealers, the farm insurance industry, and other local community groups cannot be over-emphasized.

According to Bettinghaus and Cody (1987), educators who have more expertise than their clients are more effective when they demonstrate adaptive behaviors to meet the needs of the targeted audience and when they offer packages of materials or products that are tailor-made for the targeted audience. Adapting behaviors to meet the needs of the audience also leads to success when there is a good relationship and low conflict between the educator and audience and when the educator anticipates future interactions with the audience.

Other factors which are important for programs include the most effective means of gaining and maintaining the attention of the target audience and the frequency with which the particular safety education program should be repeated in a given farming season.

### **Format and Setting**

A large number of experimental studies have shown that the aged learn less efficiently than younger adults, and benefit more from specific accommodations in the design and execution of educational programs. The studies show that learning by aged persons can be enhanced through: reducing outside interference; allowing for learning at a self-paced rate; assistance in organizing the material presented; helping to identify important points; making subject matter relevant; reducing anxiety generated by the learning setting; using both visual and verbal means of communicating information; and providing immediate feedback to reduce possible misunderstanding (Peterson et al., 1986). Encouraging the involvement of aged tractor operators in the planning of the format and setting of tractor safety education programs ensures their commitment to the program. Their involvement may also help to minimize inconsistencies in the program, thereby enhancing relevance to specified situations.

Reviewed literature also suggests that evenings, weekends, or all-day programs are not as suitable for the aged as programs scheduled at midday. On the other hand, midday programs that interrupt the workday may be particularly unpopular for most aged farm operators during peak farming periods. Nevertheless, aged persons find it particularly troublesome to drive or walk in poorly lighted conditions due to eyesight problems associated with the aging process. Peterson et al. (1986) suggests that

educational sessions for the aged should be short. For example, one two-hour session per week for three weeks is more effective than one all-day program.

Aged persons are also more likely to participate in programs of organizations with which they are familiar and when they expect social interaction to occur (Hooper and Marsh, 1978; Peterson, 1981). This suggests that traditional avenues of contact such as churches, farm organizations, farm insurance agencies, community action groups, and public health groups working in the various farmstead communities are a good way to establish an initial contact.

## Conclusions

The role that safety education can play in the lives of aged tractor operators is yet to be completely understood. Conscious efforts to design safety educational experiences specifically for aged tractor operators appear to be non-existent. General, mass-appeal programs appear not to have had a significant impact on the observed behavior of aged tractor operators. Farm safety educators need to develop new programs and strategies which are specifically oriented toward aged tractor operators. This means designing programs around the needs and with the participation of aged farm operators, as opposed to just giving general tractor safety information.

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