Risk Perceptions, Barriers, and Motivators to Tractor ROPS Retrofitting in the New York State Farm Community

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ABSTRACT. *The prevalence of tractor rollovers among agricultural workers has made the retrofitting of tractors with rollover protective structures (ROPS) and seat belts a public health priority for agricultural health and safety specialists. To address this concern, the New York Center for Agricultural Medicine and Health (NYCAMH) developed a seven-question survey, designed to assess perceptions of risk as well as potential motivators and barriers to retrofitting. Data from 465 phone surveys were gathered from New York State farmers representing various commodities and farm sizes. Analysis of responses to three qualitative questions contained in the survey indicated that most farmers in New York understand the importance of ROPS but lack the proper motivation to consider retrofitting. It appears that more convenient safety strategies, cost, and age of the tractor compete with a farmer's initiative to retrofit. In addition, survey responses illustrate that although many farmers believe ROPS are important in a general sense, many believe that this safety measure is not necessary for them in particular. Frequent motivators to retrofitting are concerns about safety, although the authors conclude that a more thorough analysis of these "general safety concerns" in qualitative interviews is important.*

Keywords. *Agricultural fatalities, Agricultural safety, Retrofit, Risk perceptions, Rollover protective structures, Social marketing, Tractor fatalities, Tractor safety.*

Deaths connected with tractor operation are the leading cause of workplace fatalities among farmers in the U.S. and have been a priority for agricultural health and safety specialists for many decades (NIOSH, 2004). Tractor overturns account for nearly half of these tractor-related fatalities (NSC, 2004; Etherton et al., 1991; Murphy and Ambe, 1996). The consequences of these overturns can be prevented with the presence of a rollover protective structure (ROPS) and the use of a seat belt (Morgan et al., 2002; Reynolds and Groves, 2000). This safety innovation resembles a roll bar and serves to create a protective zone around the tractor operator, should a rollover occur. When used with a seat belt, a ROPS is 99% effective in preventing injury to the tractor operator in the event of a tractor rollover (NIOSH, 2004; Morgan et al., 2002). The relative effectiveness of ROPS in preventing tractor fatalities has been demonstrated in marked reductions in mortality rates in several countries that have introduced legislation

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mandating ROPS (Thelin, 1998; Reynolds and Groves, 2000). For example, in Sweden, tractor deaths were reduced from 17.0 to 0.3 per 100,000 tractors over three decades with the passage of mandatory ROPS laws (i.e., rollover protective structures that were mainly crush-proof cabs) (Springfeldt et al., 1998).

Unfortunately, as many as half of U.S. tractors lack this protective device and seat belts. Although ROPS have been a safety addition on all tractors manufactured in the U.S. after 1985 (manufacturer voluntary standard on all tractors over 20 hp; *ASAE Standards*, 1985), many tractors manufactured without ROPS prior to this date are still in use. Varying estimates of the percentage of ROPS-equipped tractors in the U.S. exist. During the late 1980s, researchers estimated that 19% of Pennsylvania tractors had ROPS (Huizinga and Murphy, 1989); in the 1990s, a survey on New York farms found that 39% of tractors had ROPS (Hallman et al., 1997). During a similar period, national estimates indicated that approximately 38% of tractors had ROPS (Myers and Snyder, 1995).

Many efforts have been directed at encouraging farmers to retrofit their tractors, including safety education programs, community-based awareness campaigns (Struttmann et al., 2001; Myers et al., 2004; Morgan et al., 2002), and financial incentives (Hallman, 2005), all of which have met with varying degrees of limited success. Many of these studies indicated that issues beyond those of knowledge, awareness, or cost of ROPS were behind farmers' resistance to adopting this safety measure. As Murphy (2003) states in his book *Looking Beneath the Surface of Agricultural Safety and Health*, there is "considerable incongruence and large disconnects between farm people's safety knowledge, values, and practices." Murphy refers to these gaps as "the farm safety-risk paradox."

In order to create rollover prevention programs that truly motivate farmers to act, there is a need to better understand these "disconnects" by delving further into the farming community's perceptions of risk and perceived barriers to retrofitting. As stated in a National Institute for Occupational Safety and Health (NIOSH) publication on tractor safety initiatives: "It is essential to both better understand why people resist practices that literally save their lives, and then to devise the means to overcome this resistance" (NIOSH, 2004).

In order to explore this gap between awareness and action, a survey was developed to assess farmers' risk perceptions, as well as perceived barriers and motivators to action, using a social marketing frame of reference. Social marketing strategies have been used to address issues such as smoking (Lowry et al., 2004), helmet usage (Ludwig et al., 2005), and seat belt usage (Cohn et al., 2002) with promising success. These strategies analyze motivators and barriers connected with targeted behaviors to develop programs that: (1) make adopting the desired behavior easier, and (2) make the option of choosing this behavior more appealing (Prochaska et al., 1992; Andreason, 1995).

For the purpose of laying the foundation for a successful social marketing campaign, researchers decided it was necessary to first assess the New York farming community's degree of readiness to retrofit tractors currently lacking ROPS. The first step in this assessment involved determining whether the "degree of readiness" differed according to various demographic characteristics. The next step was to gather qualitative information on issues involved in retrofitting from the farmer's perspective. The first two assessments are described elsewhere (May et al., 2006). The purpose of this study is to analyze the frequency and nature of farmers' stated opinions on various aspects of ROPS retrofitting. The strategy would then be to target those issues most salient to farmers for retrofitting for the purpose of moving them closer to the desired behavior change.

A random sample of 465 New York farms was surveyed. Results indicated that most farmers (82% of those surveyed) are aware of the dangers of tractor rollovers and the effectiveness of ROPS in preventing fatalities. However, 83% of the 465 say they have

not considered the possibility of retrofitting their tractors currently lacking a ROPS. The current analysis focuses on responses to questions in the survey that are related to perceptions of risk as well as motivators and barriers to action. It is hoped that a better understanding of farmers' perceptions and opinions will allow researchers to remove perceived barriers to action, provide more supports that motivate farmers to action, or change the perceptions themselves to make fatalities an unacceptable consequence of farming.

Methods

Telephone surveys were conducted over two months among a random sample of New York farmers. Participants were selected from a database of farms generated from commodity association membership lists and a list from the New York State Department of Agriculture and Markets' Agricultural Statistical Service (NASS-NY). A random sample of farms was selected within each commodity strata (livestock, dairy, cash crop, fruit, vegetable, and organic) with the goal of recruiting a roughly equivalent number of surveys for each (450 total). This method was chosen to ensure that each stratum had a large enough sample to permit between-strata comparisons for the quantitative questions contained in the survey. Thus, weighting of the sample would be required in order for any overall estimate to be representative of all New York farmers.

To offer farms the option to participate, each selected farm received two daytime, two afternoon, two nighttime, and one weekend phone call. If a farm could not be contacted with this protocol, it was classified as a non-responder and replaced with another selected farm until the desired number of participants was obtained. The survey response rate was 87%. After receiving informed consent, the questionnaire took five to seven minutes to complete with no identifiers being collected from participants.

Responses were entered into an ACCESS database for analysis. The subject's overall risk perception was assessed with the following question: "How important do you believe it is to have rollover protection on your tractors?" A modified Likert scale was used for responses with the following options: "not at all important," "not very important," "important," and "very important." These responses were dichotomized into not important (not at all important, not very important) and important (important, very important).

A follow-up question asked respondents to elaborate on the overall risk question: "Why do you believe rollover protection is (whatever answer respondent indicated in the first question)?" Responses to this question were open-ended and were used for qualitative analysis of perceptions of risk.

Motivators and barriers to retrofitting were assessed in a similar fashion. Respondents were first asked: "Have you ever thought about installing rollover protective structures on any of your tractors that do not currently have one?" Respondents indicated either "yes" or "no." All respondents answering "yes" were classified as having considered retrofitting, and all "no" responses were classified as having not considered retrofitting.

Respondents were then asked either of the following questions based on their response to the preceding question: "If yes, what influenced you to consider purchasing a rollover protection structure?" or "If no, why have you not considered it?" Subjects also responded to this second question in an open-ended format.

The dichotomous responses to the questions ("How important do you believe it is to have rollover protection on your tractors?" and "Have you ever thought about installing rollover protective structures on any of your tractors that do not currently have one?") were compared between commodity groups using chi-squared (χ^2) analysis.

For the two open-ended questions, telephone surveyors recorded responses verbatim without prompting or paraphrasing. One researcher then coded the major idea expressed in the farmers' free-text responses, while a second researcher coded these same responses independently. Differences between the two researchers' coding selections were then identified and discussed by both coders until agreement was reached.

Response percentages for open-ended questions were calculated by counting up codes and comparing them to the overall number of responses given to a particular question. The purpose of this qualitative analysis technique was to assess whether predominant themes were markedly different between commodities and to assess which issues might serve as points of departure for more in-depth qualitative analysis. For this reason, statistical comparisons were not considered applicable to analyzing qualitative themes.

A "doer/non-doer" qualitative analysis was also carried out to assess possible differences in motivators between these two groups. The "doer" category consisted of farmers who had retrofitted at least one tractor with a ROPS, and "non-doers" were farmers who thought ROPS were important and had considered retrofitting, but had not actually followed through. Frequencies of responses to the question: "What influenced you to consider purchasing a rollover protective structure?" were compared between both groups.

Results

A total of 644 New York farmers were contacted by telephone. Of these, 562 (87%) agreed to participate in the phone survey. Subsequently, 97 farms were ineligible because all tractors had ROPS and none of them had been retrofitted. This left a total of 465 farmers to be included in the final analysis. Characteristics of this group are listed in table 1.

Risk Perceptions

Table 2 depicts a count and frequencies of response codes for farmers who felt that ROPS were "not at all important" or "not very important."

Table 1. Characteristics of the farmer cohort.

							Tractors			
	No.	Age [a]	Acres[a]	No.of Live-stock[a]	Tractor Hours[a][b]	Percent with Youth on Tractors[a]	Total	Non-ROPS Total	No. per Farm[a]	Non-ROPS per Farm[a]
All farmers	465	54.3	––	––	2222.8	19.4	2826	––	––	––
Dairy	82	50.4	––	328.4	3321.9	17.6	527	227	6.4	2.8
Livestock	95	55.3	––	110.9	793.8	20.4	320	227	3.4	2.4
Cash crop	88	61.6	211.6	––	539.2	18.9	292	207	3.3	2.4
Fruit	74	54.8	194.3	––	2734	15.9	567	335	7.7	4.5
Vegetable	77	50.3	667.3	––	5055.2	16.6	951	422	12.4	5.5
Organic	49	50.8	70.3	––	694.2	10.5	169	110	3.5	2.3

[a] Mean value listed.
[b] Annual hours of tractor usage for all tractors combined.

Table 2. Why do you believe a ROPS is not at all or not very important?

Why Not Important?	Total	Livestock	Dairy	Cash Crop	Fruit	Vegetable	Organic
Careful, experienced, pays attention	25% (21)	45% (5)	50% (1)	28% (8)	18% (3)	13% (2)	20% (2)
Flat land	44% (37)	36% (4)	50% (1)	14% (4)	53% (9)	75% (12)	70% (7)
Makes work difficult	9% (8)	––	––	3% (1)	29% (5)	6% (1)	10% (1)
No child operators	1% (1)	––	––	3% (1)	––	––	––
No hired help	1% (1)	––	––	3% (1)	––	––	––
Not important for what the farmer does	2% (2)	––	––	7% (2)	––	––	––
Not used much	6% (5)	––	––	17% (5)	––	––	––
Small tractors	2% (1)	––	––	––	––	6% (1)	––
Not applicable[a]	10% (9)	18% (2)	––	24% (7)	––	––	––
Total	85	13% (11)	2% (2)	34% (29)	20% (17)	19% (16)	12% (10)

[a] Indicates that the farmer's response was unrelated to the question, e.g., "I'm retiring," "We don't qualify for agricultural tax status."

Of the 465 respondents in the survey, 85 (18%) said they believed that rollover protection on tractors was "not at all important" or "not very important." Chi-squared analysis revealed that this proportion differed significantly across commodity strata ($p < 0.0001$). As shown in figure 1, this belief was most commonly held among cash crop farmers (32%) and least commonly held among dairy farmers (2%).

The reason most often given for the opinion that a ROPS was unimportant (44%) was that the topography of the respondent's land (i.e., flat vs. hilly) made having one unnecessary (table 2). An additional 25% of farmers stated that caution, years of experience, and mindfulness of safety issues all precluded their need for a ROPS.

There was some variability in these themes across commodity strata. For both livestock farmers (45%) and cash crop farmers (28%), experience, attention, and care was the most commonly cited reason for the belief that a ROPS was unimportant. Topography (36%) was also cited quite commonly as a ROPS disincentive within the livestock stratum. While most fruit farmers who stated that ROPS were unimportant cited flat land as the reason (53%), it is noteworthy that a substantial proportion of fruit growers (29%) stated that a ROPS makes their work difficult.

Table 3 depicts a count and frequencies of response codes for farmers who indicated that they felt a ROPS was "important" or "very important."

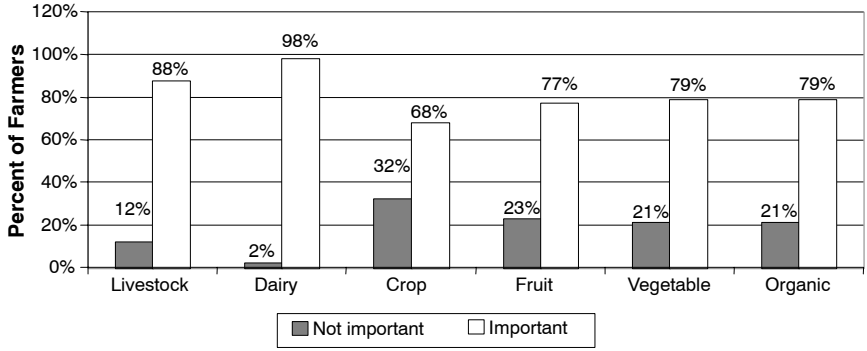

Figure 1. Percentage of New York farmers who consider ROPS important/not important.

Table 3. Why do you believe a ROPS is important or very important?

Why Important?	Total	Livestock	Dairy	Cash Crop	Fruit	Vegetable	Organic
Experienced a rollover	3% (10)	2% (2)	4% (3)	2% (1)	2% (1)	5% (3)	––
General safety	63% (241)	61% (51)	72% (57)	63% (40)	50% (28)	72% (44)	55% (21)
Have ditches	0% (1)	––	––	––	––	2% (1)	
Have hills	8% (32)	10% (8)	9% (7)	10% (6)	5% (3)	3% (2)	16% (6)
Heard rollover stories	2% (8)	2% (2)	4% (3)	2% (1)	2% (1)	––	3% (1)
Personal acquaintance killed	3% (10)	6% (5)	3% (2)	––	––	2% (1)	5% (2)
Personal acquaintance injured	2% (6)	1% (1)	––	5% (3)	––	2% (1)	3% (1)
Worker safety	3% (13)	4% (3)	1% (1)	––	9% (5)	5% (3)	3% (1)
Child safety	1% (2)	––	––	2% (1)	2% (1)	––	––
Not applicable[a]	15% (57)	13% (11)	8% (6)	17% (11)	30% (17)	10% (6)	16% (6)
Total	380	22% (83)	21% (79)	17% (63)	15% (56)	16% (61)	10% (38)

[a] Indicates that the farmer's response was unrelated to the question.

Three hundred eighty (82%) respondents believed ROPS were "important" or "very important." Of these, 241 (63%) cited general safety reasons as their primary concern (i.e., avoiding fatalities, keeping the driver safe, etc.). This reason was most commonly cited within the individual commodity strata, as well. Topography was also a popularly cited reason indicating a need for ROPS (i.e., for 10% of livestock farms, 9% of dairy farms, and 16% of organic farms).

Motivators to Retrofitting

Table 4 depicts a count and frequencies of response codes for farmers who indicated that they had given thought to or followed through on the installation of a ROPS on one or more of their tractors without ROPS.

Seventeen percent (79) of the surveyed farmers indicated they had given thought to installing a ROPS on their tractors that did not currently have one. Chi-squared analysis of these proportions revealed significant differences across commodity strata ($p < 0.03$). As shown in figure 2, approximately twice the number of livestock farmers (30%) had considered purchasing a ROPS, when compared to farmers specializing in other commodities.

Table 4. What influenced you to consider purchasing a ROPS?

Influences	Total	Livestock	Dairy	Cash Crop	Fruit	Vegetable	Organic
Child safety	4% (3)	4% (1)	––	14% (1)	––	––	11% (1)
Dealer or program incentive	5% (4)	4% (1)	8% (1)	––	15% (2)	––	––
General safety	45% (36)	52% (14)	58% (7)	43% (3)	31% (4)	45% (5)	33% (3)
Dangerous job task	9% (7)	7% (2)	8% (1)	––	8% (1)	18% (2)	11% (1)
News of accidents	4% (3)	––	8% (1)	––	8% (1)		11% (1)
Rollover death of someone they knew	3% (2)	––	––	––	8% (1)	9% (1)	––
Worker safety	1% (1)	––	––	––	––	9% (1)	––
Not applicable[a]	29% (23)	33% (9)	17% (2)	43% (3)	31% (4)	18% (2)	33% (3)
Total	79	34% (27)	15% (12)	9% (7)	16% (13)	14% (11)	11% (9)

[a] Indicates that farmer's response was unrelated to the question.

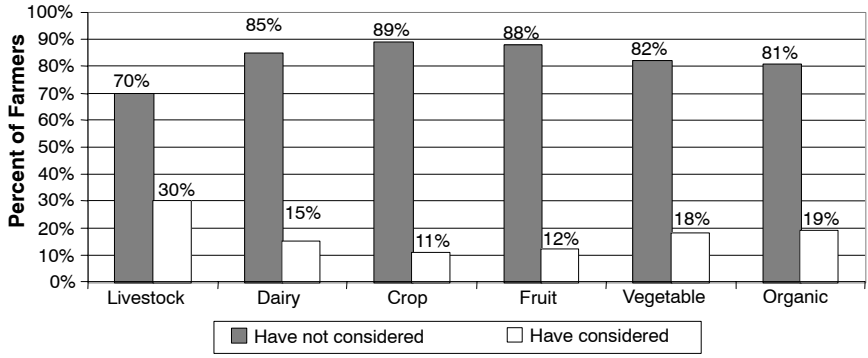

Figure 2. Percentage of New York farmers who have/have not considered retrofitting.

A large proportion of those who had considered purchasing a ROPS (45%) indicated general concerns about safety (e.g., "because it can save your life," "for the safety of my family") as an important motivational factor (table 4). Others indicated that the necessity of performing unsafe tasks (9%) or concerns about child safety (4%) was a motivating factor. For fruit farmers, dealer/program incentives (15%) were cited more commonly as a motivating factor than in any other commodity stratum.

Barriers to Retrofitting

Table 5 depicts a count and frequencies of response codes for farmers indicating they had not considered a ROPS retrofit for any of their tractors.

Eighty-two percent (380) of those surveyed indicated they had not considered a ROPS retrofit. The most prominent barrier cited by many respondents (40%) was that "they didn't feel it (ROPS) was necessary." Factors such as flat land, minimal use of tractors without ROPS, use of tractors with ROPS for dangerous tasks, caution, experience, awareness of safety issues, and tractor design were all listed as reasons for this belief.

Table 5. Why have you not considered purchasing a ROPS?

Why Not?	Total	Livestock	Dairy	Cash Crop	Fruit	Vegetable	Organic
Tractor age	12% (47)	19% (12)	12% (8)	14% (13)	7% (4)	13% (8)	5% (2)
Won't fit in barn	3% (10)	2% (1)	8% (5)	2% (2)			5% (2)
Cost	19% (73)	33% (21)	32% (21)	8% (7)	5% (3)	18% (11)	26% (10)
Not necessary	40% (151)	22% (14)	35% (23)	41% (37)	49% (28)	50% (31)	46% (18)
Don't like them	0% (1)	––	––	––	––	2% (1)	––
Don't know how	1% (2)	2% (1)	––	––	2% (1)	––	––
Never thought about it	2% (8)	3% (2)	3% (2)	2% (2)	––	––	5% (2)
Only used by farmer	2% (8)	5% (3)	3% (2)	1% (1)	2% (1)	––	3% (1)
Tractor won't accom–modate ROPS	4% (14)	8% (5)	3% (2)	1% (1)	––	6% (4)	5% (2)
Rented tractor	0% (1)	2% (1)	––	––	––	––	––
Show tractor	1% (2)	––	2% (1)	––	––	––	3% (1)
Will buy newer tractors	2% (9)	––	2% (1)	4% (4)	7% (4)	––	––
They get in the way	5% (18)	––	––	2% (2)	28% (16)	––	––
Hassle	0% (1)	––	––	1% (1)		––	––
Not applicable[a]	9% (35)	6% (4)	2% (1)	23% (21)	2% (1)	11% (7)	3% (1)
Total	380	17% (64)	18% (66)	24% (91)	15% (58)	16% (62)	10% (39)

[a] Indicates that the farmer's response was unrelated to the question.

"Cost" (19%) and "age of tractor" (12%) were also frequently cited barriers to considering a ROPS purchase when looking at all strata combined. A variety of these responses indicated that farmers consider retrofitting an old tractor as not "cost-effective." These trends are reflected in each stratum, as well, with a few exceptions (e.g., "cost" was more of a barrier for livestock farmers, while design issues, "they get in the way," was a prevalent issue for fruit farmers).

Doer/Non-Doer Analysis

Researchers compared the frequencies of coded responses between doers (those who had retrofitted) and non-doers (those who thought ROPS were important and had considered purchasing but had not actually followed through). The purpose of this comparison was to assess whether motivators to action were different between these two groups. For this reason, coded responses to the question "What influenced you to consider purchasing a ROPS?" were compared for doers and non-doers (table 6).

Doers and non-doers were similar with regard to motivators, with general safety concerns being their primary motivators to considering a ROPS purchase. However, twice as many doers indicated that the necessity of performing dangerous tasks triggered consideration of retrofitting.

Discussion

Risk Perceptions

The farmer responses in our survey indicate that a general knowledge of ROPS and the danger of tractor rollovers is not lacking in the farming community. Many farmers (82%) believed that ROPS are generally a good safety feature to have on their tractors, due to a concern for safe tractor operation. What is interesting is that so few (17%) had actually considered retrofitting, lending credence to the statement by Murphy (2003) that there is a vast difference between what farmers know and what farmers do (the farm safety-risk paradox). Even when farmers indicated that a ROPS was not important, there appeared to be some knowledge of the safety risks of operating tractors without one. This is most likely related to the belief that their particular circumstances (flat land, experience, or knowledge of the dangers) afford them protections that make ROPS unnecessary. This belief in the susceptibility of others and not oneself to a particular hazard is described by Weinstein (1988) as the "precaution adoption process." Weinstein discusses three stages an individual must go through in order to take on a particular safety behavior. In stage 1, the individual has heard of the hazard. In stage 2, the individual believes in the likelihood of the hazard for others, but not for himself. In stage 3, the

Table 6. Doer/non-doer comparison of motivators.

What influenced you?	Non-doers	Doers
Dealer incentive or program incentives	5% (3)	5% (1)
General safety concerns	47% (27)	35% (8)
Necessary due to dangerous job task	7% (4)	18% (4)
Rollover death or accident involving someone they knew	2% (1)	5% (1)
Worker safety	3% (2)	––
Concerned about child safety	5% (3)	––
News coverage of accidents	5% (3)	––
Not applicable[a]	26% (15)	36% (8)
Total	58	22

[a] Indicates that the farmers' responses were unrelated to the question.

individual acknowledges personal susceptibility. Results from our survey indicate that many New York farmers are in stage 2, believing that rollovers can occur, but not to them personally.

It is also interesting to note the variance in risk perception in the different commodity strata. For example, one-third of cash crop farmers appear unconvinced of the need for a ROPS (one-third of respondents indicating that a ROPS was "not at all" or "not very important"), while only 2% of dairy farmers felt similarly. It is difficult to say whether this is due to differences in risk exposures (hilly vs. flat terrain, several employees vs. none) or whether cash crop farmers lag in their understanding of the risks associated with tractor operation. Perhaps further exploration of this phenomenon in interviews or focus groups is necessary.

Barriers and Motivators to Retrofitting

The discrepancy between the relatively large number of respondents who see the benefits of ROPS and the relatively small number who have considered retrofitting may indicate that proper motivators are currently lacking or that the existing barriers are significant enough to prevent serious consideration of acting.

Responses from our survey indicate that a more careful exploration of motivators is necessary. The motivators discussed by respondents in this survey who had considered the purchase of a ROPS (e.g., "general safety concerns") were rather vague. Comments such as: "because it (ROPS) can save your life," "it is dangerous not to have one (ROPS)," and "they're (ROPS) a good idea for safety" are not specific enough to allow constructive analysis of how to get farmers to consider this safety measure. It is clear that subtle distinctions in this category exist and further exploration in qualitative interviews would be necessary to get a deeper understanding of what is behind these concerns and which of these concerns actually lead to action.

Several farmers who cited safety concerns specifically indicated that the protective features of cabs were what they found appealing (e.g., protecting from sun exposure, chemicals, or other undesirable elements). Perhaps marketing features that more immediately appeal to farmers' sensibilities, or designing a ROPS with features that provide more immediate rewards, would be good targets for interventions.

Another motivator mentioned by those who had considered retrofitting was the necessity of performing dangerous job tasks, although these tasks were not explicitly stated. This possibly lends credence to the theory that farmers have their own internal process of calculating risk and act accordingly. If they feel the job warrants protection, they may be more willing to follow through.

Fruit farmers indicated that dealer/program incentives were persuasive, but the sample size was relatively small, and it is difficult to say conclusively whether this would be an effective motivator for this group.

Few farmers indicated that news coverage of a rollover fatality or the injury or death of a personal acquaintance was a motivator. Of course, it is possible that several farmers citing general safety concerns could have been influenced by knowledge of rollover tragedies, but as stated previously, this seems to indicate that a more thorough exploration of general safety concerns is necessary.

Many of the 378 (39%) farmers who had not considered retrofitting said that they felt it was unnecessary. As discussed previously, this appears to contradict the general acknowledgement that ROPS are an important safety feature and also indicates that many New York farmers do not perceive personal susceptibility to rollovers. In addition, several of these farmers stated that they used tractors without ROPS for less dangerous work (i.e., primarily using tractors on flat land, using their tractors with ROPS for dangerous tasks, and rarely using tractors without ROPS). This indicates that some

farmers strategize and use more convenient, less costly alternatives, which they believe keep them safe and allow them to operate tractors with less fear of injury.

Cost and age of tractor were also barriers to action that were cited by respondents (although infrequently), as was a propensity for a ROPS to interfere with work (fruit farmers). Further exploration of financial issues in qualitative interviews would be helpful, as previous research among New York farmers indicates that financial issues are complicated and may indeed be farmers' reactive response to retrofitting (Hallman, 2005).

For fruit farmers, engineering solutions may prove most successful in convincing them to take the step of retrofitting, since responses indicate the cabs or rollover bars either damage tree branches or add difficulty to moving through rows of trees and grapes in orchards and vineyards.

Although the results of this survey provide an interesting look into the relative importance that New York farmers ascribe to ROPS and the factors that influence decisions to retrofit, the study has limitations worth mentioning. Participants were randomly sampled from agriculture member association lists and information provided from NASS-NY. It is possible that these lists may contain farms that are not representative of farmers in the state as a whole. Additionally, the nature of the survey required brief responses, making in-depth analysis of attitudes or beliefs impossible. Perceptions of safety about ROPS are complex and difficult to impart in a one- to two-sentence response. However, since the study was designed to be a preliminary step to more detailed analyses, this weakness may eventually be addressed in subsequent research. Furthermore, the limited numbers of responses in some cells make comparisons inconclusive and may indicate areas that require further exploration in qualitative interviews.

Although the responses are brief, a fairly large number of responses are available for analysis and are perhaps more representative of New York farming perspectives than in-depth interviews or focus groups. In addition, few preliminary analyses have been published on attitudes or perceptions that could strongly influence or help in the design of social marketing campaigns or at least lend an inside perspective on the factors that influence farmers' decisions to retrofit. Furthermore, the results of the quantitative part of our survey are validated by three separate studies done in the 1990s, all of which involved visual inspection of tractors (Hallman et al., 1997; Hill et al., 1992; West and May, 1998) and which lead us to believe that the responses gathered in this survey may address the issues of selection bias previously mentioned.

Conclusions and Recommendations

As stated previously, the object of a social marketing campaign is to remove barriers to action and to enhance motivators, in order to move an individual closer to a desired behavior. The responses given to the open-ended questions in this survey indicate fruitful points of departure for further qualitative inquiry. The data generated will then be used to design retrofit programs that confront the actual barriers preventing farmers from retrofitting (i.e., cost, ROPS design issues, and other factors), as well as the perceived barriers (i.e., "don't think it's necessary," "don't think it's cost-effective for older tractors," etc.). It will also involve a more in-depth exploration of what "general safety concerns" motivate farmers and what incentive packages can be designed that will make the process easier once an individual has decided to take the initial step.

Most importantly, the responses given to these survey questions indicate that a necessary component of any social marketing campaign will be to convince farmers that they are personally susceptible to rollovers and that ROPS are a necessary safety feature

for anyone driving a tractor (experienced or inexperienced, careful or not careful), regardless of circumstances. Such a campaign will also need to emphasize the point that the financial and emotional issues that accompany rollover fatalities are often devastating enough to cause loss of the farm (NIOSH, 2004), in the end making purchase of a ROPS, even for an old tractor, "cost-effective."

Results from the survey also indicate that perceptions of risk and motivators and barriers to action differ slightly between commodity strata (e.g., cost appears to be more of an issue for livestock farmers, while design issues are more salient for fruit farmers). These differences indicate that messages and programs designed to motivate farmers may need to be tailored to the concerns of the different commodity segments, in order to create real change.

As well as exploring the themes generated from the questions in this initial survey, formative research for an effective social marketing campaign will also require an exploration of how to present messages most effectively (i.e., which messages are most persuasive, and in what context are farmers most receptive to safety messages) and how to make retrofits and the process of retrofitting more appealing to farmers (i.e., improving the product).

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