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# Retrofitting Tractors with Rollover Protective Structures: Perspective of Equipment Dealers

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**ABSTRACT.** *This study was one of a cluster of studies that originated via requests for proposals from the NIOSH National Agricultural Tractor Safety Initiative. The present study design consisted of several steps: (1) formation of an advisory group, (2) development and testing of a standard paper self-responding survey instrument, (3) sample selection of farm equipment dealers, (4) administration of the survey, (5) assessment and analysis of the survey, and (6) in-person response panel of dealers (n = 80) to review results of the questionnaire for further definition and sharpening of the recommendations from the survey. A key finding is that most dealers do not currently sell or install ROPS retrofit kits. Barriers cited by dealers included (1) actual or perceived lack of farmer demand, (2) injury liability, (3) expensive freight for ordering ROPS, (4) lack of dealer awareness of the magnitude of deaths from tractor overturns and the high life-protective factor of ROPS, and (5) difficulty and incursion of non-recoverable expenses in locating and obtaining specific ROPS. Despite not currently selling or installing ROPS, dealers responded favorably about their future potential role in ROPS promotion and sales. Dealers were willing to further promote, sell, and install ROPS if there was demand from farmers. Recommendations include establishing a ROPS “clearing house” that dealers could contact to facilitate locating and obtaining ROPS orders from customers. Additional recommendations include education and social marketing targeting farm machinery dealers as well farmers, manufacturers, and policy makers.*

**Keywords.** *Dealer, Overturns, Rollover protective structures, ROPS, Safety cabs, Tractors.*

The agricultural sector (including agriculture, forestry, fishing, and hunting) has long been recognized as a hazardous industry. According to preliminary data from the Census of Fatal Occupational Injuries (CFOI), there were 651 fatalities reported in this sector in 2008, which results in the highest fatality rate (29.4 per 100,000 full-time equivalent workers) of any sector (BLS, 2009). Farm tractors are the

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leading cause of fatalities in this sector (NIOSH, 2006). Deaths related to tractors can be due to run-overs, falls, entanglements, and overturns. Nearly half of all tractor-related deaths are due to overturns (NIOSH, 2006). Experiences in Sweden suggest that most of these overturn deaths could be prevented by installation of rollover protective structures (ROPS) and use of a seat belt (Springfelt et al., 1998).

Surveys show that there are more than 4 million tractors used in the U.S.; however, only 2.5 million (59%) of those tractors are equipped with ROPS (NASS, 2008). Tractors may not have ROPS because they were not manufactured to accept ROPS (circa pre-1975). From 1975 to 1985, most tractors were manufactured to accept ROPS, but ROPS were an optional customer order item and were often not ordered. From 1985 forward, ROPS were installed at manufacture according to industry standard, but may have been removed to allow entry into low buildings or for other low clearance requirements. Studies surveying tractor usage in New York State showed that most farms have an average of 4 tractors and only 33% of tractors had ROPS (Kelsey et al., 1996). Similar results were found in Iowa where farmers in the Keokuk Rural Health Study had an average of 3.1 tractors with only 39% of these tractors equipped with ROPS (Sanderson et al., 2006). Freeman (1999) found that 43% of used tractors sold in central Iowa without ROPS were sold by farm equipment dealers and 90% of those sold without ROPS had retrofit kits available for them. It is estimated that approximately 4% of non-ROPS tractors are replaced and retired each year (Kelsey and Jenkins, 1991).

Using these data one can predict that it will take nearly 50 years to attain a (subjective) level of 95% of tractors with ROPS, if effective interventions are **not** deployed. This estimate was made assuming a stable number of total tractors (4 million), an annual 4% replacement of tractors without ROPS, and a target of 5% of tractors (200,000) without ROPS at some future date. Where  $n = \text{years}$ ,  $[200,000 = (0.96^n) * 1,500,000]$ , solving for  $n$ , the calculation reveals 49.4 years.

The cost of ROPS kits can vary from approximately \$250 for some makes and models up to \$4600 for kits that are part of an entire closed-cab system (Marshfield Clinic, 1997). Several studies have examined the cost of the ROPS kits compared to costs from overturn deaths and injury and found significant savings for installing ROPS on all tractors in the U.S. (Pana-Cryan and Myers, 2000; Myers et al., 2005). It is believed that at least 2000 lives could be saved over 15 years if a staged intervention was widely developed to increase the number of ROPS-equipped tractors (Donham et al., 1997).

There have been many initiatives relating to the importance of retrofitting ROPS on older tractors. In the conference report "Agriculture at Risk: A Report to the Nation" (Merchant et al., 1989), specific recommendations were made to mandate ROPS on all new tractors and provide monetary incentives to retrofit ROPS on older tractors (initiative 1.3, p. 30). The Surgeon General's Conference on Agricultural Safety and Health in 1991 identified preventing overturn fatalities as a priority area for intervention (CDC, 1992). In 1995, The University of Iowa published the TRAC-SAFE (Tractor Risk Abatement and Control) manual that detailed a community-based intervention involving ROPS promotions, marketing, and programs to reduce deaths and injuries from tractor overturns (Lehtola and Rautiainen, 1995). TRAC-SAFE interventions were found to be successful due in large part to the strong involvement of tractor dealers.

In 1997, participants of the Tractor Risk Abatement and Control (TRAC) Policy Conference developed a model comprehensive national strategy to reduce tractor-

related injuries (Donham et al., 1997). This conference involved key stakeholders such as equipment manufacturers, equipment dealers, safety specialists, scientists, and others in developing model ROPS legislation and recommendations. In 2004, NIOSH and its agricultural centers developed the National Agricultural Tractor Safety Initiative (NIOSH, 2004; Swenson, 2004). This initiative calls upon the NIOSH agricultural centers to create a national campaign to address issues relating to tractor safety. Recommendations from this document suggest better injury surveillance programs, databases, further development of low-cost ROPS retrofits, and further research regarding the promotion of ROPS retrofits and tractor safety.

The purpose of this study was to determine the current potential of farm equipment dealers to be facilitators of retrofitting ROPS on older tractors. This project was funded by NIOSH through the National Agricultural Tractor Safety Initiative. Through this survey of equipment dealers, recommendations were made regarding the potential and prospects of equipment dealers to become part of a broader ROPS installation program. As our previous studies have indicated, machinery dealers can be an effective entity in programs to retrofit tractors with ROPS. Our overarching question in this study was to determine if dealers can still be an important force in ROPS installation. Further, we aimed to determine how dealers could be helpful in a broader program of ROPS installation.

## Methods

### Design

This study was one of a cluster of studies that originated via requests for proposals from the NIOSH National Tractor Safety Initiative. The study design of this project consisted of several steps: (1) formation of an advisory group, (2) development and testing of a standard paper survey instrument that included both structured and open-ended questions, (3) sample selection of farm equipment dealers, (4) administration of the survey, (5) assessment and analysis of the survey, and (6) discussion of the survey data with an in-person response panel ( $n = 80$ ) of INEDA dealer members to further define and sharpen the recommendations. The advisory group consisted of a team of Midwest safety professionals ( $n = 3$ ) and stake holders including farm equipment dealers ( $n = 3$ ), members of the Iowa-Nebraska farm equipment dealers association (INEDA) and INEDA staff ( $n = 2$ ), manufacturers ( $n = 3$ ), and farm organizations ( $n = 3$ ). The advisory group was made up of individuals largely chosen from previous participants in the Tractor Risk Abatement and Control Policy Conference of 1997 (Donham et al., 1997). The group members were surveyed by face-to-face meetings, conference calls, and questionnaires to determine their opinions and beliefs and intended actions to assist in retrofitting of ROPS on tractors and general promotion of tractor safety. This questionnaire was then distributed by INEDA staff on INEDA letterhead through their electronic communication system (group fax) to all 220 dealer-owner members (this represented 380 stores as some dealers own more than one store). The target sample represented a 100% sample selection of agricultural equipment dealer-members of INEDA. Two reminders were sent out to those who did not return the completed questionnaires within the time period requested. The response data were initially compiled by INEDA staff, and then forwarded to the University of Iowa for analysis. Additional details of the instrument and sample follow.

## **Instruments**

The principle designers of the questionnaire team included agricultural safety specialists: three authors of this article (Donham, Sanderson, and Purschwitz), the executive director of INEDA, and his executive assistant. The director and his staff worked actively with the investigators to design and administer the questionnaire. Further, three important documents were mined from three important previous works to formulate the basis of relevant questions, including: (1) the formalize consensus process held at the TRAC Policy Conference (Donham et al., 1997), (2) the TRAC-SAFE intervention (Lehtola and Rautiainen, 1995), and (3) the National Agricultural Tractor Safety Initiative ([www.nasdonline.org/docs/d001801-d001900/d001837/d001837.html](http://www.nasdonline.org/docs/d001801-d001900/d001837/d001837.html)). The resulting questions were discussed and modified according to input from the advisory group. Additional questions were formulated based on the committee's input. A standardized questionnaire was developed and reviewed and edited by the committee for clarity, accuracy, and brevity. The survey instrument allowed for more detailed responses to the categorical choices by including a section for open-ended responses. Survey questions assessed topics such as general information, barriers for ROPS retrofits, what dealers are willing to do to promote ROPS installation, what the dealers think it will take to achieve ROPS installation, and dealer opinions of potential regulations relating to ROPS retrofit installation. The entire survey instrument can be viewed at: [www.public-health.uiowa.edu/ICASH/](http://www.public-health.uiowa.edu/ICASH/). All 220 persons who were sent questionnaires were invited to participate in an ad hoc response panel to review and comment on the questionnaire data. This response panel meeting was held in conjunction with the annual meeting of INEDA (about 60 days following administration of the questionnaire). Eighty stakeholders participated in this response panel. Results of the survey were presented. Questions were posed and discussion engendered in order to gather further information and definition of opinions and suggestions that were discerned from the results of the questionnaire. Based on this input, specific conclusions and recommendations were made regarding the potential role of agricultural equipment dealers in achieving retrofit ROPS installation on tractors.

## **Sample**

The Iowa-Nebraska Equipment Dealers Association (INEDA) has been active in tractor safety issues since 1997. This trade organization includes approximately 86% of all dealers who sell new and/or used tractors in the Iowa and Nebraska area (D. Miller, INEDA staff, personal communication, 24 Oct. 2007). INEDA was a full partner in the National Conference Tractor Risk Abatement and Control: the Policy Conference. The executive director of INEDA and his staff were contacted regarding the current study, and they were very eager to collaborate in all phases of this project, including facilitating communication with equipment dealers in the Iowa and Nebraska area. The executive director of INEDA selected all member dealers whose primary business was selling and servicing production agriculture farm equipment (a 100% sample of relevant members). The survey was sent electronically on INEDA letterhead by the executive director of INEDA (via their group fax communication system) to individual member-dealers along with a cover letter explaining the purpose of the survey. Dealers were asked to fill out the survey and fax the results back to INEDA headquarters. A total of 220 surveys were sent out. A second reminder fax was sent to members who did not respond to the initial fax.

# Results

## Survey Responses

A total of 57 responses (26% response rate) were returned from the initial survey. The major finding throughout the survey responses and through personal interaction with dealers was the perceived lack of farmer demand. Dealers were not actively promoting ROPS. Other findings were the concern for dealer liability, difficulty finding or installing retrofit ROPS, the need for support for financial incentives, and opposition to government mandates regarding ROPS. The primary concern that dealers expressed regarding liability was the concern of the ROPS failing or not being installed correctly. The other aspect of liability that was largely unrecognized by the dealers participating in this study was the liability of NOT installing ROPS when they are available and effective in preventing injury and death due to overturns. The following results are reported according to the category of survey questions.

### *How Are Dealers Currently Involved in Retrofit ROPS?*

Most equipment dealers responding to the survey (75%) do not currently sell or install retrofit ROPS (table 1). Only 44% of all dealers responding reported that they had been involved in ROPS retrofitting promotions at some point in the past. In assessing the knowledge of manufacturer “ROPS-at-cost” programs, more than half of all dealers (55%) were not aware of any current programs. Most dealers (61%) reported that the ROPS-at-cost programs of the past were “somewhat” successful in getting ROPS installed.

Open-ended survey responses indicated that ROPS programs (i.e., manufacturer ROPS-at-cost programs) had been more heavily promoted in the past. Dealers were asked to briefly describe ROPS promotional programs if they had been involved. Some ( $n = 12$ ) identified manufacturer promotional programs. Other dealers ( $n = 6$ ) asked farmers if they are interested in ROPS or did their own promotional programs and/or advertising. One dealer reported more extensive promotions such as posters, flyers, and open houses. Dealer statements addressing these ideas were:

- “We ask new owners of used tractors if they would like to add a ROPS.”
- “We encourage farmers to have ROPS installed on cabless tractors, especially with hired help or children operating them.”
- “Several years ago, Case-IH made ROPS available and we promoted them heavily with very little acceptance. The program has apparently gone by the wayside as I've heard nothing for several years.”

**Table 1. Dealer involvement in ROPS retrofits.**

Survey Question	Yes	No
Do you currently install ROPS on tractors?	$N = 14$ (25%)	$N = 41$ (75%)
Have you been involved in promotions to encourage tractor owners to install ROPS?	$N = 24$ (44%)	$N = 30$ (56%)
Are you aware of manufacturers' ROPS-at-cost programs?	$N = 25$ (45%)	$N = 31$ (55%)
Has this program (ROPS-at-cost) been promoted by manufacturers?	$N = 19$ (58%)	$N = 14$ (42%)
Has this program been successful in getting tractors equipped with ROPS?	$N = 3$ (8%)	$N = 12/N = 23$ (somewhat) (32%)/(61%)

**Table 2. What are you willing to do to promote ROPS?**

Survey Question	Yes	No	Don't know
Would you be willing to gear up to purchase and install a large number of retrofit ROPS if the demand were created?	N = 26 (49%)	N = 11 (21%)	N = 16 (30%)
Would you favor a financial incentive to you as a dealer to order and install ROPS?	N = 35 (69%)	N = 9 (17.5%)	N = 7 (13.5%)
Would you favor a financial incentive to manufacturers who make and sell ROPS?	N = 20 (43%)	N = 8 (17%)	N = 19 (40%)
Would you favor a financial incentive to tractor owners to encourage ROPS?	N = 38 (76%)	N = 8 (16%)	N = 4 (8%)
Would you be willing to sell ROPS for break-even costs?	N = 25 (47%)	N = 16 (30%)	N = 12 (23%)

***What Will it Take to Promote ROPS?***

Questions in this category assessed the dealer opinion on financial incentives (table 2). Most responding dealers favored a financial incentive to the tractor owners (76%). Not surprisingly, financial incentives to dealers were also favored by most responders (69%). The dealers were less supportive of financial incentives aimed toward equipment manufacturers with only 43% supporting such an incentive. Nearly half (47%) of dealers would be willing to sell and install ROPS at break-even costs with an additional 23% of dealers being unsure.

***What Barriers Exist for ROPS Programs?***

Dealers were allowed multiple responses to identify how many had experienced various barriers to ROPS installation (table 3). The primary barrier perceived by 64% of equipment dealers was a lack of demand from farmers. The second barrier experienced was not knowing where to order retrofit ROPS (37%), followed by difficulties in finding ROPS (30%). Dealers had experienced problems with not having adequate ordering information provided by the manufacturer (28%) and felt as though liability was a barrier (28%). Some dealers (25%) found ROPS difficult to install and others felt it was a money losing business (25%). Additional problems identified by dealers were:

- “Not supposed to cut or weld or drill on ROPS.”
- “The cost is too prohibitive. Customers seem to feel that cost is excessive even at our cost.”
- “Customers prefer not to install ROPS on tractors”
- “In some instances, height is a problem and the variety of folding (ROPS) is limited.”

***What Are Dealers Willing to Do?***

These questions assessed whether the dealer was “not interested,” “somewhat interested,” or “very interested” in supporting ROPS retrofit programs (fig. 1). Most dealers reported that they were either somewhat (56%) or very interested (12%) in preventing tractor-related injuries in their communities. Dealers who were not interested (32%) reported issues such time, cost, lack of customer interest, liability, and other issues such as inventory and space.

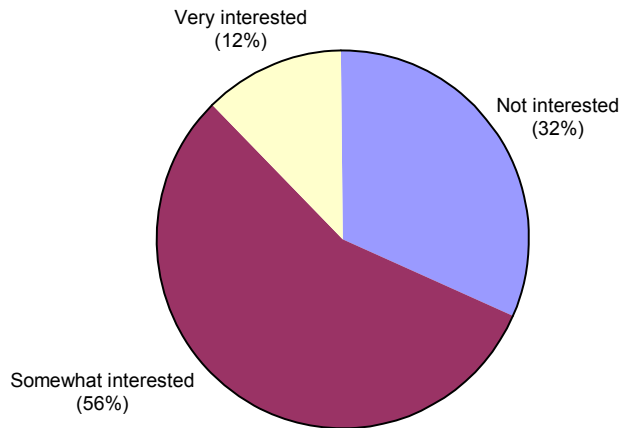
***What Should be Done Regarding Legislation and Mandates?***

Opinions on legislation and mandates were mixed (table 4). Dealers (80%) strongly favored establishing limits on liability claims for those who install ROPS. Dealers



**Table 3. What are barriers for you to promote and install ROPS on tractors?  
(multiple responses allowed).**

Survey Question	Total No. of Responses
No demand from farmers	N = 36 (63%)
Do not know where to order retrofit ROPS	N = 21 (37%)
Orders cannot be filled because ROPS cannot be found	N = 17 (30%)
Liability	N = 16 (28%)
Tractor manufacturer does not provide adequate ordering information	N = 16 (28%)
A money losing business	N = 14 (25%)
ROPS difficult to install	N = 14 (25%)
Too expensive if after market companies are used	N = 13 (23%)
Difficult to get ROPS	N = 12 (21%)
Long delays before receiving ROPS after ordering	N = 10 (18%)
Excessive time (entire process of locating, ordering, installation)	N = 9 (16%)
Puts me at a competitive disadvantage to other dealers	N = 2 (4%)



**Figure 1. Which statement describes your interest and commitment to working on prevention of tractor related injuries?**

were not supportive of policy enforcing mandatory ROPS installation on tractors. Only 17% supported legislation mandating ROPS for resale, and only 29% supported mandatory ROPS for tractors driven on public roads. Slightly more dealers (53%) were supportive of policy that required tractors to have ROPS if they were operated by youth or employees. Further, the removal/recycling of old tractors without ROPS was not favorable, with only 12% supportive of such a measure. Comments regarding mandatory ROPS legislation involved opinions that government involvement was unwanted, classic tractors should be exempt from mandatory ROPS retrofits, and mandates may be a good idea but enforcement would be difficult or impossible.

## Discussion

Through the initial survey and further contact with equipment dealers, additional insight was gained into the dealer perspective on ROPS retrofits. The dealer perspective is an important one in the consideration of issues relating to ROPS retrofits. During prior policy conferences about tractor safety and ROPS (Donham et al., 1997), and

**Table 4. What is your opinion on what should be done?**

Survey Question	Favorable	Not favorable	Won't work
Establish limits on liability claims for dealers.	N = 40 (80%)	N = 1 (2%)	N = 9 (18%)
Require that tractors have ROPS if operated by youth or employees.	N = 28 (53%)	N = 5 (9%)	N = 20 (38%)
Establish a fund to recycle/remove tractors unable to have ROPS fitted.	N = 6 (12%)	N = 22 (43%)	N = 23 (45%)
Require that all tractors have ROPS before resale within the next 7 years.	N = 9 (17%)	N = 27 (52%)	N = 16 (31%)
Require all tractors driven on public roads have ROPS in the next 8 years.	N = 15 (29%)	N = 25 (48%)	N = 12 (23%)
Require that all tractors have ROPS in the next 10 years.	N = 8 (16%)	N = 24 (48%)	N = 18 (36%)

in a specific ROPS retrofit intervention program (TRAC) (Lehtola and Rautiainen, 1995), dealers were key members involved in these meetings and in the success of the intervention. Equipment dealers, manufacturers, and farmers are all influential in ROPS health and safety issues. While there are many common concerns among the three groups, there are also issues that are of primary importance to each individual group.

There were several findings as a result of this survey. While some were expected, others were somewhat surprising. Dealers were primarily concerned with aspects of ROPS relating to money and liability. This may be because they feel their role is primarily business driven and there is no customer demand, or it could be due to their lack of knowledge about the effectiveness of ROPS in preventing deaths from overturns. Further, they had little knowledge about the current status of manufacturer ROPS promotions. Most dealers were not sure if these programs were still functioning. This could be due to poor communication between the manufacturer and dealer or perhaps lack of active promotions. A number of dealers were unsure about where to find ROPS for older tractors.

Dealers were very concerned about the potential liability if a retrofit ROPS failed. Legislation setting limits on dealer liability may make more tractor dealers willing to install retrofit ROPS. This fear of liability may be strongly influencing the dealer's willingness to actively promote ROPS retrofits. This issue needs to be explored further, but it seems that if an approved ROPS retrofit kit is installed according to the manufacturer's specifications, the dealer should have limited liability exposure.

The other issue involved in ROPS liability is failing to install a safety feature that is known to be effective in preventing deaths due to overturns. Only one dealer mentioned anything about the liability of NOT installing ROPS on tractors when ROPS are known to be effective in preventing deaths due to overturns. Other research has shown that many farmers recognize the potential liability of having employees operating tractors without ROPS (Struttman et al., 2001). Dealers should recognize that there is liability in failing to sell and install ROPS if there is a ROPS available for the make and model that is being sold or serviced by their dealership. Dealers should be educated about this potential liability. This finding may be key in gaining the participation of dealers in ROPS retrofit programs and installations.

Financial incentives continue to be the main method that responders felt would increase the appeal of ROPS retrofits. These incentives could be partial rebates on ROPS offered to the farmer and/or the dealer. While dealers in this survey felt rebates

would increase sales, previous studies have shown that this method alone may not be completely effective. Kelsey et al. (1996) found that 40% of New York farmers would not accept a rollover protective structure even if it was free. More recent research showed a marked increase in ROPS sales when a financial incentive was used as part of a social marketing campaign (Sorensen et al., 2008) This is an issue that needs to be explored further by assessing potential results of a more comprehensive program involving policy, social marketing, and technical assistance, among other methods.

### **Limitations**

Despite sending out multiple reminder faxes to INEDA dealers, there was still a low response rate (26%). This low response rate makes it unlikely that all issues involved in ROPS retrofits have been explored. However, the follow-on response panel supported and validated the survey results by those members attending the INEDA annual meeting. There are also limitations due to only assessing equipment dealers in the Iowa and Nebraska region. There may be additional issues and dealer experiences in other parts of the U.S. This survey only assessed ROPS retrofits from the equipment dealer perspective and did not explore the farmer or manufacturer perspective. Additionally, the results were in response to a survey instrument that may or may not have been comprehensive in scope. We attempted to be as comprehensive as possible by using a wide range of questions that also allowed for open-ended responses for facilitating input that we may not have originally considered.

## **Recommendations**

### ***Education and Facilitation for Equipment Dealers***

- Develop a social marketing campaign targeting equipment dealers and their importance and effectiveness in getting ROPS installed on tractors.
- Actively support equipment dealers by providing education, rebates, and promotional materials to allow them to further promote ROPS retrofits to their customers.
- Limit dealer liability relating to ROPS so that equipment dealers feel more secure in promoting and installing ROPS retrofits.
- Establish educational programs targeted to equipment dealers about the risk and liability of failing to promote and install ROPS.

### ***Social Marketing to Producers***

- Target campaigns to tractor owners to increase their interest in ROPS so that they are receptive to the dealer's ROPS initiatives.

### ***Policy Changes***

- Provide financial incentives such as rebates, tax credits, or insurance discounts to purchase ROPS and equipment dealers who sell and install ROPS.
- Promulgate regulations that would require ROPS be installed on tractors operated by children under the age of 18.

### ***Manufacturer Promotions***

- Promote further development of ROPS rebate programs and provide technical assistance in finding ROPS for all tractor makes and models.
- Encourage manufacturers to develop ROPS that are reasonably priced and easily accessible (including timeliness of ordering and shipping). Discounts or expe-

dited shipping and ordering would allow for dealers to fill orders in a timely manner.

***Develop a “Clearinghouse” for ROPS***

- There should be one central number to call and order a ROPS for a specific tractor. The clearinghouse would evaluate sources such as salvage, aftermarket companies, manufacturers, and other dealers and would arrange shipping and delivery. This could be a government sponsored service (NIOSH and or USDA combined) competitively contracted to one of the NIOSH Agricultural Health Centers or a Land Grant University Extension program.

## **Conclusion**

Farm equipment dealers can play a large role in the retrofitting of ROPS. Results of an intervention program in Iowa (Lehtola and Rautiainen, 1995) revealed that interested and motivated dealers can be very influential in getting ROPS installed on tractors. There appears to be sufficient interest among dealers that if they were offered support in terms of programming, liability constraints, time, and resources, they would participate in a campaign. Dealer support in the past and willingness now to meet customer demand shows that while equipment dealers may not currently sell or install ROPS, many are willing to do so. Previous promotional programs by equipment manufacturers and dealers have been successful in increasing the sales of ROPS in the past, but these programs have waned. If dealers were supported in developing programming and resources for ROPS retrofits, it is likely that this would again increase sales and installation. Equipment dealers need to be educated about the liability of failing to retrofit ROPS on older tractors. Further, if issues of inventory, ease of locating specific ROPS, and timelines in receiving ROPS could be minimized, then dealers would be more likely to become involved. In order to make a difference in tractor safety, all involved members, including farmers, equipment dealers, and equipment manufacturers, need to be encouraged to revisit the need for ROPS and resume a more active role.

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