

**SMALL AND MEDIUM FARM TRACTOR END USERS SURVEY
ON POTENTIAL ACCEPTABILITY OF
AUTOMATIC DEPLOYING ROLLOVER PROTECTIVE STRUCTURES
(AD-ROPS)**

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1. INTRODUCTION

This evaluation study is a part of the INSPL (Institute of Public and Occupational Health of Navarre) and the Occupational Safety and Health Institute of the Region of Murcia research program to evaluate the interest of tractors users to implement new rollover protective systems developed in the last years.

Tractor overturns are by far the leading cause of fatal injuries in the agricultural industry. Rollover protective structure (ROPS) use is increasing, but the number of overturn-related fatalities per year has not been declining significantly. There are still some tasks, such as orchard work, greenhouses tasks and barn cleaning that cannot be performed with a rigid ROPS mounted to the tractor.

Manually adjustable ROPS have been developed by the agricultural equipment industry to address the issue of low clearance situations. If these adjustable ROPS are used properly, they are quite effective systems. The problem is that they require the operator to take an active role in making sure the ROPS is properly adjusted when not in a low clearance situation (a task some operators may not consistently perform).

Each year hundreds of people die as a result of agricultural tractor rollovers. The use of rollover protective structures (ROPS), along with seat belts, is the best-known method for reducing the frequency of these fatalities. One impediment to ROPS use, however, is low clearance situations, such as orchards, greenhouses and animal confinement buildings. Manually adjustable ROPS have been developed by the agricultural equipment industry to address the issue of low clearance situations. If these adjustable ROPS are used properly, they are quite effective systems. The problem is that they require the operator to take an active role in making sure the ROPS is properly adjusted when not in a low clearance situation (a task some operators may not consistently perform).

With these facts in mind and to address the need for ROPS that are easily adapted to low clearance situations, industry and institutions researchers have developed automatically deploying rollover protective systems. These newly conceived systems are signaled to automatically raise to its protective position before the overturning tractor contacts the ground.

New automatic deploying rollover protective structures (AD-ROPS) comprise from spring activated structures (AutoRops, in USA), to hydraulic activated ROPS (Italy and Murcia, Spain), to air activated ROPS (Navarra, Spain)

A unique aspect of these automatic deploying systems is that they are a passive device, which has the potential to be more protective for the tractor operator because it does not require any action on their part for the ROPS to be effective. The passive nature of automatic systems should make it

more appealing to farmers. The Automatic Deploying ROPS (AD-ROPS) are normally latched in its lowered position for day-to-day use. If a rollover condition is detected by the sensor, the retracted ROPS will automatically deploy and lock in the full upright position before ground contact.

The objective of this study is to get an initial measurement of the usability of these automatic structures among tractor operators who would be probable users of this new technology. This study only examines whether farmers have an initial positive interest in this new concept for preventing tractor rollover-related fatalities.

In general terms, the sample group was of the opinion that automatic deploying systems are more effective than the manual ROPS alternative and that the protection effectiveness provided by automatic systems will be superior to the protection provided by manual ROPS. It must be stressed that most interviewees would be willing to purchase a tractor equipped with an automatic rollover protective system rather than a tractor with manual ROPS.

2. OBJECTIVE

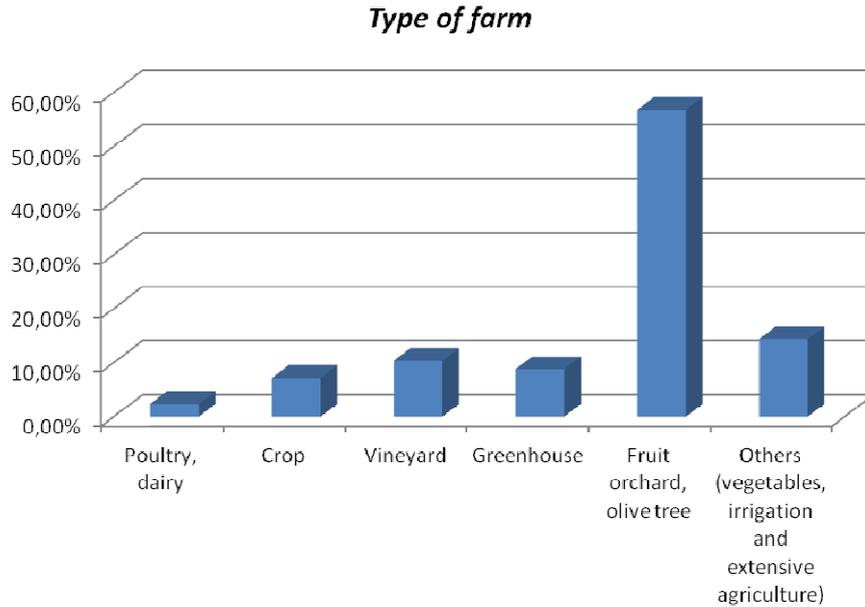
The objective of this study was to obtain an initial assessment of the acceptability of AD-ROPS systems relative to a manually adjustable ROPS among a sample of typical potential users of the new technology. The objective was to be achieved by obtaining potential user responses to rating questions. Questions were focused to evaluate how far potential users would agree to use automatic systems rather than manual ROPS and would potential users of AD-ROPS-equipped tractors be more inclined to procure an AD-ROPS-equipped tractor than a tractor equipped with manually adjustable ROPS?

3. POTENTIAL USERS SAMPLE

Seventy-eight tractor users participated in this survey. The farmers ranged in age from 20 to 77 with an average of 49 years old and an average experience operating farm tractors of 25 years. None of them had suffered a tractor rollover accident.

Participants were recruited by the INSPL and the Occupational Safety and Health Institute of the Region of Murcia in their provinces (Navarra and Murcia).

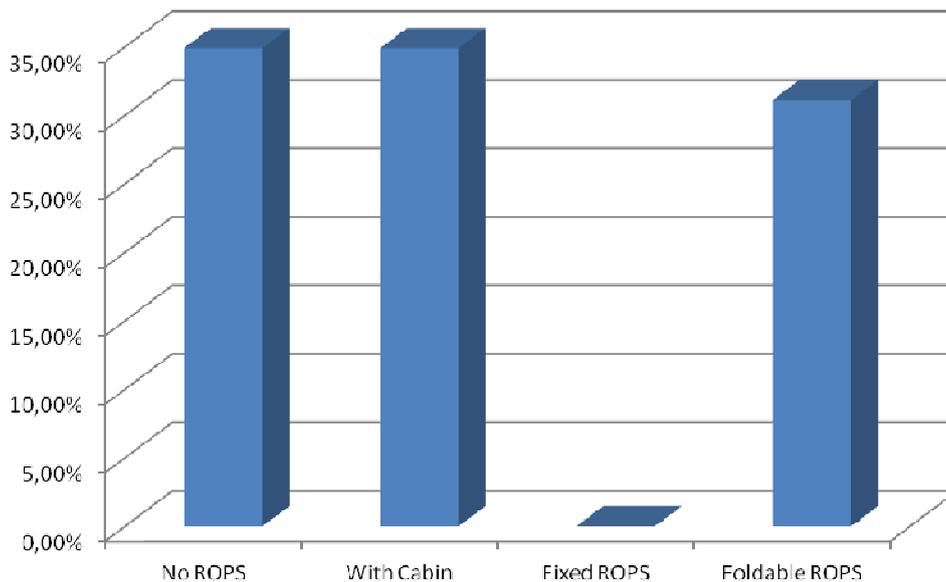
Table 1



The main farming activity among all participants was fruit orchards and olive trees operations (57%) as shown in Table 1.

Participants owned a total of 106 farm tractors. Table 2 indicates that almost 35% of these tractors were not equipped with any rollover protective device and 31% were equipped with manually foldable ROPS.

Table 2
Protective Structures on tractors



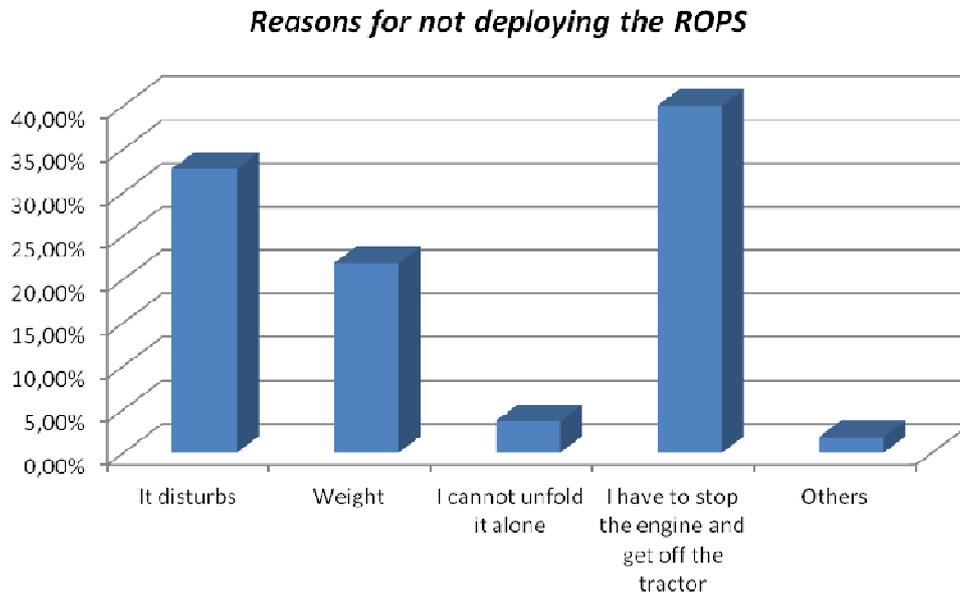
4. METHOD

Before proceeding with the survey a verbal explanation was given to explain main features of automatic rollover protective systems and main differences with manually foldable ROPS. Most of

the questions were asked to participants to show their degree of discrepancy in 5 different degrees (strongly disagree, disagree, neutral, agree, strongly agree) or a degree of frequency (never, almost never, sometimes, almost always, always).

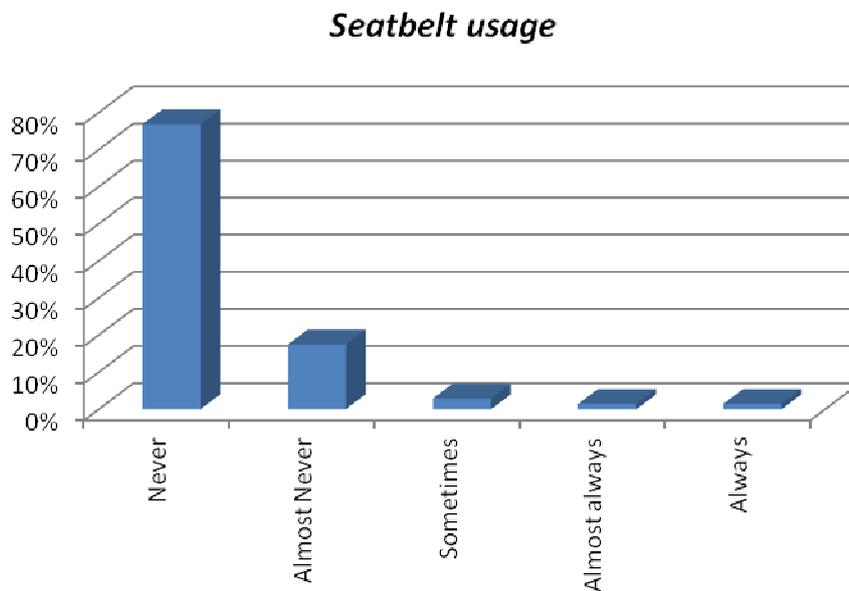
5. RESULTS

5.1 Reasons for not deploying the ROPS



Most of participants were of the opinion that the main reason for not deploying the manually foldable ROPS was the inconvenience of stopping the engine and getting off the tractor to unfold de ROPS, followed by that an unfolded ROPS disturbs during the normal farm tasks.

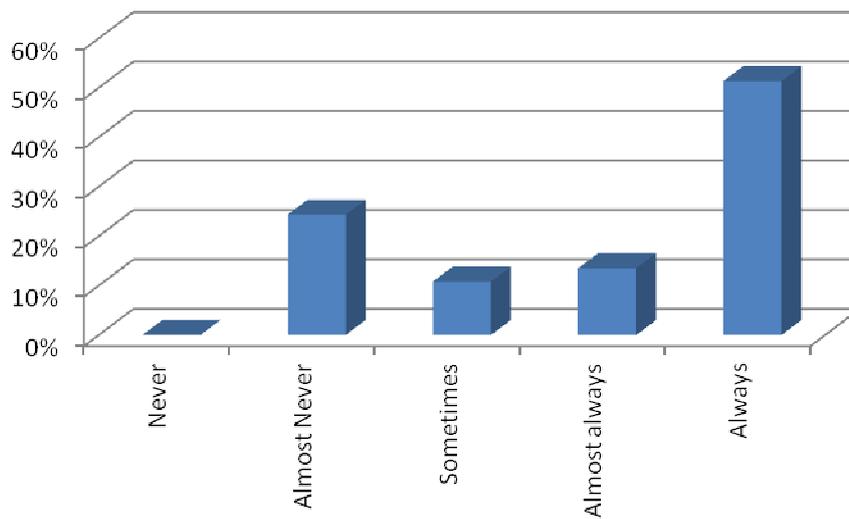
5.2 Seatbelt usage



A large majority of the group answered that they *never* (77%) or *almost never* (17%) use the tractor seatbelt.

5.3 Does a ROPS disturb for normal tractor tasks?

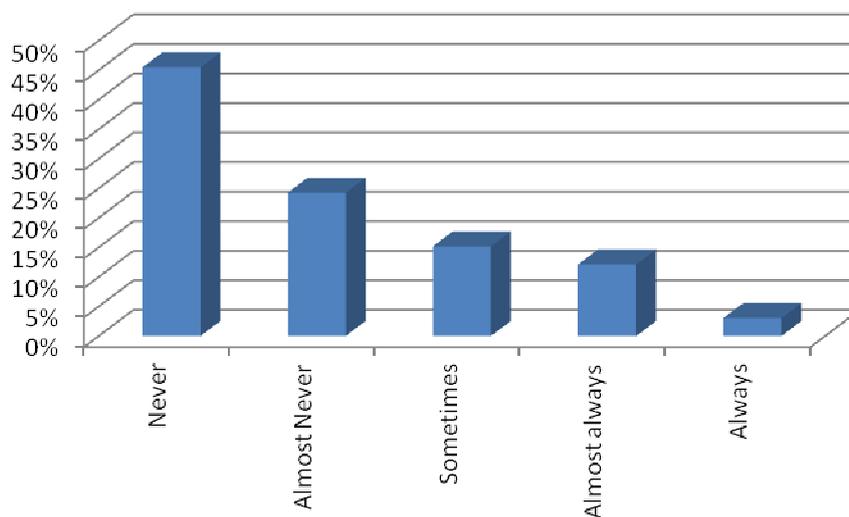
Does a ROPS disturb for normal tractor tasks?



While a bit more of half of the participants answered that ROPS *always* disturbs in normal tasks, 24% of interviewed think that ROPS *almost never* disturbs.

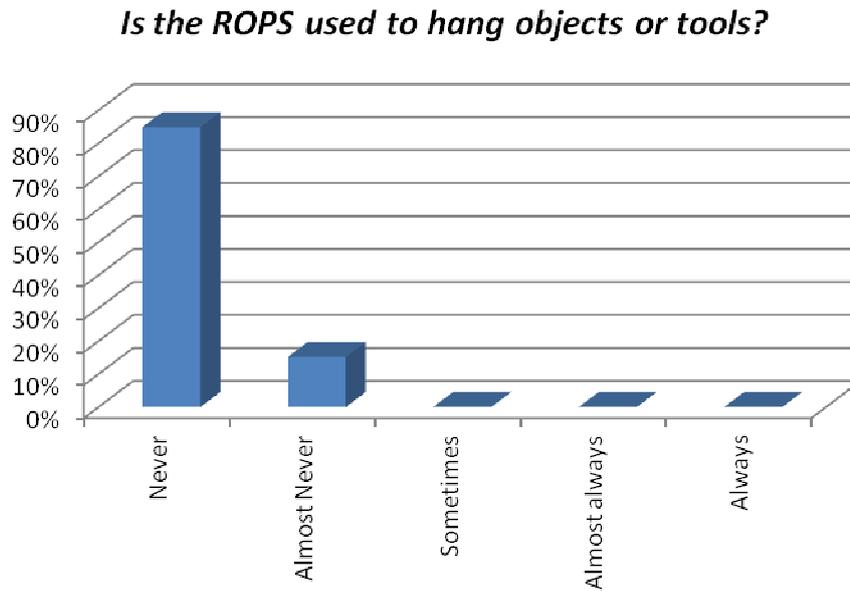
5.4 Visibility reduction with front ROPS

Does a front ROPS reduce visibility?



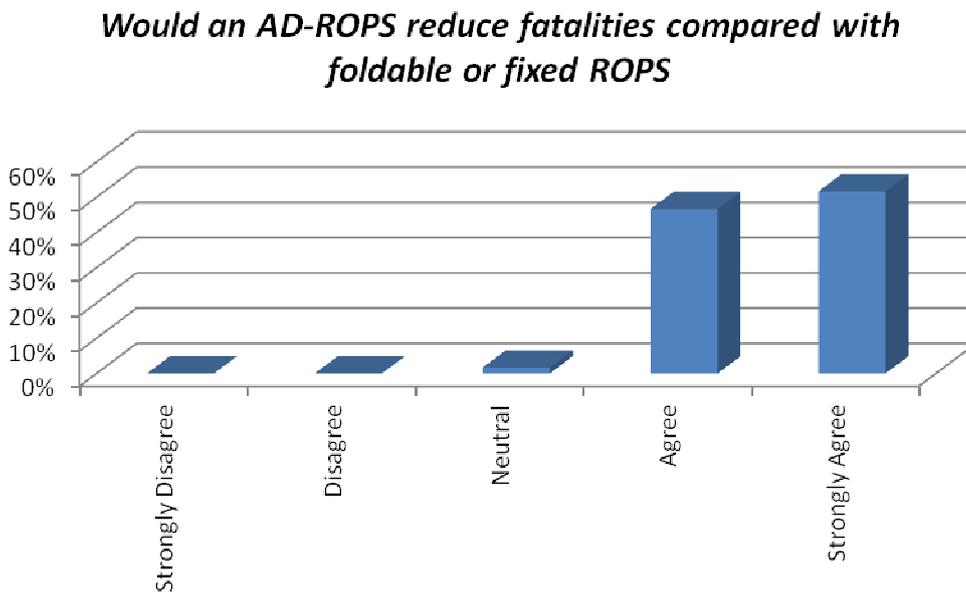
A 45% of responses coincided in indicating that front ROPS *never* reduce visibility and 24% were of the opinion that they *almost never* reduce visibility.

5.5 Other uses of ROPS



Nearly all respondents stated that they never use the ROPS to hang objects or tools or to other uses different from a protection device.

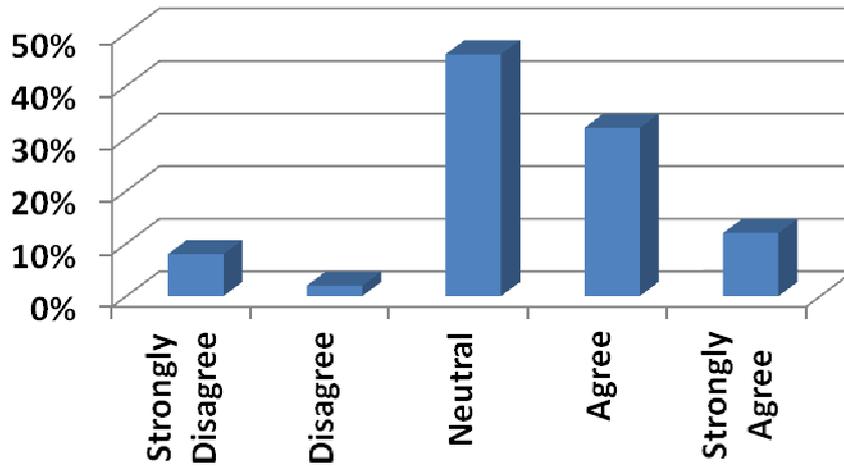
5.6 Fatality reduction with AD-ROPS



More than half of participants *strongly agreed* that an automatic deployable ROPS would reduce fatalities compared with foldable or fixed ROPS, and 47% also *agreed* on this.

5.7 Seatbelt usage with AD-ROPS

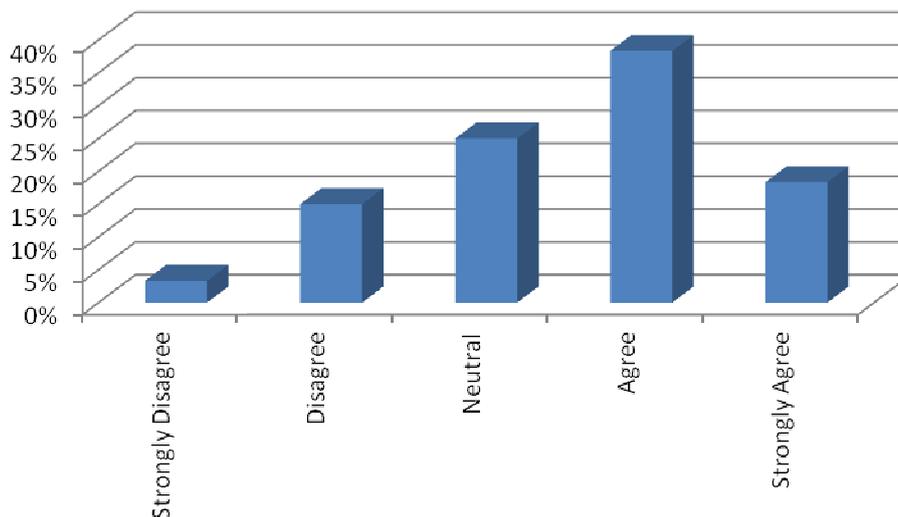
Would be more acceptable the use of seatbelts with AD-ROPS ?



From the responses it appears that the majority of interviewees showed a *neutral* position to determine if the use of seatbelts with AD-ROPS would be more acceptable. 32% of the group *agreed* to accept the use of the seatbelt with AD-ROPS.

5.8 Field of vision improvement with AD-ROPS

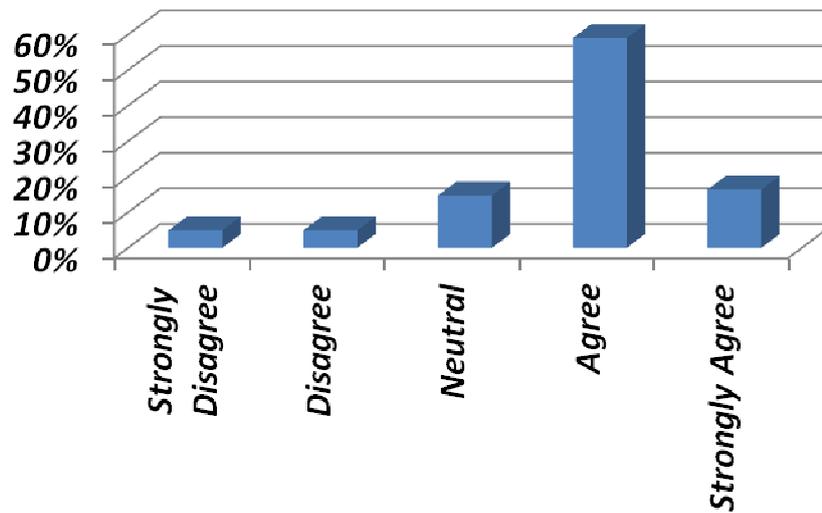
Field of vision improvement with AD-ROPS



More than half of participants *agreed* or *strongly agreed* that the field of vision would be improved with the use of AD-ROPS.

5.9 Safety feeling with AD-ROPS

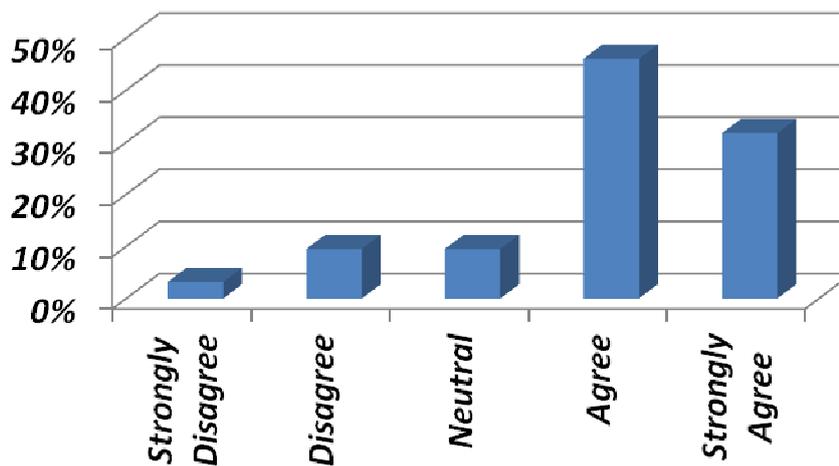
Would you feel safer with an AD-ROPS?



59% of respondents *agreed* that they would feel safer with an AD-ROPS compared with a manually adjustable ROPS and 16% *strongly agreed* with this feeling.

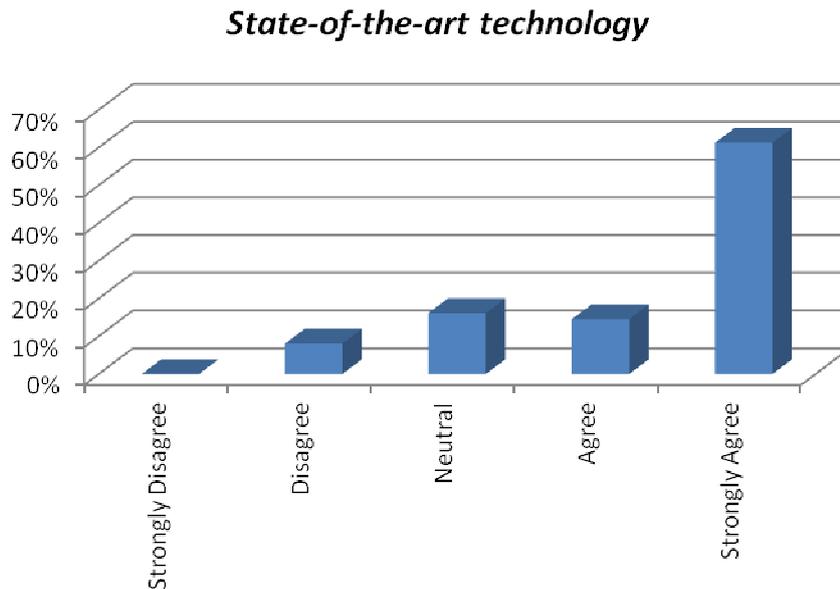
5.10 Which ROPS is more dangerous?

Is a foldable ROPS more dangerous than an AD-ROPS?



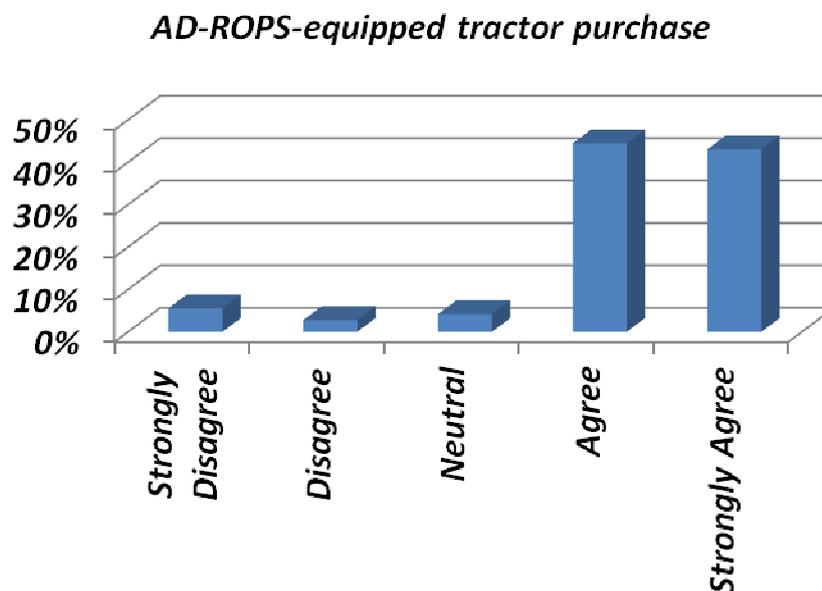
Almost 80% of participants considered a manually foldable ROPS more dangerous than an AD-ROPS.

5.11 State-of-the-art technology



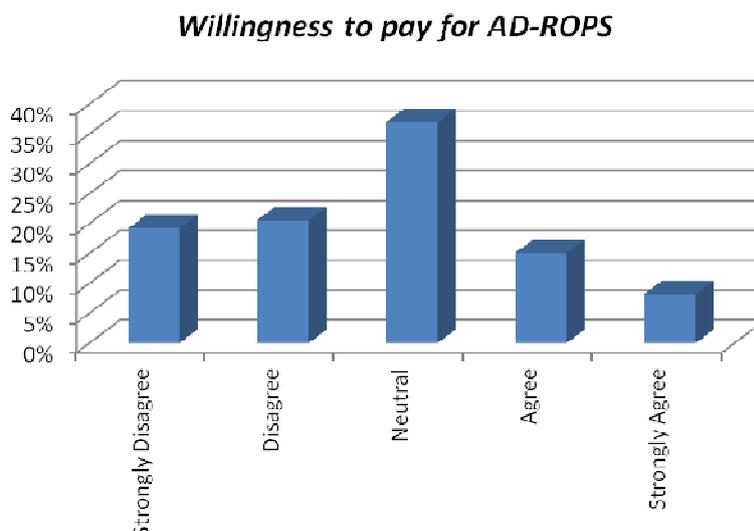
More than half of participants *strongly agree* that current state-of-the-art technology is ready to implement AD-ROPS in the market, followed by 15% responses that *agree* with this statement.

5.12 Purchase decision



Almost 90% of respondents strongly agreed or agreed that they would be more interested in purchasing a new tractor equipped with an AD-ROPS than a tractor equipped with a manually adjustable ROPS.

5.13 Willingness to pay for AD-ROPS



Although most of the answers were neutral, the tendency of majority is not to pay more for an AD-ROPS-equipped tractor than for a standard ROPS-equipped tractor.

5.14 Summary tables with results

	Never	Almost Never	Sometimes	Almost always	Always
Seatbelt usage	77%	17%	3%	1%	1%
Does a ROPS disturb for normal tractor tasks?	0%	24%	11%	14%	51%
Does a front ROPS reduce visibility?	45%	24%	15%	12%	3%
Is the ROPS used to hang objects or tools?	85%	15%	0%	0%	0%

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
Would an AD-ROPS (Automatic Deployable ROPS) reduce fatalities compared with foldable or fixed ROPS	0%	0%	2%	47%	52%
Would be more acceptable the use of seatbelts with AD-ROPS rather than with standard ROPS?	8%	2%	46%	32%	12%
Will the field of vision be improved with AD-ROPS?	3%	15%	25%	38%	18%
Would you feel safer with an AD-ROPS?	5%	5%	15%	59%	16%
Is a foldable ROPS more dangerous than an AD-ROPS?	3%	10%	10%	46%	32%
Is the state-of-the-art technology ready to implement AD-ROPS in the market?	0%	8%	16%	15%	61%
If a new tractor were being purchased, would an AD-ROPS-equipped tractor more interesting than a standard ROPS-equipped tractor?	6%	3%	4%	44%	43%
Would you be willing to pay a bit more for an AD-ROPS-equipped tractor rather than a standard ROPS-equipped tractor	19%	21%	37%	15%	8%

5. CONCLUSIONS

- The results of this survey provide an indication that AD-ROPS may be successfully introduced into the agricultural equipment marketplace.
- The farmer group was of the opinion that AD-ROPS deployment is more effective than the manual ROPS alternative and that the protection effectiveness provided by AD-ROPS will be superior to the protection provided by manual ROPS.
- Moreover, most of interviewees considered that the field of vision is improved with automatic deployable ROPS.
- It is also important to remark the willingness of participants to purchase an AD-ROPS-equipped tractor rather than a standard ROPS-equipped tractor.

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