Jens Karl Wegener[1], Katrin Ahrens[1], Gabor Molnar[1], Sabine Martin[2], Markus Röver[3], Sebastian Dittmar[4]

Survey about the dissemination of different cabin categories in plant protection of German practice

Umfrage zur Verbreitung verschiedener Kabinenkategorien für den Pflanzenschutz in der deutschen Praxis

Affiliations
[1]Julius Kühn Institute (JKI) – Federal Research Centre for Cultivated Plants, Institute for Application Techniques in Plant Protection, Braunschweig, Germany.
[2]German Federal Institute for Risk Assessment, Department Pesticides Safety, Berlin, Germany.
[3]Federal Office of Consumer Protection and Food Safety, Braunschweig, Germany.
[4]Social Insurance for Agriculture, Forest and Horticulture, Kassel, Germany.

Correspondence
Prof. Dr. Jens Karl Wegener, Julius Kühn Institute (JKI) – Federal Research Centre for Cultivated Plants, Institute for Application Techniques in Plant Protection, Messeweg 11/12, 38104 Braunschweig, Germany, email: jens-karl.wegener@julius-kuehn.de

Abstract

The Federal Office of Consumer Protection and Food Safety (BVL) specified that certain driver cabs are suitable to replace personal protective equipment prescribed with the approval of plant protection products during application. This protective effect has been accepted since 2017 for category 3 or 4 driver's cabs (EN 15695-1/2017) and since 2020 for enclosed cabs equipped with air conditioning including an air filtration system (BVL category 2*). The protection level of cat. 2* cabins is currently being investigated in a research project. In this context, a survey of farmers was conducted to obtain more information about the distribution and equipment of tractor cabins in agricultural practice in Germany. The questionnaire is divided into two sections. The first part collects personal demographic data and data on the structure and location of the farms. The second part deals with the technical equipment and use of the vehicles. A total of 4,199 valid questionnaires were evaluated. The results from Part 1 of the survey on the percentage distribution of participating farms across the German Federal States and the sizes of farms represented are close to the statistical data from Destatis. Larger farms are slightly overrepresented in this survey. Nevertheless, the results provide profound information on the prevalence of different cab categories in agricultural practice in plant protection in Germany.

The survey provided further results, regardless of the cab category. It showed that the replacement interval for cabin air filters is less than 2 years in most cases, that 40% of the participants indicated that they clean their cab after applying plant protection products, and that almost 90% of the users feel well protected against plant protection products in their cab. The results are plausible and in line with earlier assumptions. With the publication of the results, valid information on this topic is now available.

Keywords

EN 15695, cabin category, plant protection, protective level, personal protective equipment, survey, Germany

Zusammenfassung

Das Bundesamt für Verbraucherschutz und Lebensmittelsicherheit (BVL) hat festgelegt, dass bestimmte Fahrerkabinen beim Einsatz im Pflanzenschutz geeignet sind, persönliche Schutzausrüstung zu ersetzen, die mit der Zulassung von Pflanzenschutzmitteln während der Anwendung vorgeschrieben sind. Diese Schutzwirkung wird seit 2017 für Fahrerkabinen der Kategorien 3 oder 4 (EN 15695-1/2017) und seit 2020 für geschlossene Kabinen, die über eine Klimaanlage sowie eine Zuluft-Filterung verfügen (BVL-Kategorie 2*), angenommen. Das Schutzniveau von Kat. 2* Kabinen wird aktuell in einem Forschungsprojekt untersucht.

Vor diesem Hintergrund wurde eine Umfrage bei Praktikern durchgeführt, um mehr Informationen über die Verbreitung und Ausstattung von Traktorkabinen in der landwirtschaftlichen Praxis in Deutschland zu erhalten.

Der Fragebogen gliedert sich in zwei Abschnitte. Im ersten Teil werden demografische Daten zur Person sowie Daten zur Struktur und Lage des Betriebs erfasst. Im zweiten Teil geht es um die technische Ausstattung und Nutzung der Fahrzeuge. Insgesamt konnten 4.199 gültige Fragebögen ausgewertet werden. Die Ergebnisse aus Teil 1 der Umfrage zur prozentualen Verteilung der beteiligten Betriebe über die Bundesländer und die repräsentierten Betriebsgrößen sind nahe an den statistischen Daten von Destatis. Größere Betriebe sind in dieser Umfrage leicht überrepräsentiert. Trotzdem liefern die Ergebnisse profunde Informationen über die Verbreitung von

Submitted/accepted for publication: 20 June 2022/24 August 2022

verschiedenen Kabinenkategorien in der landwirtschaftlichen Praxis im Pflanzenschutz in Deutschland.

Die Auswertung zeigt, dass es in den letzten 10 Jahren zu einer signifikanten Zunahme von Kabinen der Kategorie 3 und 4 in der Praxis gekommen ist, mit einem etwas höheren Anteil bei den größeren Betrieben. In Bezug auf die Betriebsform ist der Anteil von Kategorie 3 und 4 Kabinen insbesondere im Obstbau, in den Spezialkulturen und bei den Lohnunternehmen höher. Die Umfrage lieferte weitere Ergebnisse, unabhängig von der Kabinenkategorie. Es zeigte sich, dass das Wechselintervall bei den Zuluft-Filtern in den meisten Fällen kleiner als 2 Jahre ist, dass 40% der Befragten angeben, ihre Kabinen nach der Applikation von Pflanzenschutzmitteln zu reinigen und knapp 90% der Anwender sich in ihrer Kabine gut gegen Pflanzenschutzmittel geschützt fühlen. Die Ergebnisse sind plausibel und decken sich mit früheren Annahmen. Mit der Veröffentlichung der Ergebnisse liegen jetzt stichhaltige Informationen zu diesem Thema vor.

Stichwörter

EN 15695, Kabinenkategorie, Pflanzenschutz, Schutzniveau, persönliche Schutzausrüstung, Umfrage, Deutschland

Introduction

Within the process of authorization of plant protection products (PPP) the necessary personal protective equipment (PPE) for operators (e. g. protective gloves, protective coverall, respiratory protection) handling or applying PPP is defined on the basis of a risk assessment for each individual PPP. PPE is mandatory in cases where exposure to the PPP needs to be lowered to an acceptable level for which unacceptable health risks can be excluded. The specific PPE requirements are communicated with the authorization of each PPP and described in detail in the instructions for use.

In 2017, the labelling instruction SB199[1] was published (BVL, 2017). It offered an exemption releasing the operator from the requirement to wear obligatory PPE during the application of PPP within the vehicle´s cabin, if his machine used for plant protection purposes is equipped with a cat. 3 or cat. 4 cabin according to DIN EN 15695-1 (2018) and DIN EN 15695-2 (2018) This publication was a starting point for discussions between different stakeholders, pointing out that many operators were not aware of the liability to wear obligatory PPE within a closed vehicle cabin, if their cabin does not fulfill the requirements of cat. 3 or cat. 4. One result of these discussions was the request to extend the exemption also for other types of cabins.

[1] SB199: When applying the product with tractor-mounted, trailed or self-propelled application equipment, only vehicles with closed pressurized cabins (e.g. cabin category 3, if no respiratory protective equipment or particle-filtering masks are necessary or category 4, if gas-tight respiratory protective equipment is needed acc. to EN 15695-1 and -2) are suited to replace personal protective equipment during application. During all other activities outside of the cabin the prescribed personal protective equipment must be worn. In order to avoid contamination of the cabin, it is not permitted to enter the cabin with contaminated personal protective equipment (it should be deposited e.g. in an appropriate storage facility). Contaminated gloves should be washed before removing the gloves and hands should be washed before entering the cabin with pure water, respectively.

Against this background and after the German authorization body for plant protection products (Federal Office of Consumer Protection and Food Safety – BVL) gained further experiences about acceptance, practicability and problems with the implementation of SB199 it was decided to modify labelling instruction SB199. In 2020 an announcement (BVL, 2020) was published, which extended the exemption of SB199 from cat. 3 and cat. 4 cabins to so called cat. 2* cabins for a transitional period. This cabin type, not being referred to in EN 15695, was defined as a tightly closed cabin with air condition and dust-filter system. In parallel a project analyzing the protective level of different cabin categories in comparison started, in order to reevaluate this latest decision based on experimental data. Within this project, partners from BVL, German Federal Institute for Risk Assessment (BfR), Social Insurance for Agriculture, Forest and Horticulture (SVLFG) and Julius Kühn Institute (JKI) identified a lack of information about the actual distribution of different cabin categories in practice. To fill this gap, it was decided to run a survey to elucidate, what kind and share of different cabin categories are in practice on the vehicles used for plant protection purposes. The internet-based survey started in July 2020 and ended in May 2021. Within that period the campaign was promoted by the field inspector crew of SVLFG, who invited farmers directly to participate in the survey. Furthermore, notifications published in different journals, were giving background information and explaining the aims of the survey (e.g. SVLFG, 2021).

Despite the decision in 2020 to introduce cabin category 2* for a transitional period, BVL strongly encourages the selection of vehicles with category 3 or 4 cabins for new purchases. To support buying decisions, a list of available vehicles was published on the Internet in June 2021 (BVL, 2021; link to cabin register available on www.bvl.bund.de/PPE). Since the survey presented here was already completed in May 2021, the evaluation does not take into account this additional source of information. However, it can be assumed that the development of the cabin register has contributed to stabilizing the availability of vehicles with high-quality cabin technology.

Methods used for the survey

The survey focused on questions in order to explore general information about the operators, farm sizes, type of agricultural business as well as information about the mechanization regarding the vehicles and the category of cabins they use for plant protection. A total of 4,199 participants answered the questionnaire. Due to inconsistent answers and based on the structure of the survey not all responses were valid for all questions. The total number of all valid participants per question is given for each question.

The survey in two-stage design firstly addressed general information and structural aspects of the farm:

- Location of the farm on basis of the German Federal States
- Age of the interviewee
- Type of agricultural business
- Farm size
- Position of interviewee on the farm
- Who is responsible for the practical application of PPP?

On second stage, technical details were requested:

- Type of vehicles for PPP application: tractor, narrow track tractor, self-propelled sprayer
- Age of the machinery
- Operating hours per year
- Specifications of cabin configuration
- Number and types of filter elements
- Change interval of filters
- Cabin category: no cat.[2], cat. 1, cat. 2, cat 2*, cat. 3, cat.4,
- Is the inner space of the cabin cleaned after application of PPP?
- Does the interviewee feels himself well protected during the application of PPP within his type of cabin?
- In case of purchase of new tractors, would the interviewee consider a higher protection level of the cabin into his buying decision?

All possibilities for answers were predetermined within the whole survey (multiple choice with no open questions). In the case, that the responsibility for plant protection belongs to a third party, the survey ended for the interviewee following the first stage.

For the evaluation of the survey, the results were based on the following cabin categories:

- No category: Vehicles with closed cabin but without classification.
- Category 1 (cat. 1): Vehicles without any level of protection (tractors with only rollover bar, top or without closed cabin) according to EN 15695-1 and -2 or
- Category 2 (cat. 2) according to EN 15695-1 and -2 and Category 2* (cat. 2*) for vehicles with tight closing cabin, air condition and dust filter defined by BVL (2020)
- Category 3/4 (cat. 3/4) according to EN 15695-1 and -2, both categories were summarized

Results and discussion

Validity of the survey

Within the following results concerning general and geographical data all participants of the survey were considered (n = 4,199). The comparison of the regional distribution data from the survey to statistical data from Destatis (2020a; 2020b) shows slight differences between both sources. Nevertheless, participants of all Federal States have answered to the survey. As shown in Table 1 numbers are in general comparable to data represented in the Destatis report (2020a).

Taking the parameter “farm size” into account (Table 2) the survey slightly over represents larger farms when compared to Destatis findings. A possible explanation might be that the range of promotion (notifications and field inspector crew of SVLFG) did not reach the same amount of smaller (part time) farmers in the same way as larger farms. Another reason could be that bigger farms with typically shorter reinvestment cycles and newer tractors might have a higher motivation to participate in the survey. Nevertheless, the survey does not give information about this aspect.

Table 1. Regional distribution data from survey in comparison to Destatis (2020a) (n = 4,199)

Federal State	Number of farms from survey [%]	Number of farms from Destatis [%]
Baden-Wuerttemberg	17.1	14.9
Bavaria	19.3	32.3
Berlin	0.0	-
Brandenburg	1.7	2.1
Bremen	0.0	-
Hamburg	0.7	-
Hesse	8.4	5.8
Mecklenburg-Western Pomerania	2.4	1.8
Lower Saxony	14.1	13.5
North Rhine-Westphalia	8.2	12.8
Rhineland-Palatinate	8.6	6.1
Saarland	0.7	0.4
Saxony	2.3	2.5
Saxony-Anhalt	6.6	1.7
Schleswig-Holstein	6.6	4.6
Thuringia	3.1	1.4
Total	**100.0**	**99.7**

[2] Before 2009 there was no obligation for the manufacturer to categorize the type of tractor cabin. For this reason there are tractors with closed cabins without classification on the market.

Table 2. Farm size from survey in comparison to Destatis (2020b) (n = 4,199)

Farm size	Number of farms from survey [%]	Number of farms from Destatis [%]
< 10 ha	11.8	25.2
10 – 100ha	45.3	60.3
100 – 500ha	29.8	13.0
500 – 1,000 ha	5.5	0.9
> 1,000 ha	7.5	0.6
Total	**100.0**	**100.0**

Overall, the relatively high number of data sets of this survey allow profound statements regarding the distribution of different cabin categories for plant protection purposes in different regions and farm structures.

Table 3 shows the number of participants belonging to different types of agricultural business. More than 2/3 of the participants belong to the type "crop cultivation" and "crop cultivation/animal farming". Moreover, there are several responses from other types of business. It is not clear if this distribution is representative, as data from Destatis (2021a) concerning the type of business are categorized in a different way, which seemed not to be applicable for the aims of this survey. Overall, the distribution of participants to different types of agricultural business should allow differentiated considerations.

Results from the survey

Figure 1 shows the results of the survey according to the distribution of different cabin categories against the age of the vehicles. Specific focus is given to the period of the last 5 years. The numbers illustrate a significant increase of cat. 3/4 over the last 10 years. Among vehicles less than one year old during the survey period, the percentage of cat. 3/4 cabins was just below 50%.

In line with this trend the proportion of cat. 1 and not categorized cabins decreases significantly over the time. It is remarkable that vehicles with cat. 3/4 cabs were mentioned, which are older than the standard (2017, n = 18) or even the definition of cat. 3/4 cabs (manufactured before 2009, n = 8). One possibility might be that these vehicles have been retrofitted. Whether these retrofitted cabs meet all technical requirements from EN 15695-1 and -2 according to the classification

Table 3. Participants of the survey sorted by type of agricultural business (n= 4,199)

Agricultural business from survey	Numbers from survey
Crop cultivation	2,053 (48.9%)
Crop cultivation/animal farming	1,558 (37.1%)
Viticulture	557 (13.3%)
Orcharding	265 (6.3%)
Special crops	282 (6.7%)
Machinery contractors	267 (6.4%)
Machinery ring	39 (0.9%)
Others	151 (3.6 %)
Total	**5,172**[a]

[a] Multiple answers were possible.

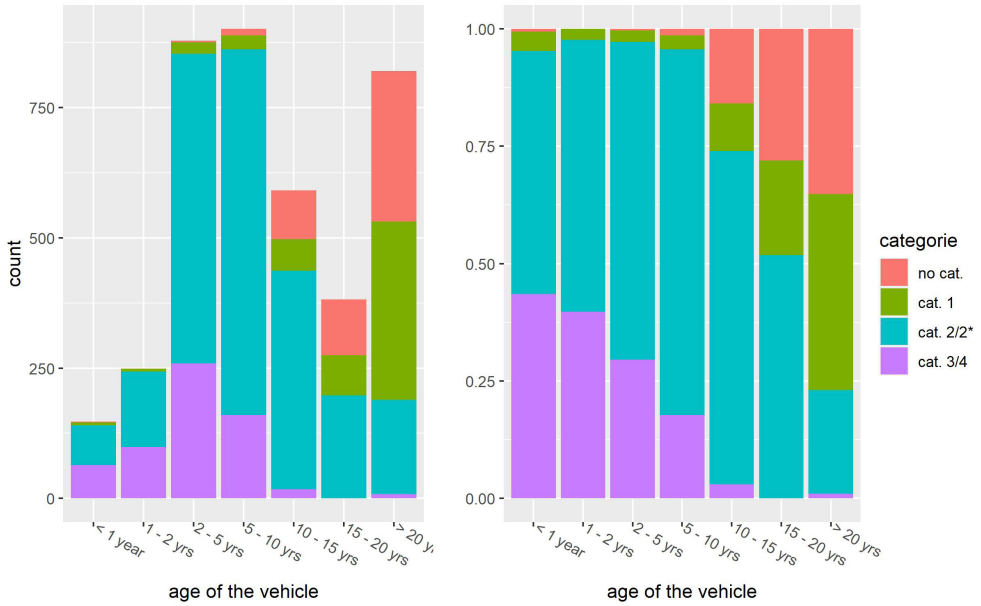

Fig. 1. Age of vehicle sorted by categories of cabins (n=3,968).

of the cat. 3/4 cab is not clear. The sample size for this and the following questions (Fig. 1 – Fig. 3 and Table 4) was n = 3,968. Participants who delegated their responsibility for plant protection to a third party (n = 166) have been excluded. Another reason is that 65 interviewees missed to fill in the category of their cabins and therefore were excluded from data evaluation.

Figure 2 displays the farm size in correlation to the various categories of cabins. The data shows that the proportions of cat. 1 and cat. 3/4 cabins are strongly correlated with different farm sizes. In bigger farms, vehicles are more often equipped with cat. 3/4 cabins. Vice versa the proportion of cat. 1 cabin is significantly higher in smaller farms. This underlines the assumption, that bigger farms with presumably shorter reinvestment cycles have better opportunities to invest into new technologies. Furthermore, the management of larger farms, where the plant protection business is usually delegated to specialized employees, might be much more interested to invest in best protection measures due to occupational safety reasons.

The same is true when looking at the location of the farms: Participants from eastern parts of Germany representing rather large farms are more likely to have vehicles with cat. 3/4 cabin than participants from the southern and south-western parts of Germany (Bavaria, Baden-Wuerttemberg, Rhineland-Palatinate, Hesse, North Rhine Westphalia**),** cultivating rather small farms (Fig. 3).

Taking into account the cabin categories sorted by type of agricultural business (Table 4) one can see that the share of cat. 3/4 cabin is higher in orcharding, special crops and for machinery contractors.

One reason for this observation could be the structural change in German agriculture. The total number of farms is decreasing constantly, whereas the mean cultivated area per farm is

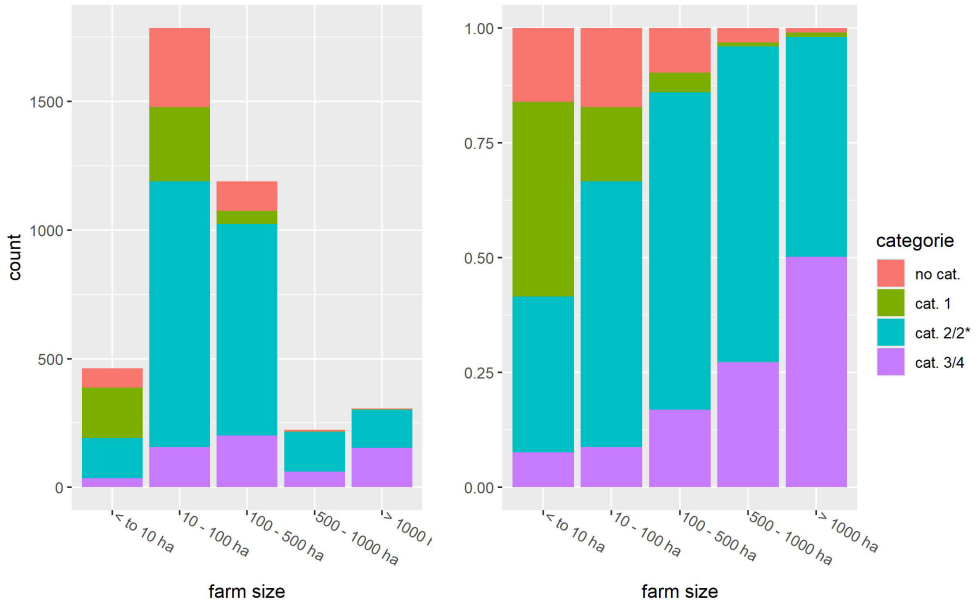

Fig. 2. Farm size sorted by categories of cabins (n=3,968).

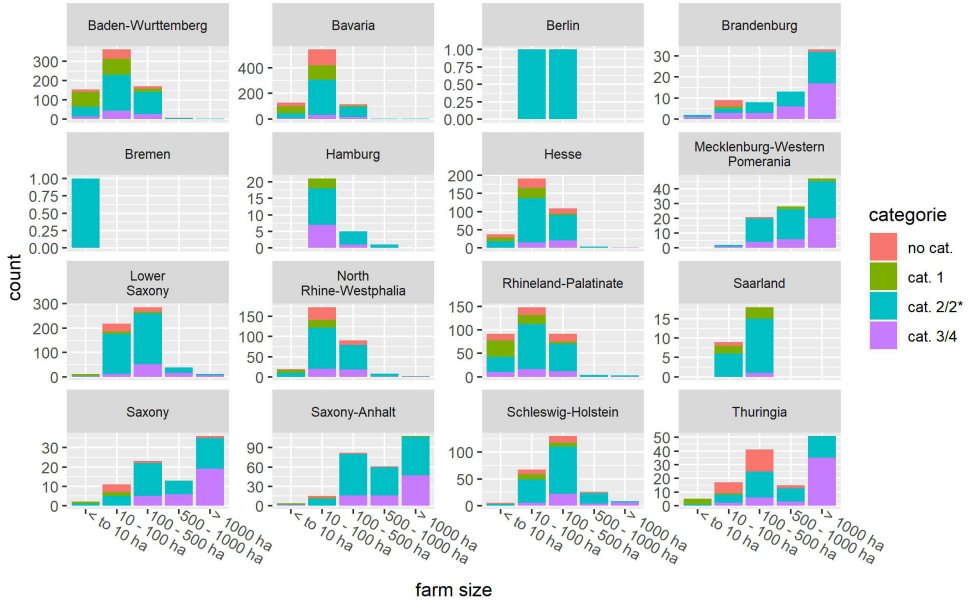

Fig. 3. Farm size sorted by categories of cabins and broken down to locations (federal states) (n = 3,968).

Table 4. Cabin category sorted by type of agricultural business (n = 3,968, multiple answers possible)

Agricultural business	No Cat.		Cat. 1		Cat. 2/2*		Cat. 3/4		Total
Crop cultivation	268	14%	197	10%	1,177	61%	302	16%	**1,944**
Mixed farming	178	12%	159	11%	908	62%	208	14%	**1,453**
Viticulture	67	12%	144	27%	257	48%	73	13%	**541**
Orcharding	23	9%	53	21%	125	49%	56	22%	**257**
Special crops	32	12%	27	10%	143	54%	64	24%	**266**
Machinery contractors	25	10%	8	3%	150	58%	77	30%	**260**
Machinery ring	5	13%	3	8%	23	61%	7	18%	**38**
Others	12	9%	46	34%	62	46%	16	12%	**126**

increasing. This trend is also observed in viticulture (Destatis, 2021b) and orcharding (Destatis, 2017). In contrast to viticulture, the number of applications of plant protection products in orchards is much higher. A better protection of the operator might be seen of more relevance compared to viticulture and could result in a higher willingness to invest in protective techniques.

For special crops – particularly vegetables – the gross value from agricultural production per unit area is higher. Moreover, farms are undergoing a structural change towards larger sizes (Dirksmeyer et al., 2017). Often plant protection is done by employees and not by the owner himself. Again, this might be a reason for an increasing proportion of cat. 3/4 cabin in this area due to occupational safety purposes.

In the case of machinery contractors, the legal aspects of operator protection and faster reinvestment cycles might also be a major reason for a higher share of cat. 3/4 cabins.

The change interval of cabin filters is an important issue concerning the efficacy of the filtering system and as such the protection level of the cabin. For this reason, the interviewees were asked about their individual exchange interval. Figure 4 shows the results of the survey. Most of the interviewees (80%) are changing the filters annually or at least once every two years. Regarding the responses for cat. 3/4 cabins a relatively higher proportion changes filters in shorter intervals. This might reflect a higher awareness of the requirements for safe operation of the cabins at a high level of protection. The question was answered by 3,432 interviewees. Out of these, only 3,346 answers were valid, because 86 interviewee have stated that they have cat. 1.

Besides the questions concerning the technical configuration of the vehicles the participants of the survey were also asked about non-technical facts. One question was addressing the point of cabin cleaning. Figure 5 shows that almost 40% of the interviewees cleaned the interior of the cabin after application of the PPP. A number of 3,484 interviewees answered to this question.

Independent from cabin category the interviewees were asked if they feel well protected on their vehicle – quantified on a scale from 1 to 6. Figure 6 shows that the individual perception of the protection level is increasing from cat. 1 to cat. 3/4. The plot shows that the expected protection level is significantly depending on the type of cabin used. Overall, a vast majority (89%) feels well protected within a closed cabin. 3,496 interviewees answered to this question.

The last question of the survey asked the interviewees (n = 3,521) if they would consider the protection level of the

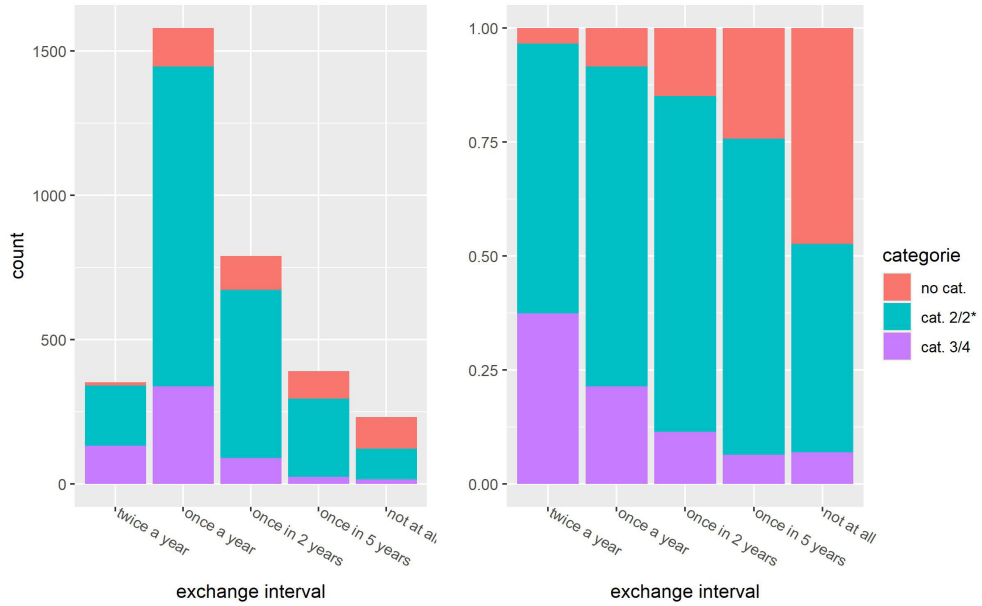

Fig. 4. Exchange interval of cabin filters in dependency of cabin categories (n=3,346).

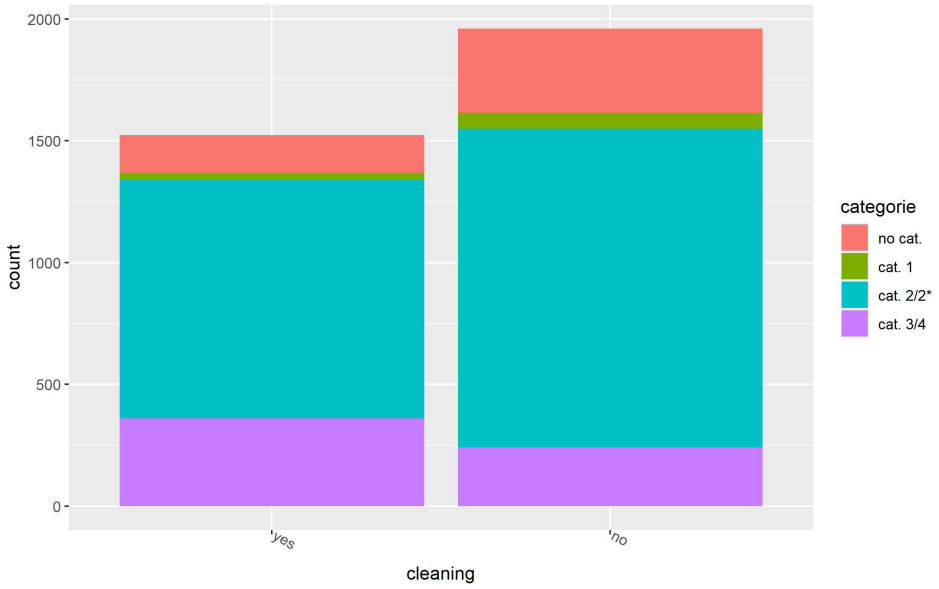

Fig. 5. Share of interviewees cleaning their cabin interior after application of plant protection products (yes) or not (no) in dependency of cabin category (n = 3,484).

cabin in their decision in case of purchase of new technique. About three quarters (76%) would consider this aspect (Fig. 7).

Table 5 shows, that 4% of respondents of this survey (n = 179) indicated that crop protection measures are outsourced to an external party. These were mainly agricultural businesses in the areas of crop cultivation and mixed farming. The affected farms are of all sizes and do not differ meaningful in their distribution to the farm sizes of the survey (e.g. Table 2).

Conclusion

The distribution of participants of the survey is closely comparable to the present statistical mean of the German agricultural sector regarding farm sizes and regional location. The survey allows valid conclusions on the distribution of different cabin categories on vehicles in German agriculture. Most of the results are in agreement with the expected outcome; despite they have not been underpinned yet with numbers and figures.

Conflicts of interest

The author(s) declare that they do not have any conflicts of interest.

Acknowledgement

We are thankful to the field inspector crew of SVLFG, which assisted the survey and promoted it in practice. Moreover, we are thankful to BVL and SVLFG who are financing the project.

References

BVL, 2017: Persönliche Schutzausrüstung beim Umgang mit Pflanzenschutzmitteln – Richtlinie für die Anforderungen an die persönliche Schutzausrüstung im Pflanzenschutz. Bundesamt für Lebensmittelsicherheit und Verbraucherschutz.

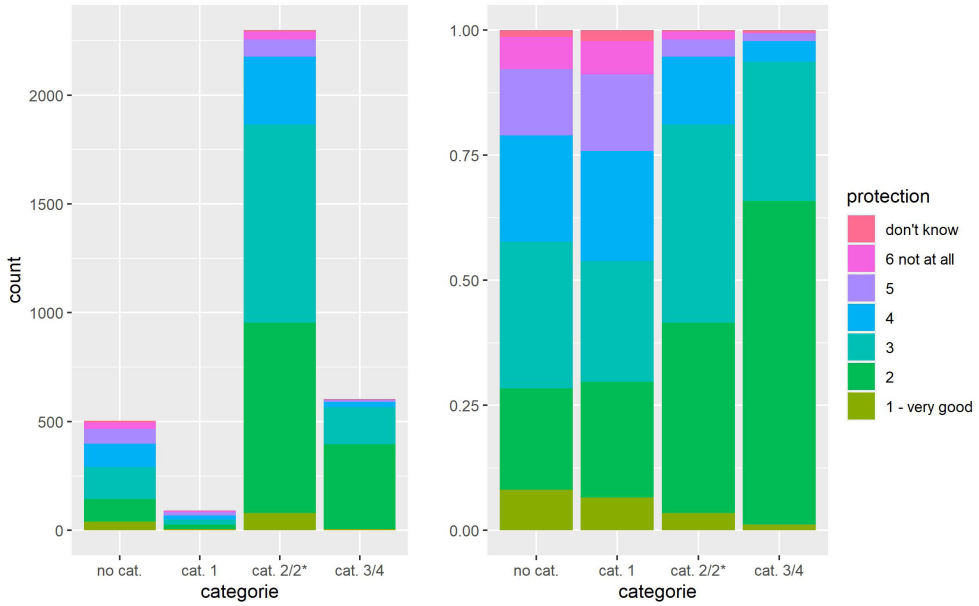

Fig. 6. Individual perception of the protection level in dependency of cabin category used (n = 3,496).

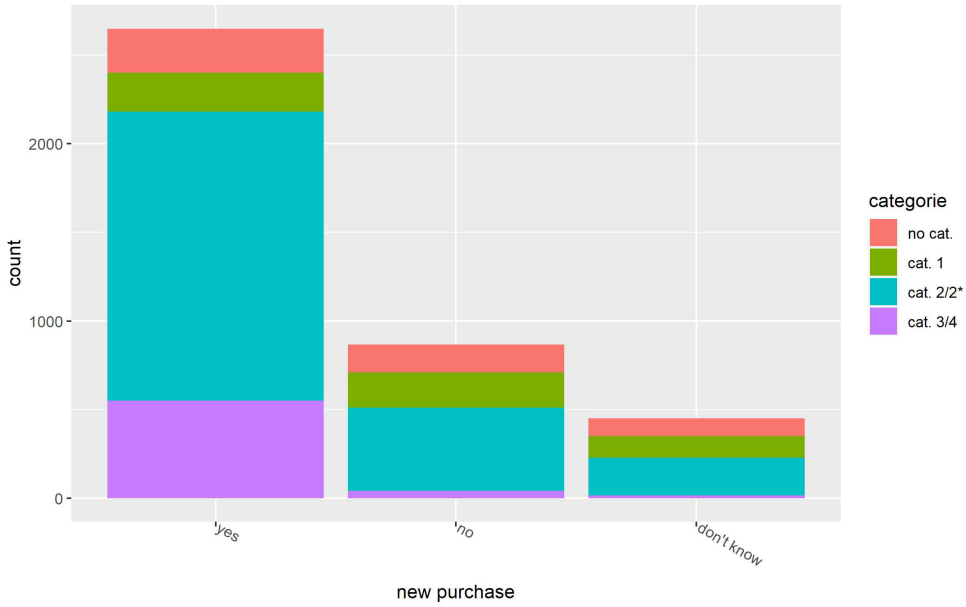

Fig. 7. Share of interviewees considering cabin category as an important criterion for new purchase (n = 3,521).

Table 5. Participants of the survey giving away the job of plant protection to a third party (e.g. machinery contractor) sorted by type of agricultural business (n = 166)

Agricultural business from survey	Total
Crop cultivation	72
Crop cultivation/animal farming	86
Viticulture	9
Orcharding	1
Special crops	1
Others	10
Total	**179**[a]

[a] Multiple answers were possible.

BVL, 2020: Fachmeldung: Einsatz von dicht schließenden Fahrerkabinen mit Luftfiltration im Pflanzenschutz. Internet (accessed 10.03.2022): https://www.bvl.bund.de/SharedDocs/Fachmeldungen/04_pflanzenschutzmittel/2020/2020_01_08_Fa_Fahrzeugkabinen_Schutzausruestung.html

BVL, 2021: BVL-Kabinen-Register Version 2022.01, May 2022 (accessed 01.06.2022) https://www.bvl.bund.de/SharedDocs/Downloads/04_Pflanzenschutzmittel/BVL-PSA-Kabinen-Register.html?nn=11010638

Destatis, 2017: Betriebe und deren Flächen mit Baumobstanbau 2012 und 2017. Internet (accessed 10.03.2022): https://www.destatis.de/DE/Themen/Branchen-Unternehmen/Landwirtschaft-Forstwirtschaft-Fischerei/Obst-Gemuese-Gartenbau/Tabellen/baumobstanbauerhebung.html;jsessionid=FCB710C8D3E1EEAFE2649B906FA34CE9.live722

Destatis, 2020a: Landwirtschaftliche Betriebe insgesamt und Betriebe mit ökologischem Landbau nach Bundesländern 2020. Totale Ergebnisse der Landwirtschaftszählung 2020. Internet (accessed 10.03.2022): https://www.destatis.de/DE/Themen/Branchen-Unternehmen/Landwirtschaft-Forstwirtschaft-Fischerei/Landwirtschaftliche-Betriebe/Tabellen/oekologischer-landbau-bundeslaender.html

Destatis, 2020b: Betriebsgrößenstruktur landwirtschaftlicher Betriebe nach Bundesländern. Internet (accessed 10.03.2022): https://www.destatis.de/DE/Themen/Branchen-Unternehmen/Landwirtschaft-Forstwirtschaft-Fischerei/Landwirtschaftliche-Betriebe/Tabellen/betriebsgroessenstruktur-landwirtschaftliche-betriebe.html

Destatis, 2021a: Land- und Forstwirtschaft, Fischerei – Betriebswirtschaftliche Ausrichtung und Standardoutput Landwirtschaftszählung 2020. Statistisches Bundesamt, Fachserie 3, Reihe 2.1.4., 108 pages.

Destatis, 2021b: Landwirtschaftliche Betriebe mit Rebfläche 2020, 2016 und 2010 nach landwirtschaftlich genutzter Fläche (LF) und Rebfläche sowie nach Größenklassen der Rebfläche. Internet (accessed 10.03.2022): https://www.destatis.de/DE/Themen/Branchen-Unternehmen/Landwirtschaft-Forstwirtschaft-Fischerei/Wein/Tabellen/betriebe-rebflaechen-qualitaetsweinanbau-groessenklassen.html

Dirksmeyer, W., H. Garming, K. Klockgether, 2017: Chancen durch Vielfalt. Agrarmanager **1**, 10-13.

DIN EN 15695-1, 2018: Agricultural tractors and self-propelled sprayers – Protection of the operator (driver) against hazardous substances – Part 1: Cab classification, requirements and test procedures. 33 pages.

DIN EN 15695-2, 2018: Agricultural tractors and self-propelled sprayers – Protection of the operator (driver) against hazardous substances – Part 2: Filters, requirements and test procedures. 12 Pages.

SVLFG (Sozialversicherung der Landwirtschaft, Forst und Gartenbau), 2021: Traktoren im Pflanzenschutz – Umfrage läuft noch bis zum 1. Mai. LSV Kompakt Ausgabe 01/2021, S.11.