

Opportunities to reduce fatal injuries in Swedish agriculture using a prevention program

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Abstract

Agriculture is one of the most dangerous sectors from a global point of view. This is also the situation in Sweden with many fatal and non-fatal injuries. The objective of this paper is an approach to make an overall evaluation of a national injury prevention intervention program (2009–2013). To reach the goal, the development of occupational fatalities in Swedish agriculture was examined during 15 years, 5 years before an intervention program, during the intervention program, and the five years after the intervention. Both official statistics, as well as unofficial statistics based on paper-clippings are used in this article.

The overall results showed a decrease of the fatalities with about 45% during the 5 years of the intervention according to official statistics, but the effect was almost gone during the 5 years after. When adding the information from paper clippings a broader picture of agricultural fatalities is shown, including children, visitors, non-occupational incidents as well. In this article, suggestions are discussed as the importance of long-term interventions, possibilities of a digitalized OHS for farmers, international collaborations, and the value of the Vision Zero created by the International Section of the ISSA on Prevention in Agriculture.

Keywords: intervention, ISSA, prevention, statistics, Sweden, injuries, Vision Zero, fatalities.

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Introduction

Working in agriculture is associated with a number of hazards and risk factors and is quite different compared with other industries¹. Injuries, both fatal and non-fatal injuries are a large problem within the agricultural sector, and being a farmer is worldwide considered one of the most dangerous jobs². Over the last 10 years, there has been an average of over 500 registered deaths per year in the agriculture and forestry sector and over 150,000 non-fatal accidents in Europe³. This problematic situation is also true for Sweden with agriculture having the highest number of work-related fatalities together with the construction industry and the transport sector⁴. Another problem is that in Sweden we have seen a low reporting rate of work-related injuries in agriculture. Swedish studies showed that less than 10 percent of non-fatal occupational injuries were reported to the authorities⁵. Sweden has legislation demanding ROPS⁶ on tractors for more than 60 years. Still, there are injuries and fatalities due to major sources such as tractors, farm machinery, animal handling, falls and other events where the victim was crushed, caught, or stuck in one way or another when dealing with large and heavy objects, such as big bales, trees or machines⁷.

Different approaches have been used worldwide to reduce the number of injuries and fatalities in agriculture through different interventions such as engineering

1. The problems regarding fatal and non-fatal occupational injuries further described and discussed by others such as ILO, *Safety and health in agriculture*. Report VI (1), International Labour Organisation Conference, 88th Session 2000, International Labour Office Geneva, 1999 and P. Lundqvist, *Ökad säkerhet inom jordbruket genom interventioner och andra strategier – kunskapssammanställning*, Report RAP 2012, 15, The Swedish Work Environment Authority, Stockholm.
2. The total context of health and safety in agriculture is described with a global perspective in a textbook: K.J. Donham, A. Thelin, *Agricultural medicine: Rural occupational and environmental health, safety, and prevention*, 2nd ed., Hoboken, NJ, John Wiley & Sons, 2016.
3. Eurostat is the overall responsible authority on EU level for providing statistics regarding occupational injuries and diseases.
4. The Swedish Work Environment Authority has published an overview of occupational fatalities within all major industries, J. Björnstig, U. Björnstig, B. Järvholm, *Dödsolyckor i arbetslivet*, Delrapport 1, Kunskapssammanställning 2016, 9, Arbetsmiljöverket, Stockholm, 2016.
5. A number of studies has shown the low reporting rate regarding occupational injuries among farmers: S. Pinzke, P. Lundqvist, *Occupational accidents in Swedish agriculture*, "Journal of Agricultural Engineering Research" 2007, No. 13, p. 159–165; S. Pinzke, C. AlwallSvennefelt, P. Lundqvist, *Occupational injuries in Swedish agriculture: Development and preventive actions*, "Journal of Agricultural Safety and Health" 2018, Vol. 23(4), p. 355–373, <https://doi.org/10.13031/jash.12816>, access 18.10.2021.
6. Roll-over protection.
7. Despite a long history of health & safety legislation is there still major issues regarding injuries in agriculture as described by P. Lundqvist, *Ökad säkerhet inom jordbruket genom interventioner och andra strategier – kunskapssammanställning*, Report RAP 2012, 15, The Swedish Work Environment Authority, Stockholm. Lundqvist, 2012.

solutions, enforcement through rules and legislation as well as different types of education-based programs according to the principles presented by Haddon⁸. During the Nordic Meeting on Agricultural Occupational Safety and Health (2006), it was established a “Kuopio-declaration” with a zero-vision for occupational fatalities in Nordic agriculture by the year 2012⁹. This was a starting point for a process where Sweden initiated a major national education-based intervention program funded by the Government and the Swedish part of the EU Rural Development Program during the time period 2009–2013. About 160 part-time supervisors, all with some knowledge about farming and the agricultural sector, were initially educated and trained during the year before the start. The program called “Safe Farmers Common Sense” with a farmer perspective and organized activities such as short courses, individual farm visits by supervisors, open farm activities plus a lot of media attention. During the same time, other stakeholders such as the Swedish Work Environment Authority, the farm employer organization, and the farmworkers union added a number of other activities also to prevent farming injuries¹⁰. Evaluating the outcome of intervention programs regarding injury prevention in agriculture is quite difficult¹¹. As described earlier the number of injuries is reported to a low extent in Swedish agriculture and it was not possible to show any relevant decrease of reported injuries during or after the intervention program. It was also pointed out that farmers may increase their willingness to report injuries during an intervention, which makes it even harder to draw any major conclusions of the impact. The statistics regarding occupational fatalities is often more reliable compared to non-fatal injuries¹².

8. Haddons principles, such as the 3 E; Engineering, Enforcement and Education has been the classical reference point regarding prevention of injuries.
9. The Kuopio declaration has been the real inspiration document for stakeholders in the Nordic countries to develop and implement intervention programs as described by P. Lundqvist, *Ökad säkerhet inom jordbruket genom interventioner och andra strategier – kunskapssammanställning*, Report RAP 2012, 15, The Swedish Work Environment Authority, Stockholm.
10. The intervention program further described by Lundqvist & Alwall Svennefelt, 2012; C. Alwall Svennefelt, P. Lundqvist, *Safe Farmer Common Sense’ – A National Five-Year Education-Based Program for Prevention of Occupational Injuries in Swedish Agriculture-Background, Process, and Evaluation*, “Journal of Agromedicine” 2020, Vol. 25(2), p. 221–230, <https://10.1080/1059924X.2019.1659203>, access 18.10.2021.
11. L. DeRoo, R.H. Rautiainen made comprehensive studies in order to evaluate the outcome of a large number of intervention program: L. DeRoo, R.H. Rautiainen, *A systematic review of farm safety interventions*, “American Journal of Preventive Medicine” 2000, Vol. 18, Issue 4, Supplement 1, p. 51–62, [https://doi.org/10.1016/S0749-3797\(00\)00141-0](https://doi.org/10.1016/S0749-3797(00)00141-0), access 18.10.2021.
12. The challenges regarding the reporting rates of injuries is further discussed by: S. Pinzke, C. Alwall Svennefelt, P. Lundqvist, *Occupational injuries in Swedish agriculture: Development and preventive actions*, “Journal of Agricultural Safety and Health” 2018, Vol. 23(4), p. 355–373, <https://doi.org/10.13031/jash.12816>, access 18.10.2021 and K.J. Donham, A. Thelin, *Agricultural medicine: Rural occupational and environmental health, safety and prevention*, 2nd ed., Hoboken, NJ, John Wiley & Sons, 2016.

The present study aimed to make an overall broad evaluation of the Swedish national intervention program to reduce injuries in agriculture during the period 2009–2013. To achieve the goal official statistics were used together with unofficial statistics based on paper clippings.

Method

The Swedish Work Environment Authority (SWEA) is responsible for the official statistics regarding occupational injuries (fatal and non-fatal) and diseases in Sweden. To make an overall evaluation of the 5-year intervention program and its possible impact on occupational fatalities in Swedish agriculture, we studied a period of 15 years, including 5 years before and 5 years after the intervention. Children under the age of 18 years are not included in the Swedish official statistics. To get a broader view of fatalities in the farming environment, informal statistics collected from paper-clippings by the Federation of Swedish Farmers (LRF) were also included for this study period 2004–2018.

Results

The results of the official statistics regarding occupational fatalities showed that for the 15 years period (2004–2018) there were 150 fatalities within Swedish agriculture and forestry, 95 in agriculture, and 55 in forestry, Table 1. The 5 years (2004–2008) before the intervention had a mean of almost 8 fatalities in agriculture per year. During the intervention period, the 5-years 2009–2013, the numbers decreased to a mean figure of 4 fatalities per year and even reached zero fatalities in the year 2013, which was the first time according to official statistics from SWEA. The intervention program ended that year and most other stakeholders also ended or decreased their activities to promote injury prevention as well. In the following 5-year period (2014–2018) the numbers increased again as shown in table 1 to a mean of 7 fatalities per year. Regarding the occupational fatalities in forestry, there has been continued development of decreasing numbers of fatalities – also after the intervention ended. Many farmers in Sweden have a combination of agriculture and forestry within their farm activities. The intervention had a focus on agriculture, but it seemed to have an impact on the forestry work as well.

Table 1. Occupational fatalities in Swedish agriculture and forestry 2004–2018*

Year	Fatalities Agriculture	Fatalities Forestry	Total no of fatalities	Mean no of fatalities during 5 years Agriculture / Forestry / Total
2004	8	1	9	
2005	10	6	16	
2006	7	2	9	7.8 / 5.2 / 13
2007	7	11	18	
2008	7	6	13	
2009	6	1	7	
2010	3	4	7	
2011	10	3	13	4.0 / 3.6 / 7.6
2012	1	6	7	
2013	0	4	4	
2014	7	2	9	
2015	6	1	7	
2016	6	0	6	7.2 / 2.2 / 9.4
2017	7	5	12	
2018	10	3	13	
Total (Mean)	95 (6.33)	55 (3.66)	150 (10)	

* With reservation for misinterpretation of basic data.

Source: Swedish Work Environment Authority, 2019

To search for possible differences regarding age or source of injury among those performing agricultural work, there was an overall review of the fatalities, Table 2. The results showed that the major incidents during the years 2004–2018 were different types of events where the victim was crushed, caught, or stuck in one way or another when dealing with large and heavy objects, such as big bales, trees, or machines. Still, there were reports of fatalities with tractors, despite ROPS on almost all farm tractors in Sweden. Animal handling was also a problem when handling large bulls, horses, and dairy cattle. Falls were not a major problem, but still falling from higher levels was the reason for some fatalities. However, no real changes in the pattern of occupational fatalities in agriculture were found during this 15-year period.

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Table 2. Fatal injuries in Swedish agriculture 2004–2018*

Year	Age (Mean)	Source of injury:						Total
		tractors	animals	falls	machines & objects	others	missing	
2004	54	2	2	3	1	0	0	8
2005	55	1	2	1	6	0	0	10
2006	54	0	1	2	4	0	0	7
2007	59	3	1	0	3	0	0	7
2008	49	3	1	0	3	0	0	7
2009	56	4	1	0	1	0	0	6
2010	40	1	2	0	0	0	0	3
2011	63	4	1	1	4	0	0	10
2012	57	0	1	0	0	0	0	1
2013	-	0	0	0	0	0	0	0
2014	50	1	2	1	3	0	0	7
2015	63	1	1	0	2	2	0	6
2016	51	3	0	0	2	1	0	6
2017	58	2	1	0	4	0	0	7
2018	57	3	0	1	4	1	1	10
Total		28	16	9	37	4	1	95

*With reservation for misinterpretation of basic data.

Source: Swedish Work Environment Authority, 2019.

When using the informal statistics collected by LRF (2004–2018) from paper clippings it gives a broader view of fatalities in the farming environment, which includes children (<18 years), visitors, and non-occupational accidents, Table 3.

Table 3. Occupational and non-occupational fatalities in Swedish agriculture and forestry 2004–2018*

Year	Fatalities					Total no	Female	Mean no of fatalities during 5 years
	agriculture	forestry	non-occup.	children < 16 yrs	visitors			
2004	10	2	2	0	0	14	0	
2005	5	15	0	1	0	21	3	
2006	9	4	3	4	0	20	2	17.8
2007	8	11	0	1	0	20	1	
2008	7	5	1	0	1	14	0	
2009	3	4	0	4	0	11	1	
2010	7	6	2	2	0	17	0	
2011	9	5	3	3	0	20	3	14.4
2012	3	10	0	0	0	13	0	
2013	0	9	1	1	0	11	1	
2014	7	5	9	5	2	28	4	
2015	7	2	2	3	0	14	1	
2016	7	1	5	0	2	15	0	20
2017	7	6	6	1	2	22	3	
2018	10	3	7	1	0	21	3	
Total (Mean)	99 (6.6)	87 (5.8)	42 (2.8)	26 (1.7)	7 (0.5)	261 (17.4)	22 (1.5)	

* With reservation for misinterpretation of basic data.

Source: *The Federation of Swedish Farmers, 2004–2018.*

It also illustrates that females are among the victims as well, but to a low extent, and that the whole life situation is integrated because there is no clear boundary between work and leisure time. A Swedish farm is often a combination of agricultural and forestry production and a farm family spends a major part of their whole life in this integrated rural life situation, which also includes traveling with tractors, ATVs, and other vehicles between farm properties of their own or their neighbors. When comparing the total numbers of fatalities and the mean numbers for the five-year periods, there is also a decline during the intervention period (2009–2013), but to a lower extent than was shown in the official statistics. The paper clippings show in total 261 fatal injuries over these 15 years compared with the 150 shown in official statistics. In a broader perspective is it the same type of injuries that are

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most common, (Table 2 and Table 4), but adding 26 fatalities involving children and 42 non-occupational as well as other fatalities to the whole picture of Swedish farming.

Table 4. Fatal injuries in Swedish agriculture & forestry 2004–2018*

Year	Age (Mean)	Source of injury:						Total
		tractors & machinery	animals	falls	trees & forestry	traffic	others	
2004	61	3	2	2	4	3	0	14
2005	54	1	3	1	15	0	1	21
2006	47	10	1	2	6	1	0	20
2007	51	5	1	1	11	1	1	20
2008	53	6	1	0	6	0	1	14
2009	37	5	1	0	4	0	1	11
2010	48	4	2	2	6	1	2	17
2011	52	7	2	2	5	2	2	20
2012	61	2	1	0	10	0	0	13
2013	55	0	1	0	9	1	0	11
2014	48	11	2	1	7	6	1	28
2015	54	4	1	0	3	1	5	14
2016	54	6	2	0	2	3	2	15
2017	55	5	1	1	6	6	3	22
2018	53	10	0	1	5	4	1	21
Total (Mean)		79 (5.3)	21 (1.4)	13 (0.9)	99 (6.6)	29 (1.9)	20 (1.3)	261

* With reservation for misinterpretation of basic data.

Source: *The Federation of Swedish Farmers, 2004–2018.*

Conclusions and recommendations

There have been few studies with a focus on occupational fatalities in Swedish agriculture. Thelin concluded in 2002 that the number of fatalities occurring at work was decreasing in Sweden and many other countries, but not within Swedish farming and forestry operations. The present study confirms that little progress has been achieved since his statement – agriculture is still a dangerous occupation and other recent studies confirm the same situation in other parts of the world¹³.

The numbers of occupational fatalities in Swedish agriculture as presented in this study are quite small, but still indicate the development in relation to an intervention program. It shows quite a large fluctuation between individual years in the official statistics, but when counting the mean for the five-year periods it gives an interesting signal that the number of occupational fatalities decreased from a mean figure of about 7 to 4 (45 %) each year during the five year intervention period. This might have been a matter of coincidents, but still, it might have saved 15 person lives, compared to the earlier period. Evaluation of education-based intervention has been seen as difficult and there have been few good examples, which also indicate that we should be careful with any conclusions¹⁴.

The present study is an illustration of how the numbers of fatalities differ by the use of official statistics or paper-clippings and shows that agriculture is a difficult sector to cover with reliable statistics¹⁵. Another Swedish study¹⁶ concluded that non-fatal

13. The fatal injury statistics 2002 as problematic were discussed by: A. Thelin, *Fatal accidents in Swedish farming and forestry 1988–1997*, "Safety Science" 2002, No. 40, p. 501–517; Y-H. Cheng, W.E. Field, R. Tormoehlen et al., *2016 Indiana Farm Fatality Summary with Historical Comparisons*, "Journal of Agricultural Safety and Health", No. 26(3), p. 105–119, doi: 10.13031/jash.13635 @2020, access 18.10.2021; E. Scott, D.B. Dalton, *Agricultural Fatalities in New York State from 2009–2018: Trends from the past Decade Gathered from Media Reports*, "Journal of Agromedicine" 2021, Vol. 26(2), p. 132–139, doi: 10.1080/1059924X.2020.1720883, access 18.10.2021.
14. The problems regarding evaluations of education-based interventions were discussed by: L. DeRoo, R.H. Rautiainen, *A systematic review of farm safety interventions*, "American Journal of Preventive Medicine" 2000, Vol. 18, Issue 4, Supplement 1, p. 51–62, [https://doi.org/10.1016/S0749-3797\(00\)00141-0](https://doi.org/10.1016/S0749-3797(00)00141-0), access 18.10.2021.
15. Paper clippings is often a used source in USA in order to collect injury data from agriculture, but is not that often used in Europe. See: D.J. Murphy, B.L. Seltzer, C.E. Yesalis, *Comparison of two methodologies to measure agricultural occupational fatalities*, "American journal of public health" 1990, Vol. 80(2), p. 198–200; B. Weichelt, M. Salzwedel, S. Heiberger et al., *Establishing a publicly available national database of US news articles reporting agriculture-related injuries and fatalities*, "American journal of industrial medicine" 2018, Vol. 61(8), p. 667–674.
16. Researchers worked together with Statistics Sweden to collect data in two major surveys 2004 and 2013 regarding injuries in agriculture, since Official statistics was lacking sufficient reports from this sector. See: S. Pinzke, C. Alwall Svennefelt, P. Lundqvist, *Occupational injuries in Swedish agriculture: Development and preventive actions*, "Journal of Agricultural Safety and Health" 2018, Vol. 23(4), p. 355–373, <https://doi.org/10.13031/jash.12816>, access 18.10.2021.

injuries on farms decreased by about 12% in 2013, compared to a corresponding study in 2004. But they also pointed out that taking into account the reduced labor demand in agriculture and the decline in the number of farms since 2004, they found that the rate of injury has not reduced. Other studies and reports have also discussed the problem on an EU level, which makes it difficult to compare the fatality rates between countries¹⁷.

This minor study may also indicate that agriculture, dominated by family farms is an industry that might need constant attention from outside stakeholders to support and motivate farmers to work more safely and to work with measures to prevent injuries on their farms. How could we support the family farms to keep them a safe workplace and a safe home? A major education-based intervention program might be one way to go, but probably needs to be organized for a long time, 5 years is not enough, but it might also be too expensive. In Sweden, we used to have a national occupational health service (OHS) which was available all over the country and liked by the farmer, but when financial support was ended by the government, when Sweden joined the European Union (1995) it did not survive. Maybe we find new ways when using digitalization. Today most farmers have access to smartphones, and maybe it could be possible to reach the individual farmer with a digitalized OHS¹⁸. Through the smart-phone a safety engineer could have discussions about a solution for a safety issue with the farmer who could take a photo or a short movie of the actual problem. The same could be achieved, at least in parts regarding health issues, discussing with a nurse or a doctor and mental issues might be more accessible for a farmer if mental health support may be given through a serious video-chat with the rural mental health provider. In times of deficient resources and less competition within agricultural health & safety advisory services, this might be one way to go.

We need to be more creative and we need to develop further collaborations, both on a national and an international level to reach a zero-vision for fatalities

17. Further discussed by: A. Jones, M. Jakob, J. McNamara, *Review of the future of agriculture and occupational safety and health (OSH). Foresight on new and emerging risks in OSH*, European Agency for Safety and Health at Work. European Risk Observatory. Report, Bilbao, Spain, 2020, <https://doi.org/10.2802/769257>, access 18.10.2021; M. Jakob, D. Santa, K.A. Holte et al., *Occupational health and safety in agriculture – a brief report on organization, legislation and support in selected European countries*, “Annals of Agricultural Environmental Medicine” 2021, Vol. 28(3), p. 452–457, <https://doi.org/10.26444/aaem/140197>, access 18.10.2021.

18. Development of the earlier OHS in Swedish agriculture, discussed by: S. Höglund, *Occupational Health Service for Farmers in Sweden*, “Journal of Occupational Medicine” 1989, Vol. 31(9), p. 767–770 and P. Lundqvist, *Ökad säkerhet inom jordbruket genom interventioner och andra strategier – kunskapssammanställning*, Report RAP 2012, 15, The Swedish Work Environment Authority, Stockholm and future possibilities by: C. Alwall Svennefelt, P. Lundqvist, *Safe Farmer Common Sense’ – A National Five-Year Education-Based Program for Prevention of Occupational Injuries in Swedish Agriculture-Background, Process, and Evaluation*, “Journal of Agromedicine” 2020, Vol. 25(2), p. 221–230, <https://10.1080/1059924X.2019.1659203>, access 18.10.2021.

within agriculture as indicated in the Vision Zero Strategy for Agriculture developed by International Section of the ISSA on Prevention in Agriculture¹⁹.

Another important way to improve health & safety in agriculture is trying to influence the politicians within the European Union as initiated by the European network Sacurima COST Action²⁰. The policy recommendations they presented: 1) integrate Occupational Safety and Health (OSH) into current and future agricultural policies, 2) establish a European Network for agriculture safety and health, 3) allocate specific funding for Agriculture OSH research in Horizon 2020/Horizon Europe, 4) develop and implement OSH education and skills programs for farmers and workers in the agriculture sector and 5) improve statistics to reflect the true levels of agricultural workplace fatal and non-fatal injury and ill health.

A farm is not only a professional workplace for men and women from 18 to 65 years of age, it is also the home for a family, often with children, and it is also the home and the work-place for older farmers and older family members. Working in agriculture also means that you should be able to cope with different types of weather over the seasons which is getting worse due to climate change. As a farmer you should have a lot of skills and abilities when working with and operating all kinds of machines, handling of large animals and solving a never ending of small and large tasks. Most farms are struggling with economic challenges which makes them solve many of the work tasks with the lack of resources and maybe also lack of competence and skills, which might include not enough workers or not the right type of machinery or the right tool. During intensive work periods it also could include long working days, lack of sleep and not enough breaks with food and water. These problems are well-known, like also that stress and lack of sleep is increasing the risk of injuries at work. With these important factors in mind it is obvious that to make a major reduction of the high levels of fatal and non-fatal occupational and non-occupational injuries in farming a broad perspective of measures needs to be implemented, by all relevant stakeholders with the farmer, farm family and farm workers in focus.

19. The importance of a zero-vision for injuries and the need for international collaboration show: ISSA Agriculture, *International Section of the International Social Security Association on Prevention in Agriculture. Vision Zero in the agricultural sector 2019*, <http://visionzero.global/vision-zero-agricultural-sector>, access 18.10.2021 and P. Lundqvist, R. Franklin, J. Shutske et al., *About Time to Join Forces within Agricultural Health & Safety!?*, "Journal of Agromedicine" 2021, Vol. 26(2), <https://doi.org/10.1080/1059924X.2021.1893879>, access 18.10.2021.

20. The European network Sacurima COST Action was established to develop further collaboration to prevent injuries in the agricultural sector, as described on the web-page: www.sacurima.eu and by J. Leppälä, P. Griffin, J. McNamara et al., *Safety Culture and Risk Management in Agriculture: Sacurima Cost Action CA16123. Highlights and Conclusions*, "Natural resources and bioeconomy studies" 2021, No. 63, Natural Resources Institute Finland, Helsinki, 2021, <https://jukuri.luke.fi/handle/10024/547926>, access 18.10.2021.

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