Occupational accidents in Swedish agriculture

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Received 13 June 2007; accepted 7 September 2007

Abstract - Kurzfassung

The Swedish University of Agricultural Sciences in co-operation with Statistics Sweden carried out a comprehensive survey of accidents in Swedish farming and forestry that occurred in 2004. The aim was to get in-depth knowledge about the origin and extent of the accidents and also to obtain information as a basis for the planning of preventive measures in agriculture. The study was financed by the Swedish Farmers' Foundation for Agricultural Research. In 2004, there were about 67,000 farms with agricultural operations in Sweden. 7,000 questionnaires with 14 questions were sent out to a sample of the pure agricultural farms and combined agricultural/forestry farms. The most important question was whether any accidents had occurred at the farms during 2004. Those farms that reported accidents were thereafter contacted by telephone with additional questions about the respective accident. A total of 5,646 farms (81 %) answered the questionnaires. About 5,000 accidents occurred on agricultural farms in 2004 that resulted in bodily injuries and constituted obstacles at work (about 74 % accidents on pure agricultural farms and 18 % on agricultural farms with forestry). According to official statistics there were only about 400 registered accidents. This means that only 8 % of the reported accidents found in this study emerge in the official statistics of occupational injuries. In all, at least one accident occurred on about 7 % of all farms practicing agriculture. About 70 % of the affected farms had animal production and 15 % of all farms with milk production had one or more accidents during 2004. In order to reduce the number of accidents in agriculture it is important to take effective measures.

Keywords: Work accidents, injuries, farming, forestry, questionnaire, Sweden

Arbeitsunfälle in der schwedischen Landwirtschaft

An der schwedischen landwirtschaftlichen Fakultät wurde in Zusammenarbeit mit Statistics Sweden eine Untersuchung aller Unfälle im Bereich der schwedischen Land- und Forstwirtschaft des Jahres 2004 durchgeführt. Das Ziel war es, weitergehende Kenntnisse über Unfallursache und –ausmaß zu erhalten, um eine Grundlage für Präventivmaßnahmen in der Landwirtschaft zu schaffen. Die Untersuchung wurde durch die Swedish Farmers' Foundation for Agricultural Research finanziert. Im Jahr 2004 gab es in Schweden 67.000 Landwirtschaftsbetriebe. 7.000 Fragebögen mit jeweils 14 Fragen wurden an eine Auswahl reiner Landwirtschaftsbetriebe und land- und forstwirtschaftliche Mischbetriebe versandt. Die Hauptfrage war, ob sich irgendein Unfall im Jahr 2004 im Betrieb ereignet hatte. Die Betriebe, die Unfälle meldeten, wurden daraufhin telefonisch über Einzelheiten des Unfalls befragt. Der Rücklauf an beantworteten Fragebögen lag bei 5.646 (81 %). Etwa 5.000 Unfälle mit Körperverletzung und Arbeitsbehinderung ereigneten sich 2004 in landwirtschaftlichen Betrieben. Davon waren etwa 74 % reinen Landwirtschaftsbetrieben und 18 % land- und forstwirtschaftlichen Mischbetrieben zuzuordnen. In der offiziellen Unfallstatistik waren dagegen nur etwa 400 Unfälle verzeichnet. Das heißt, dass nur 8 % der Körperverletzungen registriert worden waren. Insgesamt ereignete sich mindestens ein Unfall bei 7 % aller landwirtschaftlichen Betriebe. Etwa 70 % der betroffenen Betriebe sind der Tierproduktion zuzuordnen. 15 % aller Milchproduktionsanlagen wiesen 2004 mindestens einen Unfall auf. Zur Reduzierung der Unfallzahlen in der Landwirtschaft müssen wirksame Maßnahmen umgesetzt werden.

Schlüsselwörter: Arbeitsunfall, Verletzungen, Land- und Forstwirtschaft, Umfrage, Schweden

1 Introduction

Agriculture consistently ranks as one of the highest injury risk industry sectors. Death rates for agriculture in North America as well as the 15 countries of the European Union are consistently several times higher than the average rate for all industries combined. For this reason, agriculture is often described as one of the most hazardous industries in which to work (Donham & Thelin 2006). According to Bulat et al. (2006) about 170,000 agriculture workers die worldwide every year as a consequence of occupational injuries, the majority of them in developing countries. The European Commission (Paoli 1992) has concluded that agriculture is among the three most dangerous sectors. Another study compared the injury rates between the United States, Australia and New Zealand (Feyer et al. 2001). Among the findings it was pointed out that in each country, male workers, older workers, and those work-

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ing in agriculture, forestry and fishing, in mining and in construction, were consistently at higher risk.

The number of reported accidents in agriculture in Sweden is 2-3 times higher than for example in the construction industry or in the transport sector which are the sectors following the agriculture regarding the number of accidents, relatively speaking (Swedish Board of Agriculture 2007).

1,017 occupational accidents (thereof 20 fatal accidents) were reported in the industry of agriculture, hunting, forestry and fishing at the year 1996. The corresponding numbers for the year 2006 were 444 and 10, respectively (Statistics Sweden 1996-2006). When taken the number of employed into account there is a decrease in the trend of the accidents that caused injuries as well as fatal accidents during the same time period (Fig. 1). The decrease is more pronounced for the agriculture sector compared to all occupations in Sweden. However, the fatal accidents in agriculture still today are on a very high level, 12.8 accidents per 100,000 employed, compared to 1.6 for all occupations in Sweden.

Information about work injuries is important to compile for identifying problems in the work environment and for the preventive work with the occupational health and safety issues. The information gives perspective on problems in the work environment and possibilities to evaluate the importance of them. By comparing the frequency and extent of injuries caused by different work environment problems it is possible to get an understanding of the problems that are most and least, respectively serious (Statistics Sweden 2003).

Farmers, like other self-employed, shall in the same way as employees report occupational accidents and diseases to the Social Insurance Agency. Such a report is also a condition for the Official Statistics on occupational accidents and work-related diseases for different occupations and branches to be correct and to could be used as a base for different forms of preventive measures. It is well known that a self-employed do not have the same propensity as employees to report accidents and injuries that have occurred.This has clearly been shown by Jansson (1988) and confirmed by others (Takala 1999, Donham & Thelin 2006). There are several reasons for that. The self-employed often have longer waiting periods of days during which time he will not get any sickness benefit. He often does not have the possibility to report himself sick. Despite illness and injuries he still has to take care of his business etc. Viewed in the light of these circumstances a survey of 20,000 farmers and forestry workers was performed concerning accidents occurred in Swedish farming and forestry in 1987 (Hansson et al. 1987). The study showed that the real number of accidents occurred was about twice as high as reported accidents.

During the last decade the intensive rationalization and structural changes of the Swedish farming and forestry has accelerated. The number of farms and forest companies has drastic decreased at the same time as the remaining companies becoming larger and larger. The mean size of the agricultural land as well as the herd sizes has increased. This change in the Swedish agriculture means big changes for the individual farmer and forestry worker. The working pace tends to increase and the machine equipment is becoming more and more technically complicated and costly. This process probably results in changed patterns concerning the work situation and the individual's exposure to risk factors that can lead to accidents and injuries.

Viewed in the light of the described process of changes, which the Swedish farming and forestry undergo it is important to update the statistics of accidents partly to get knowledge about the real frequency of accidents to day and partly to obtain current information as a basis for the planning of preventive measures in agriculture. The aim with the previous study was to carry out a comprehensive survey of accidents

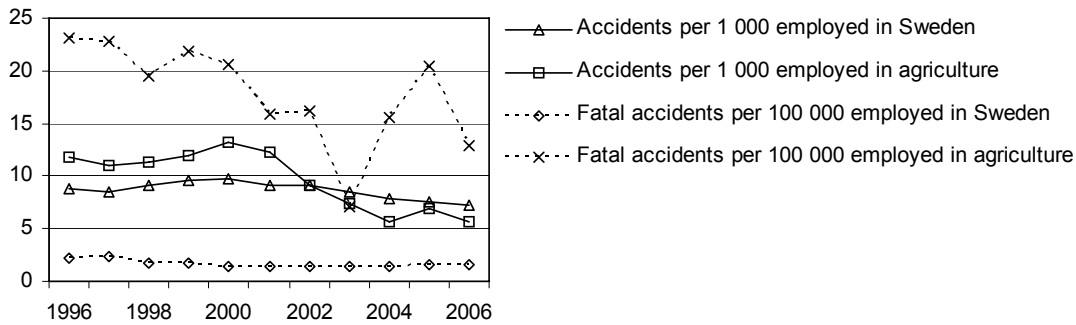

Fig. 1: Reported occupational accidents in Sweden and in the industry of agriculture, hunting, forestry and fishing, 1996-2006. Number of accident cases per 1,000 employed and fatal accidents per 100,000 employed (Statistics Sweden 1996-2006)

in Swedish farming and forestry that occurred in 2004 and in the same way as it was carried out 1987 with the objective to get deeper insight into the real situation of accidents, allowing further recommendations for action.

2 Materials and methods

The main study was carried out as a mail-in survey with two reminders and interviews by telephone with farms and companies, which reported accidents. For this, two quality tests were performed, one test for measurement errors and one test of non-response.

2.1 Sample volume

The survey population for the study comprised farms and enterprises in 2004 with at least 2 hectares of arable land, with large stocks of livestock, at least 50 cows or 250 cattle or 50 sows or 250 pigs or 50 ewes or 1,000 fowl, (regardless the size of arable land) and enterprises with horticultural production (outdoors cultivations of at least 0.3 hectares or enterprises with at least 200 m^2 greenhouse-area). A sample frame was formed, which demarcates, identifies and render possible links to the objects in the population. The sample frame for this study constituted by the Swedish Farm Register (LBR) 2003 (a register organized by the Swedish Board of Agriculture) that contains data about enterprises in agriculture and forestry as well as information about crops. The total number of enterprises in the frame finally becomes 67,061. From the sample frame a stratified sample of 7,000 farms and enterprises was drawn, which constituted the base for the mail questionnaire.

2.2 Questionnaire

The mail questionnaire constituted of a double-sided sheet with 14 questions. The most important question was if any accidents had occurred at the farms and enterprises during 2004. Accident was defined as a sudden occurrence, which resulted in an injury to the body and constituted obstacle at work. The accidents were reported by agricultural activities, e.g. farming, horticulture forestry work and other profitable activity directly connected to agriculture. The sheet for the telephone interviews consisted of ten additional questions on respective accident at the enterprise. Apart from the variables collected by the questionnaires a number of variables from the register LBR were obtained, such as labor requirement and type of farming.

The data collection period was performed from January to the end of May 2005. A total of 5,646 farms (81 %) answered the questionnaires after two reminders.

2.3 Weighting and estimation

Weights have been designed to enumerate the results from the sample level to population level. The weights in this study also compensate for unit non-responses and measurement errors while item non-responses were handled by imputations. Thus, the compilation of the results refer to the enumerate sample values to the whole population. All parameter estimations were given a so called mean error in percentage as a measure of the uncertainty of the results. Parameter estimations with a relative mean error greater than 35 % are considered with a high uncertainty and will in the result be denoted as not significant.

3 Results

The sample frame for the present study was about 67,000 farms with agriculture, combined agriculture/forestry farms, horticultural enterprises and other branches of business closely related to agriculture. Corresponding population of farms with agriculture and combined agriculture/forestry farms was in the study 1987 about 103,000 enterprises. The total number of accidents on agricultural farms and combined agriculture/forestry farms was in 1987 about 9,000 accidents. Enumerated, about 5,000 accidents occurred on agricultural farms in 2004, which resulted in body injuries and constituted obstacle at work. 74 % of the accidents occurred within farming, 18 % within forestry and 9 % within horticulture and other branches of business (Table 1). The number of accidents occurred in horticulture is uncertain but is with high probability below 100.

In all, at least one accident occurred on 7.5 % of farms with agriculture and of the combined agriculture/forestry farms in 2004 compared to the corresponding figure 8.7 % in 1987 (Fig. 2). The difference is not significant.

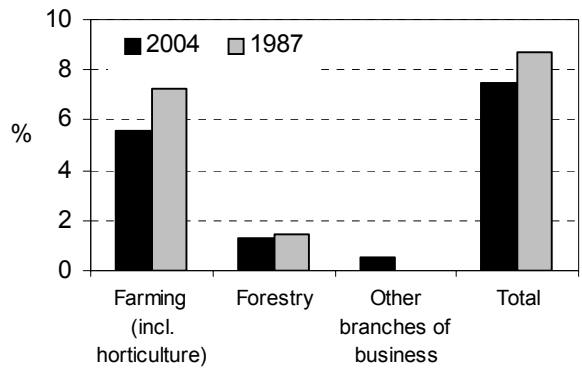

Fig. 2: Accidents occurred in different branches of business in relation to the total number of agricultural businesses, 1987 and 2004

Table 1: Number of accidents and percentage share (%) by different branches of business and number of enterprises with accidents and percentage share (%) by different branches in 2004. All values are given with mean errors

Branch	Number of accidents	%	Number of enterprises	%
Farming	3,711 ± 14	74 ± 4	3,357 ± 15	73 ± 4
Horticulture*	31 ± 37	1 ± 0	20 ± 44	0 ± 0
Forestry	891 ± 23	18 ± 4	756 ± 23	17 ± 4
Other branches of business	380 ± 27	8 ± 2	357 ± 28	8 ± 2
More than one branch			86 ± 34	2 ± 1
Total	**5,013 ± 11**	**100 ± 0**	**4,575 ± 12**	**100 ± 0**

* The uncertainty is high regarding the figures for the horticultural enterprises with a mean error greater than 35 %

The labor requirement in agriculture can be estimated in so called standard man-hours. For this study the work time with farming was estimated to 106 million standard man-hours. The corresponding value for 1987 was 150 million standard man-hours. The accident frequency per 1 million working hours was calculated to 47 in 2004 compared to 50 in 1987. The accident frequency is highest (not significant) for the small farm units with less than 400 working hours per year and the lowest accident frequency occurred on farms with crop husbandry. The highest frequencies of accidents per 1 million man-hours in 2004 were estimated to 87 and 66 in the classes 800–1600 and -800 working hours, respectively (Table 2). The corresponding values in 1987 were 47 and 67, respectively.

More than 70 % of the accidents occurred on farms with animal production (dairy cows, other animal production, combined crop and animal husbandry). Most of the accidents (more than 1,500) were on dairy farms. This means that 15 % of farms with milk production had one ore more accidents in 2004 (Table 3).

About 66 % of the accidents occurred in southern Sweden (Götaland). When taken labor requirement into account the highest number of accidents occurred in the middle of Sweden (Svealand), 53 accidents per million man-hours.

About 35 % of the work accidents occurred on agriculture and combined agriculture/forestry enterprises where the proprietor runs his own farm, 44 % of the accidents on farms with employees and 75 % of the accidents on farms where the activities have been the main type of work. The corresponding percentages for the pure agricultural farms were 32 % sole holdings, 50 % with employees and 81 % on farms where the activities have been the main work. On the farms with forestry 66 % of the accidents occurred on holdings were forest work was the main activity. The corresponding percentage for other branches of business close connected to agriculture was 36 %.

Men were suffering 84 % of all accidents. The percentage share of men by branch was 84 % in agriculture, 100 % in forestry and 45 % in other branches of business.

Above all it is the owner who was suffering (67 %) and 25 % other member of the family. Only 5 % of the accidents affected employee/work manager/substitute worker. For the pure agricultural farms the corresponding shares were 61 % owners, 32 % other members of the family and 6 % employees. The holder was also the category of individuals that suffer most frequent in forestry (94 %) and in other branches of business (62 %).

Almost half of the suffered from the accidents (46 %) in agriculture and forestry were 55 years or older, 46 % in pure agriculture, 53 % (not significant) in forestry and 32 % (not significant) in other branches of business (Table 4). The injured had in average worked 28 years in the branch where the accident occurred. About 72 % had worked 10 years and more. In the pure agriculture the injured had 29 years of work experience and 76 % had worked at least 10 years. The corresponding percentages for the forestry and other branches of business were 27 and 19 years experience, respectively and 72 % and 34 % (not significant), respectively had at least 10 years of work experience.

More than 60 % that had an accident in agriculture and forestry sought medical service at hospital in the first place (61 %) and also at health center (21 %). In 9 % of the cases an ambulance was called.

The average absence from work per accident was 14 days calculated on all the workers. For those who were at least one day away from work the average absence were 32 days. About 16 % of the accidents lead to sick leave and on the average of 9 days. In the case the worker had been sick-listed at least one day the average time were 56 sick days.

The injured in other branches of business was the group who most often sought medical service for the accidents (97 %), on the average were absence 33 days (not significant), 37 % (n. s.) were sick-listed and on the average 24 days (n. s.).

Table 2: Number of accidents and percentage share (%) by working hours and number of enterprises with accidents, percentage share (%) and percentage share enterprises with accidents by labour requirement in standard man-hours in 2004. All values are given with mean errors

Standard man-hour	Number of accidents	%	Accidents per million man-hours	Number of enterprises	%	% with accidents
- 800	834 ± 33	17 ± 5	66 ± 34	813 ± 33	18 ± 5	3 ± 1
800 – 1,600	1,571 ± 25	31 ± 6	87 ± 25	1,403 ± 26	31 ± 6	9 ± 2
1,600 – 3,200	1,198 ± 19	24 ± 4	42 ± 19	1,147 ± 19	25 ± 5	10 ± 2
3,200 -	1,410 ± 15	28 ± 4	30 ± 15	1,212 ± 15	26 ± 4	13 ± 2
Total	**5,013 ± 11**	**100 ± 0**	**47 ± 11**	**4,575 ± 12**	**100 ± 0**	**100 ± 1**

Table 3: Number of accidents and percentage share (%) per type of farming (regarding 2003) and number of enterprises with accidents, percentage share (%) and percentage share enterprises with accidents by type of farming in 2004. All values are given with mean errors

Type of farming	Number of accidents	%	Accidents per million man-hours	Number of enterprises	%	% with accidents
Crop husbandry	966 ± 33	19 ± 5	34 ± 33	937 ± 34	20 ± 6	5 ± 2
Dairy cattle	1,538 ± 17	31 ± 5	48 ± 17	1,370 ± 17	30 ± 5	15 ± 3
Other livestock	1,330 ± 15	27 ± 4	48 ± 16	1,222 ± 16	27 ± 4	7 ± 1
Mixed farming	662 ± 32	13 ± 4	53 ± 32	549 ± 26	12 ± 3	9 ± 2
Small farm units*	518 ± 50	10 ± 5	120 ± 50	497 ± 52	11 ± 5	3 ± 2
Total	**5,013 ± 11**	**100 ± 0**	**47 ± 11**	**4,575 ± 12**	**100 ± 0**	**7 ± 1**

* The uncertainty is high regarding the values for the small farm units

Table 4: The age of the injured at the time of the accident. The percentage share of the accidents by different branches of business and age. All values are given with mean errors

Branch	**Age (years)**					
	18-24	25-34	35-44	45-54	55-64	65-
Farming	7 ± 3	7 ± 3	21 ± 5	17 ± 4	40 ± 8	6 ± 2
Forestry	2 ± 2	7 ± 5	20 ± 12	18 ± 6	40 ± 12	13 ± 6
Other branches of business	4 ± 2	5 ± 3	23 ± 14	22 ± 8	31 ± 12	1 ± 1
Total	**6 ± 2**	**7 ± 2**	**21 ± 5**	**18 ± 3**	**39 ± 6**	**7 ± 2**

About 11 % of the injured in agriculture and forestry reported the accident as a work injury to the Social Insurance Office.

In total the accidents occurred 72 % outdoors and 28 % indoors. About 66 %, 92 % and 83 % occurred outdoors in the pure agriculture, forestry and other branches of business, respectively. Most of the accidents occurred during spring and autumn, April (12 %) and September (12 %), November (16 %, not significant). The main cause of the accidents in agriculture was animal-related (kicks from animals etc, 36 %), falling accidents (29 % in total, not significant), followed by vehicle accidents (12 %) and being struck by flying or falling objects (4 %) (Fig. 3). The accidents occurred foremost during construction work and work with equipment (27 %), dairy cows (24 %) and other animals (20 %).

In forestry the accidents were dominated by being struck by flying or falling objects (40 %, not significant), vehicle accidents (35 %) and mis-step etc. (17 %, not significant). The accidents occurred during tree-felling operations (55 %) and energy forest handling such as chips operation, cross cutting etc. (25 %).

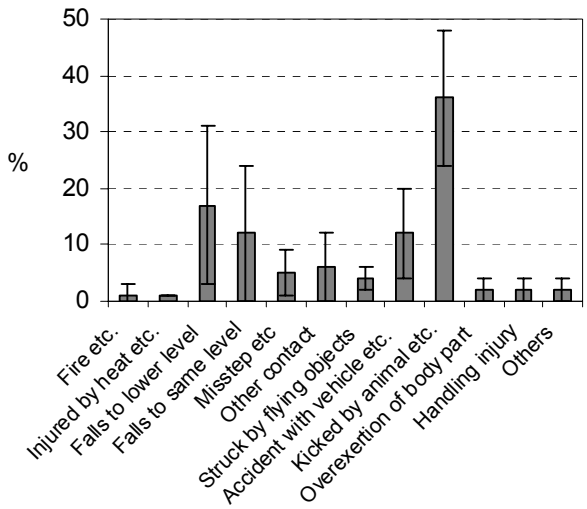

Fig. 3: Accidents in farming by main event in 2004

The most common type of injuries in agriculture and forestry was crushing, being pinched (33 %), sprain (18 %), wound (16 %) and skeletal injury (14 %). In pure agriculture the corresponding percentages were 38 %, 18 % (not significant), 14 % and 12 %, respectively. Wound injuries (29 %, not significant) and crushing, being pinched (23 %) were the most common type of accidents in forestry and skeletal injuries (53 %) in other branches of business.

In general the accidents led to injuries to hand, wrist, fingers (23 %), shoulder, arm (13 %), hip, leg and knee (14 %), foot, ankle, and toe (13 %) and head (10 %). Corresponding percentages for the pure agriculture were 22 % hand, wrist, fingers, 12 % (not significant) shoulder, arm, 16 % hip, leg and knee, 15 % foot, ankle, and toe and 10 % head injury (Fig. 4). Finger (26 %) was the most frequent injured body part in forestry and the head (24 %, not significant) in other branches of business.

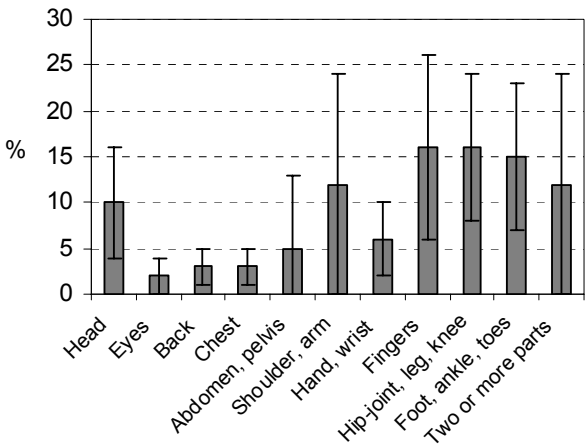

Fig. 4: Accidents in farming by main part of body injury in 2004

4 Discussion and conclusions

According to official statistics there were only just over 400 registered occupational accidents in 2004 in agriculture, hunting, forestry and fishing (Swedish Work Environment Authority 2006). This means that only 8 % of the accidents reported in this study emerge in the official statistics of occupational injuries. This low frequency of reporting injuries is a problem in various respects. The individual risks losing benefits from the insurance system and society does not recognize the scope of the problem – if no injuries are reported then there is no problem. This is not only a Swedish problem. Leigh et al. (2004) describe the undercount of between 33 % and 69 % of all non-fatal occupational injuries in United States. In another study Leigh et al. (2001) point out that the Bureau of Labor Statistics (BLS) Annual Survey estimate of non-fatal injuries is adjusted upward by a factor of 4.7 to reflect the BLS undercount of farm injuries.

This study shows that the frequency of accidents on farms today is almost as high as it was 20 years ago despite introduction of new modern techniques and equipment that aim to facilitate farm work. Instead the intensive rationalization of Swedish farming and forestry has led to increased work rates and stress that may be one of the reasons to the equal level of accidents and injuries. In a study by Stave (2005) it was pointed out that farmers considered work stress as an underlying cause of accidents. The study also revealed a conflict between production and safety, and farmers' excuse for not having started to improve safety on their farms was lack of time.

This is alarming in view of the results in the present study, which have also been confirmed by the high level of fatal injuries on Swedish farms during 2006. The fatalities affected 14 adults during work and 4 children present at the workplace. This is, however not only a national problem. The same situation is present in other north European countries. During the Nordic Meeting on Agricultural Occupational Health in Kuopio, Finland (NMAOH 2006), the participants adopted a number of suggested actions directed towards the authorities and stakeholders, calling on them to join in the efforts and work towards achieving the vision of zero fatal injuries in agriculture:

- By the year 2012 – there should be no fatal injuries in Nordic agriculture
- Develop national action plans against injuries in agriculture involving all relevant stakeholders, such as authorities, farmers' organizations and other organizations, research institutes and universities, private companies, individual farmers, as well as everyone else working in the agriculture sector
- Establish and enhance national resource/ information and coordination centres for agricultural health and safety
- Comprehensive occupational health services should be available to everyone working in the agricultural sector
- Detailed and reliable statistics on injuries in agriculture should be presented on a yearly basis
- Information and education about health and safety needs to be further developed and implemented for farmers and others working in agriculture
- Education about health, safety & leadership should be implemented in the whole education system from pre-school to university.

It was concluded that there is a need for financial resources, but there is also a need for active support from our politicians, governments, authorities and organizations – both on national levels and on a Nordic level!

As a consequence of this statement, the present study and the alarming situation of injuries in agriculture, the Swedish Government initiated a Commission to develop an action program against injuries on farms. The results from the Commission (Swedish Board of Agriculture 2007), included calculations of the economic consequences of injuries in agriculture for the whole of Swedish society based on the results presented in this paper. According to these calculations the economic consequences reach a yearly level of 200,000,000 – 300,000,000 euros. This is also compared with similar calculations in Norway (145,000,000 euros per year). The Commission also suggests a number of actions, including a system of farm level advisors and establishment of a National Competence Center on injury prevention in agriculture. Intervention programs as well as national action programs and national resource centers have been applied in various countries with mixed success. Regional programs have been developed in Denmark (Rasmussen et al. 2003), Wisconsin (Chapman et al. 2003) and Iowa (Rautianinen 2004). National programs have been used in the United States, in particularly in relation to children and youth health and safety initiatives (Lee et al. 2004). Learning from previous experiences with intervention programs is essential for a Swedish success.

Acknowledgements

The study was funded by the Swedish Farmers' Foundation for Agricultural Research and was performed by The Swedish University of Agricultural Sciences in cooperation with Statistics Sweden.

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