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Agrarsysteme

# Frequent Accident Scenarios with Vehicles, Machinery and Devices in Bavarian Agriculture

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# Aim of the project



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Identification of (groups of) agricultural vehicles, machinery and devices according to their hazardousness and develop of typical accident scenarios based on

- frequencies
- direct accident costs

# Data



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Accident data for Bavarian Agriculture from 2005 to 2008:

- Data bases for the years 2005 to 2007 (2520 data sets)
- Accident reports for the year 2008 (755) → data base created

Data provided by the Agricultural Accident Prevention and Insurance Association for Lower Bavaria, Upper Palatinate and Swabia as well as Franconia and Upper Bavaria

# Statistical analysis - Variables

- victim's age, gender, profession and position on farm
- accident time and location
- machinery involved (type of machinery, specific part of the machine, movement of the part)
- working process and specific activity during which the accident occurred
- kind of injury, injured part of the body and severity of the injury (reversible or irreversible)
- direct accident costs
- presence of an accident witness and violations of regulatory framework, influence of human, machinery, environmental factors etc.

# Statistical analysis - Tests



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Descriptive statistical analysis → frequencies

Chi square tests → significant connections between variables

# Results



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<b>Group of machinery</b>	<b>N</b>	<b>Accident costs of the whole group (in €)</b>	<b>Most frequently mentioned machine in this group</b>	<b>N</b>
<b>Motor vehicles</b>	1020	13,747,565	<b>Tractor</b>	667
<b>Trailers</b>	425	4,427,112	<b>Multi-axle trailer or trailer in general</b>	231
<b>Converting machinery for wood, corn, potatoes, beets, fruits, vegetables, honey</b>	397	4,410,570	<b>Circular saw</b>	151
<b>Machinery and devices for forest operations</b>	364	3,448,058	<b>Power saw</b>	278
<b>Harvest machinery for grass, hay, straw</b>	145	2,033,638	<b>Forage wagon</b>	51
<b>Lifting and stacking devices</b>	154	1,832,162	<b>Front end loader</b>	79



## Results: Group of Motor Vehicles/Tractors

**Motor vehicle accidents:** 82% male victims, average age of 54 years

Tractor accidents happened more often to persons who were 55 years old or more (2005-2007: 51%) than accidents with other motor vehicles,

happened significantly more often in the farmyard (2005-2007: 56%) than passenger car accidents (2005-2007: 8%)

Farmers and lumberjacks (2008: 91%) and farm managers (2008: 65%) most frequently injured

Most around noon and in the afternoon hours (2005-2007: 67%, 2008: 71%), during summer and spring (2005-2007: 71%, 2008: 68%)

## Results: Group of Motor Vehicles/Tractors

Access to operator's cab most frequently mentioned part (2005-07: 52%),  
most happened during regular operation of the vehicle (2005-07: 68%,  
2008: 59%)

Maintenance was most frequent work process leading to tractor accidents  
(2005-07: 38%), getting on/off the tractor was most frequently mentioned  
specific activity (2005-07: 48%)

Reasons for injuries: stumble, slide down or fall (2005-07: 43%, 2008: 43%)

Arms and legs most frequently injured in tractor accidents (2008: 61%),  
fractures most common injury type in vehicle accidents (2005-07: 55%)



# Results:

## Group of Motor Vehicles/Tractors



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Direct accident costs: in about 1/3 of cases higher than 10,000 € (2005-07: 31%, 2008: 30%), between 36% (2008) and 40% (2005-07) accident costs lower than 5,000 €

## Results

### Group of trailers/multi-axle trailers or trailers in general

**Trailer accidents:** 84% male victims, average age 53 years

More than half of accident victims were farm managers (2005-07: 56%, 2008: 61%)

54% happened in the farmyard

40% happened in spring, 36% in the afternoon hours

70% occurred during household and gardening activities in the years 2005-2007

Different moveable parts were mentioned most frequently to have caused the accident (2005-07: 37%, 2008: 67%)

## Results

### Group of trailers/multi-axle trailers or trailers in general

Data of 2005-07 showed that machinery parts were not moving in 56% of accidents, 2008 77% of injuries were caused by wrong or unforeseeable movements of machinery parts

Most frequent specific activity when injuries happened was loading (2005-07: 27%, 2008: 65%)

Wrong movements of body parts were reason for most injuries (2005-07: 56%, 2008: 57%), 67% (2008) of injuries affected musculoskeletal system,

75% (2005-07) to 90% (2008) of injuries were assessed to be reversible

Direct accident costs were higher than 10,000 € in 28% of the cases, in 43% costs were lower than 5,000 €

# Results

## Group of converting machinery/circular saw

### Accidents with converting machinery:

91% of the victims male, average age 50 years

Injury victims were farm managers in 46% of the cases

Most accidents happened on the farm, 2008 71% happened on the farm outside buildings

During year these accidents were distributed quite evenly, during the day, 76% around noon and in the afternoon hours

most frequently in connection with household and gardening activities (2005-07: 70%), working processes connected with wood were typical settings (2008: 74%)

# Results

## Group of converting machinery/circular saw

In 97% cutting device caused injury, in more than 90% of the cases, the movements of cutting devices were considered normal (2005-07: 91%, 2008: 98%)

Injuries were caused mainly by being caught by machine (2008: 90%) or by being cut (2005-07: 67%),

most accidents happened when the machine was operated (2008: 66%, 2005-07: 32% + „sawing“: 52%)

72% of injuries in 2008 were assessed as irreversibel (amputations), in 97% of the cases, arms were the injured body parts

caused more than 5,000 € in 63% (2005-07) and 46% (2008) of cases

## Results

### Group of machinery and devices in forest operations/power saw

Accidents with machinery and devices for forest operations: 95% male victims, average age 48 years

52% (2005-07) and 58% (2008) of accident victims were farm managers

84% did not happen on the farm

54% occurred during fall and winter, 55% around noon

Power saws: accident victims significantly older (37% older than 55 years) than accident victims with other machinery and devices for forest operation

## Results

### Group of machinery and devices in forest operations/power saw

Typical working process: forest operations (2005-07: 67%), power saws significantly less frequently used in forest operations (2005-07: 55%) but for example in construction work (2005-07: 26%)

With power saws sawing, handling or operating the machinery or device was the most important specific activity when the accident happened (2005-07: 90%)

Most important part of machinery was the saw chain or cutting device (83%), 74% of power saw accidents from 2005-07 were caused by normal movements of the saw chain, with other machinery and devices for forest operation normal movements occurred only in 39% of the cases

# Results

## Group of machinery and devices in forest operations/power saw



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**Most frequent cause of injury with saw chain: to cut oneself (83%)**

85% of the injuries 2005-07 were disruptions, 81% considered reversible (with other machinery and devices for forest operation: only 64% considered reversible)

legs and different parts of the body (2008) were injured more often with power saws (81%) than with other machinery and devices for forest operations (17%), arms were injured in only 19% of accidents

59% of power saw accidents did not cause more than 5,000 € of direct accident costs, 16% caused costs of more than 10,000 € (no significant difference to other machinery and devices for forest operations)



## Results

### Group of harvest machinery for grass, hay, straw / forage wagon

Accidents with harvest machinery for grass, hay and straw: 91%  
male victims, average age 48 years

55% (2005-07) and 61% (2008) of the accident victims were farm  
managers

most frequently happened in farmyard (45%)

51% occurred during summer, 90% during spring and summer, 40%  
happened in afternoon hours

86% of accidents (2005 to 2007) with forage wagons happened when field  
work or cultivation was carried out, 50% of accidents happened during  
harvesting and transporting forage (2008)



## Results

### Group of harvest machinery for grass, hay, straw / forage wagon

Data from 2005 to 2007 showed that in 34% of cases normal movements of forage wagons and in 34% of cases unusual movements were carried out, when the accident happened

44% of accidents with harvest machinery for grass, hay and straw caused direct accidents costs of up to 5,000 €, 33% costs of more than 10,000 €

## Results

### Group of lifting and stacking devices/ front end loader

Accidents with lifting and stacking devices: 84% male victims,  
average age 50 years

In 41% (2008) and 54% (2005-07) of cases farm managers were the  
accident victims

55% of the accidents happened in the farmyard

During the year, accidents were distributed quite evenly, during day 36%  
in afternoon hours and 31% around noon

81% of accidents with front end loaders happened in spring and summer  
(2008)

## Results

### Group of lifting and stacking devices/ front end loader

Human error was stated in 72% of front end loader accidents during the years 2005 to 2007

49% (2005-07) and 60% (2008) caused injuries by persons being hit, caught or pinched

44% (2005-07) and 20% (2008) caused irreversible injuries

29% (2005-07) and 16% (2008) caused direct accident costs of more than 10,000 €, 37% (2005-07) and 54% (2008) caused costs of up to 5,000 €

# Conclusion



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Critical points:

- Sample in most machinery groups too small to get significant dependencies
- Different data sources made it necessary to split up statistical analysis
- Accident costs do not always correspond to the severity of the injury (fatal accidents can be quite „cheap“ when looking at the direct accident costs)

# Conclusion



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- Overview of all machinery groups helps to find out about many hazardous situations (not only „spectacular“ ones) – important for prevention
- Development of prevention measures → first step: find out about accident mechanisms → was done in this project
- Going on with more detailed accident analysis in new project



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**Thank You for Your Attention!**