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FUTURE DEVELOPMENTS FOR FERTILIZING IN GERMANY

by

H. Auernhammer, M. Demmel, J. Rottmeier, T. Muhr

Technical University Munich-Weihenstephan, Germany

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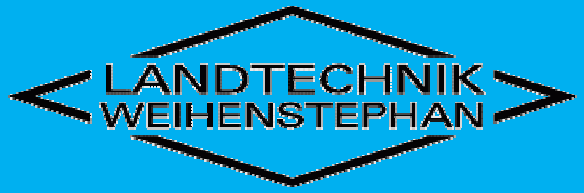


Future Developments for Fertilizing in Germany

H. Auernhammer, M. Demmel, J. Rottmeier, T. Muhr

Technische Universität München
85350 Freising-Weihenstephan, Germany

Introduction

Agriculture in the Federal Republic of Germany produces on a high level. Average yields of 6.9 t/ha of winter-wheat, 54.6 tt/ha of sugar-beets and 49.0 t/ha of corn-silage require exact scheduled fertilizing.

Even if modern distribution techniques are used, but over-fertilizing cannot be avoided. This is based on changing circumstances on the fields, mistakes during calibration and on the more psychological sight of the farmer to avoid possible nutrient shortcomings.

As a summary of all these facts investigations show that bout 36% of the phosphorus and about 42% of the nitrogen in the surface water are coming from agriculture. Phosphorus comes from erosion and nitrogen comes from over-fertilization mainly.

Taking into account, that by this over-fertilizing in the very close populated area of the Federal Republic of Germany the ground water and with it the available drinking water is more and more endangered, then it will be understandable that the requirements for a more environmental oriented fertilizing are more and more audible.

Technical objectives for an environmental oriented fertilizing system

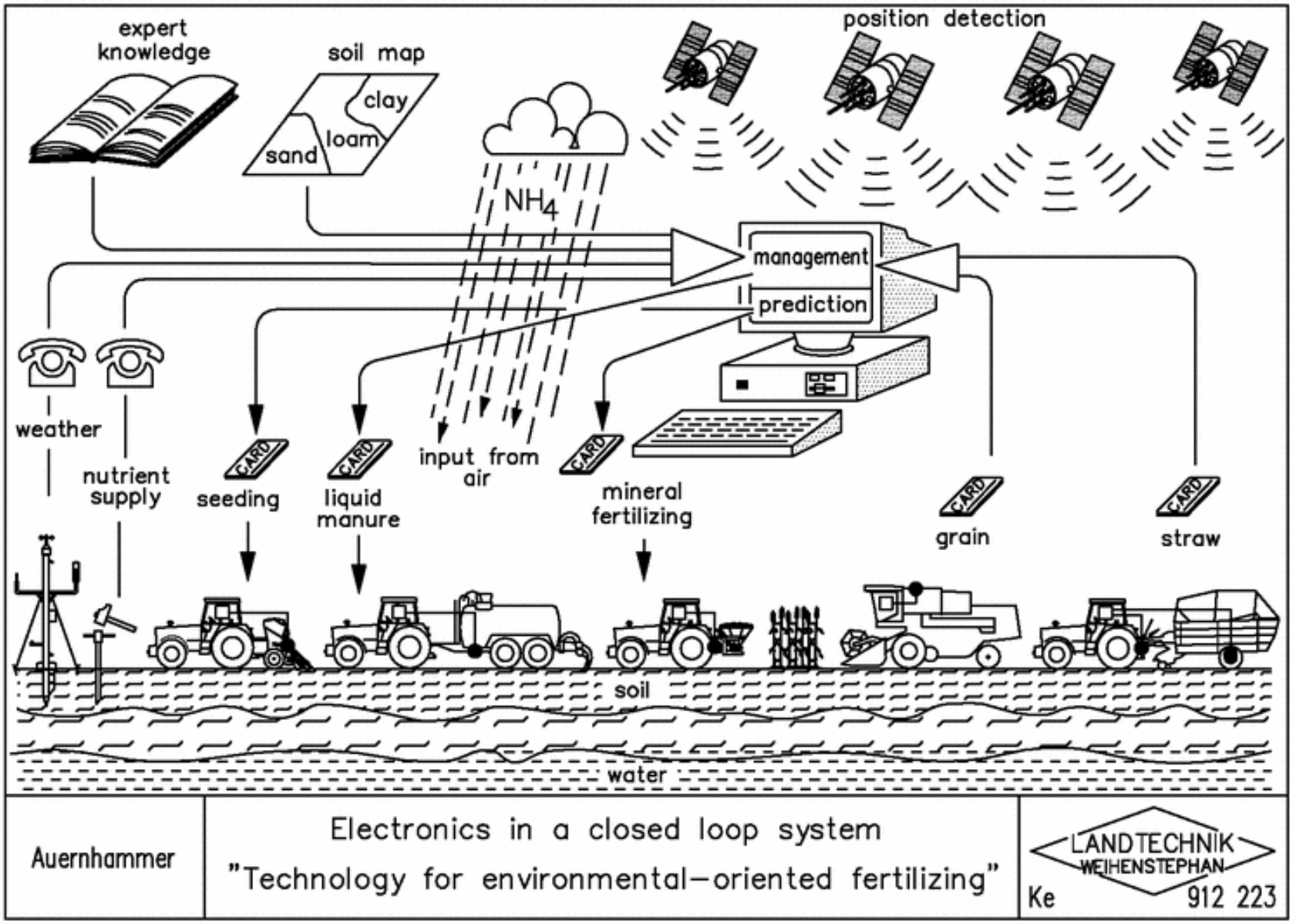
Fertilizing today is done on a strategy of demand for an expected yield.

Based on the yield of the preceding crop and its demand, respectively its crop residues together with the weather in the winter the available nutrients at the beginning of vegetation are defined as the starting position.

On this the required basic fertilizing is calculated and according to the weather during vegetation the demand on nitrogen is determined and spread out.

The following harvest with its yield allows a balancing afterwards and allows in a feed-back within the whole closed loop the required steps for the following crop.

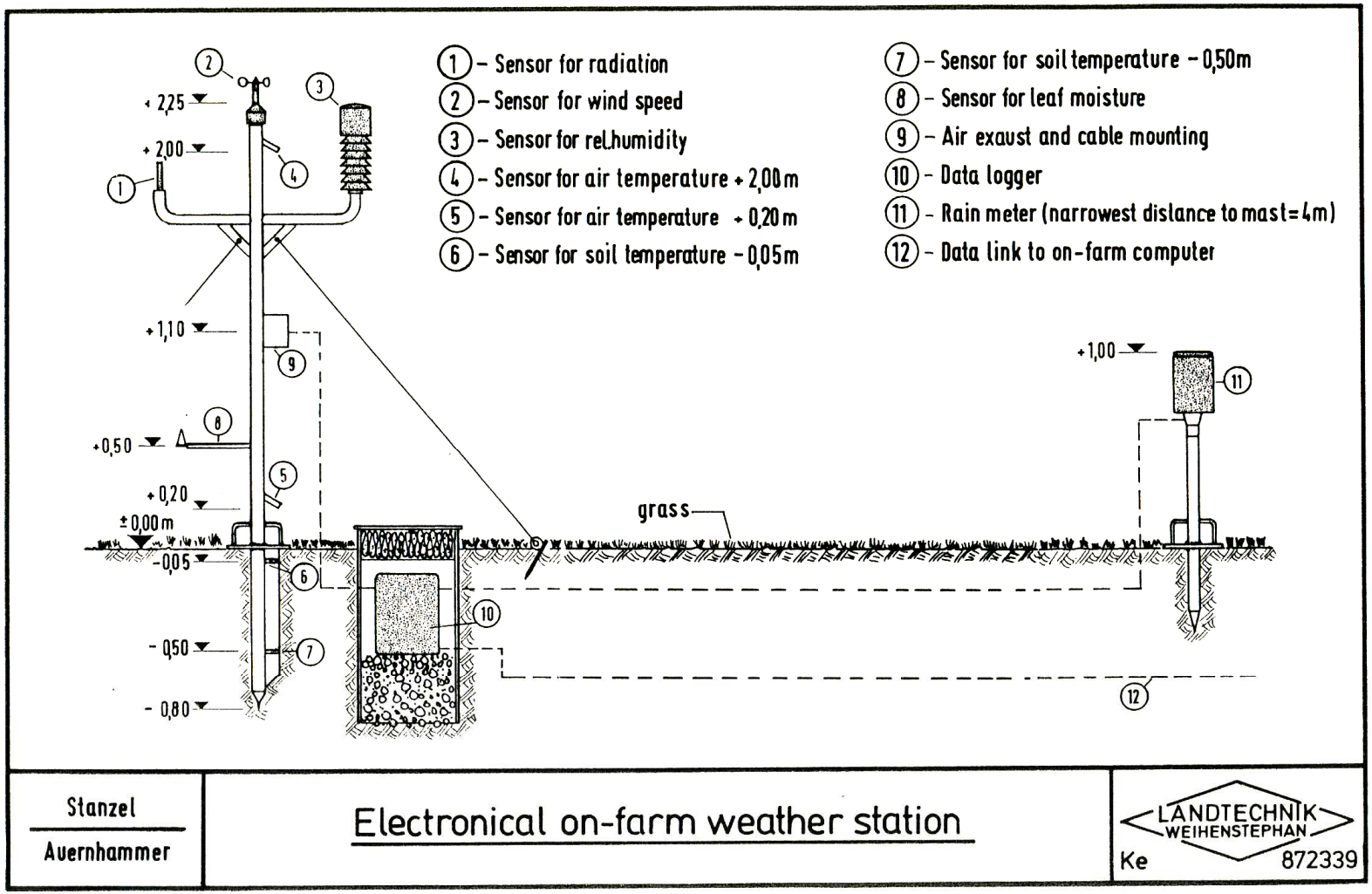
A “Closed loop system for environmental and yield oriented fertilizing” may look like this:


expert knowledge
soil map
clay
loam
sand
position detection
NH_4
management
prediction
weather
nutrient supply
seeding
liquid manure
input from air
mineral fertilizing
grain
straw
CARD
soil
water
Auernhammer
Electronics in a closed loop system
"Technology for environmental–oriented fertilizing"
LANDTECHNIK WEIHENSTEPHAN
Ke
912 223

Activities, sensors, actuators, positioning detection and data transfer in a closed loop system of "Environmental and yield oriented fertilizing"

step	*task*	*Sensors / actors*	*positioning*	*data transfer*
yield detection and mapping	cereal harvesting	paddle wheel; x-ray sensors	DGPS	chip card [3] or RAM-box
	grass and straw harvesting	strain gauge sensors load cells	GPS	
weather and soil monitoring	local weather conditions	rain fall; wind speed; two air and two soil temperatures; humidity; radiation	---	video text network
	soil sampling [1]	hydraulic driven drill or tube with cartridge	DGPS	
controlled distribution	liquid organic manure [1]	hydraulic driven positive displacement pump and slip control	DGPS	chip card [3] or RAM-box
	mineral fertilizing with	slip control together with	DGPS + dead reckoning	
	- weight control - tramline guidance - variable-rate-fertilizing	strain gages in 3 point linkage --- [2] centrifugal mixing unit		

[1] *not under examination* [2] *future activities* [3] *DIN and ISO standards under preparation*


1 – Sensor for radiation
2 – Sensor for wind speed
3 – Sensor for rel.humidity
4 – Sensor for air temperature + 2,00 m
5 – Sensor for air temperature + 0,20 m
6 – Sensor for soil temperature – 0,05 m
7 – Sensor for soil temperature – 0,50 m
8 – Sensor for leaf moisture
9 – Air exaust and cable mounting
10 – Data logger
11 – Rain meter (narrowest distance to mast = 4m)
12 – Data link to on-farm computer
+ 2,25
+ 2,00
+ 1,10
+ 0,50
+ 0,20
± 0,00 m
– 0,05
– 0,50
– 0,80
+ 1,00
grass
Stanzel
Auernhammer
Electronical on-farm weather station
LANDTECHNIK WEIHENSTEPHAN
Ke
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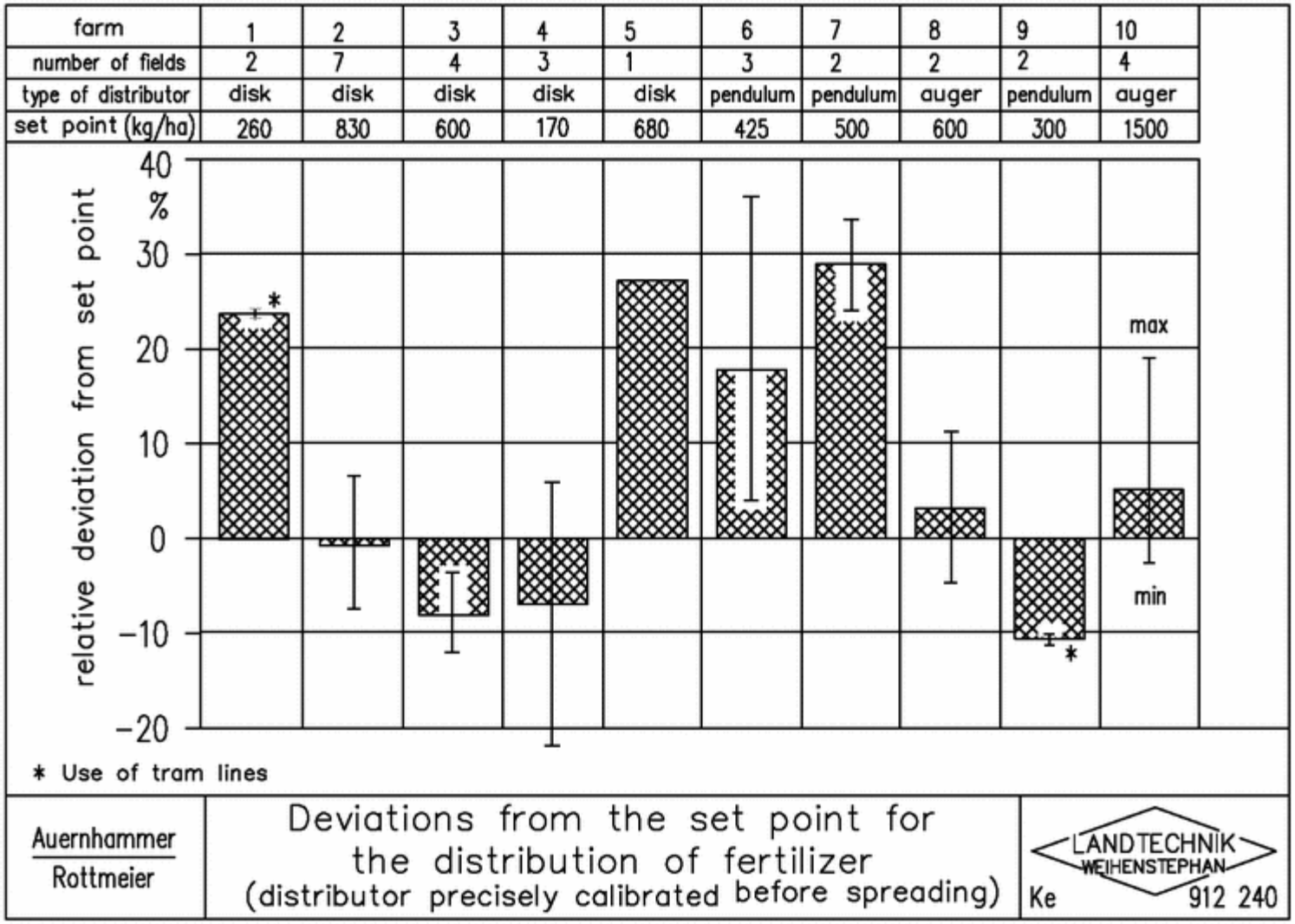
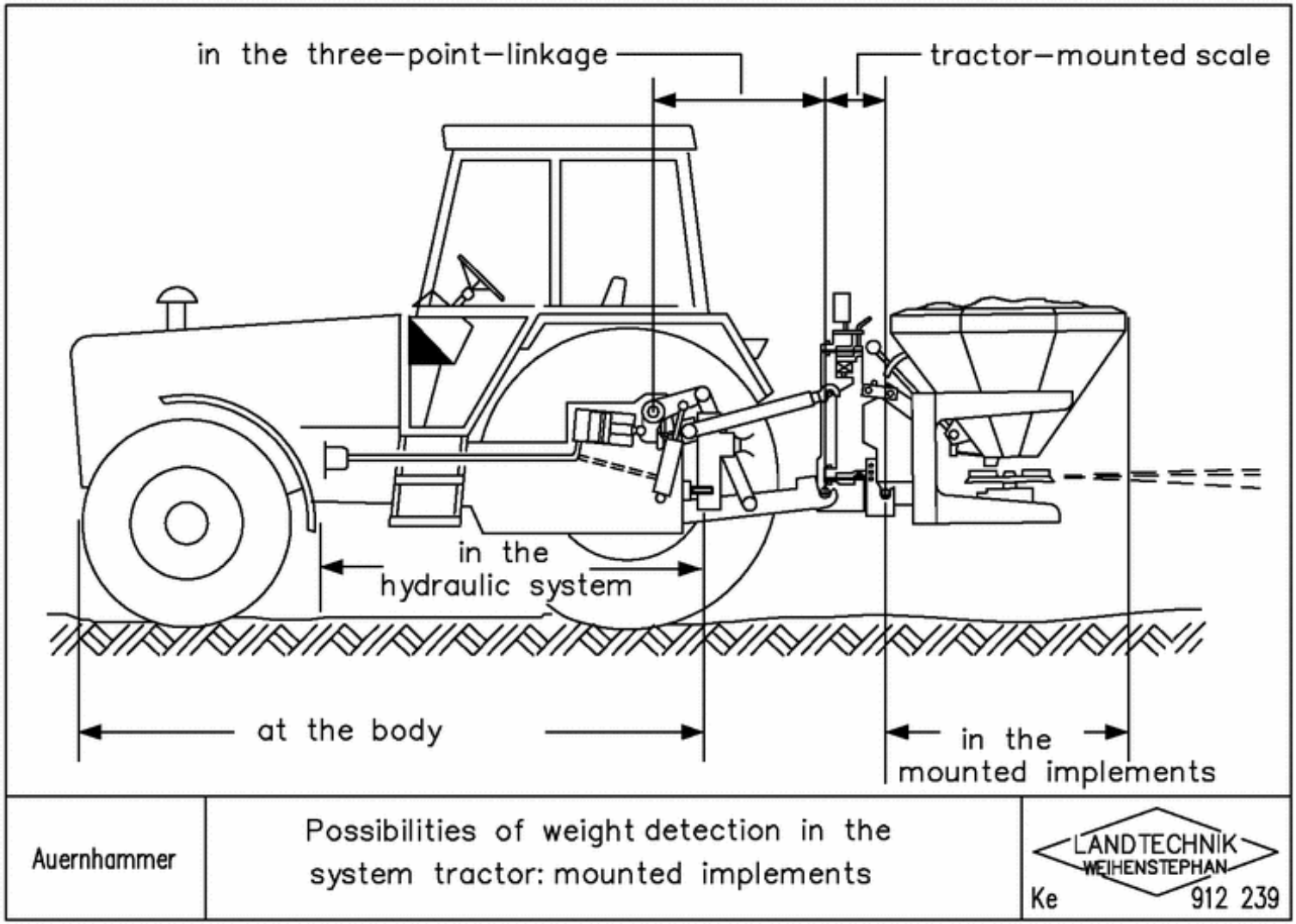
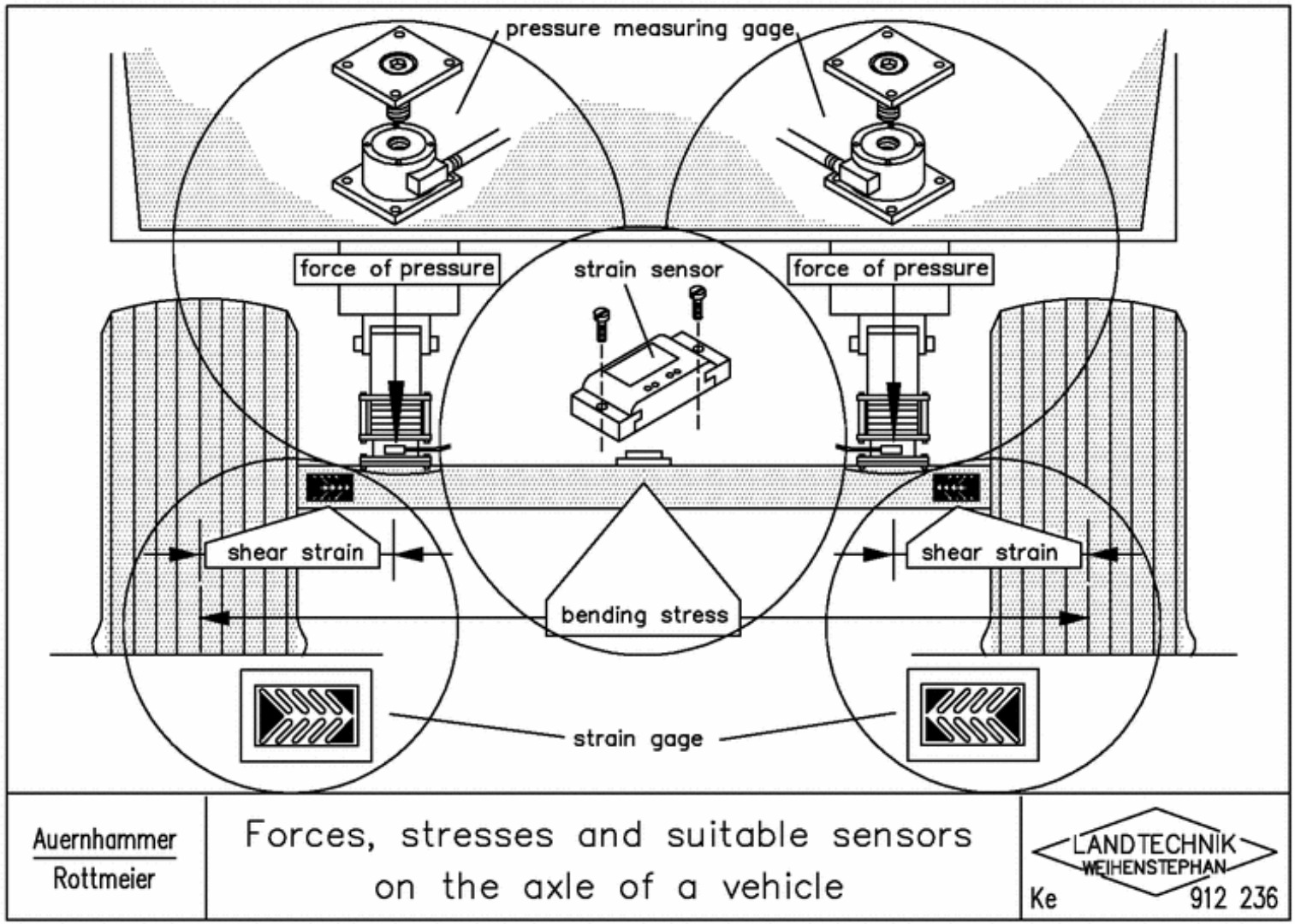
Deviations from the required fertilizer demand after fertilizing (measured on training farms in Bavaria 1989)



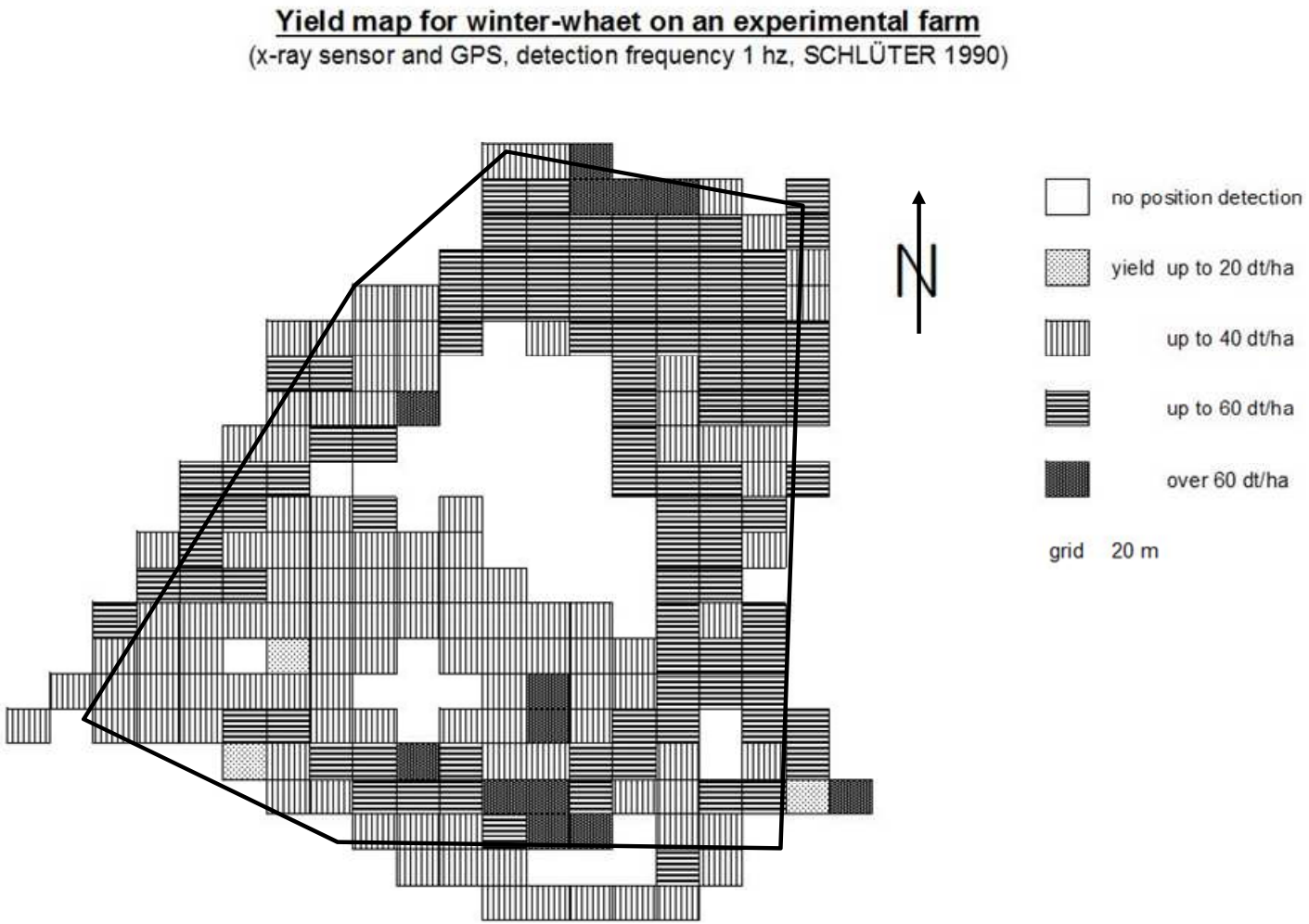
Possibilities for weight detection in a tractor-implement system



Weighing possibilities in self-loading trailers and transport tippers



Yield map for winter-wheat on an experimental farm (x-ray sensor and GPS, detection frequency 1 hz (SCHLUETER 1990)



Conclusions

In high yielding agriculture over-fertilizing will lead to environment pollution and to negative influences to drinking water. It can only be avoided if modern technologies in a closed loop control system are used.

The loop has to start with yield detection during harvesting, including the weather and the nutrients in the soil and it has to offer a local variable fertilizing.

Very soon solutions for the weight detection in self-loading trailers and transport tippers will be available for the use on farms. Also weighing possibilities in the tractor three-point-linkage will be equipped useable soon.

An excellent situation is given after the development and the installation of small electronic weather-stations in Bavaria with a video text networking to the central host with central data processing and central predictions.

In comparison low-cost and highly reliable yield detection systems for combines are still not available.

Also the error-free location detection is unresolved at the present, dead reckoning-systems are not even available and tramline-systems require drivers with highest initiative and precise work.

Nevertheless all these techniques together offer a chance to reduce the fertilizer amount at least by 15% with same yields, the potential of a 30% reduction is coming more and more into discussion.

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