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YIELD MEASUREMENTS ON COMBINE HARVESTERS

by

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

Institut für Landtechnik
Technische Universität München
Freising· Weihenstephan, Germany

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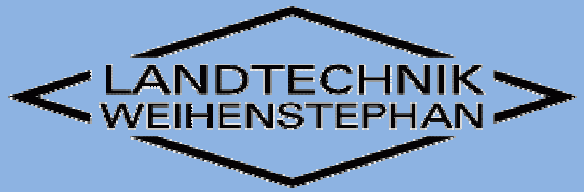


Yield Measurements on Combine Harvesters

Hermann Auernhammer, Markus Demmel, Thomas Muhr, Josef Rottmeier, Karl Wild

Technische Universität München
85350 Freising-Weihenstephan, Germany

Introduction

In this day and age, local measuring of yield is becoming more and more important. Local information on yield potentials is an important factor for contractor and machinery ring work. Additionally, taking into account previously supplied nutrients and uptake rates, the amount of nutrients remaining in the soil may be gauged more easily.

Pre-requisite for this process are permanent, reliable yield measuring devices installed in the combine harvester. On the European market there are at the moment two systems ready for practical use.

The “YIELD-0-METER” (CLAAS) works on a volume measurement principle (bucket wheel).

The device “DATAVISION FLOWCONTROL” (MASSEY FERGUSON) measures flow on the basis of a radiometric measurement principle.

A two-year experiment was conducted in order to establish the practical usage potentials of these devices. The goal was to test reliability, measuring accuracy and a potential spread in the test data, and to determine reasons for measurement errors.

Material and Methods

Site of the experiment was the acreage of the research farm "Scheyern". After the research network "**F**orschungsverbund **A**grarökosysteme **M**ünchen (F AM)" had taken over the farm, all arable land was cultivated in a two-year monitoring phase with one crop respectively, receiving the same treatment.

	Year of Experiment	
	1990/91	1991/1992
Total harvest area	120 ha	110 ha
Grain sowing date	11. – 19.10.1990	10.03. / 9. – 12.04.1992
Grain	Winter wheat	Summer Barley
Variety	Orestis B5	Sissi
Fertilizing	160 kg/ha N	50 kg/ha N
Harvesting date	12. – 20.08.1991	03. – 07.08.1992

Operation data combine I

Combine Harvester I	Year of Experiment 1990/91	1991/1992
Manufacturer	CLAAS	CLAAS
Combine type	Dominator 108 Maxi (new machine)	Dominator 108 Maxi (‘91 machine)
Yield measurement system	YIELD-O-METER (volume flow)	YIELD-O-METER (volume flow)
Cutting width / Engine power	5.10 m / 163 kW	5.10 m / 163 kW
Positioning	SEL GLOBOS LN 2000 (reversial DGPS, position corr.)	SEL GLOBOS LN 2000 (reversial DGPS, position corr.) + 2 * ASHTECH M XII (post processing DGPS, Pseudo range correction)
Data acquisition system	CONTRON IP-Lite PC386 + SCHLUMBERGER Datalogger	CONTRON IP-Lite PC386 + SCHLUMBERGER Datalogger
Operation area	50 ha	40 ha
Number of grain tank fillings	72	39
Total yield	320 t	156 t
Number of operation days	7	4
Pre-investigation area	30 ha	15 ha

Operation data combine II

Combine Harvester II	Year of Experiment 1990/91	1991/1992
Manufacturer	MASSEY FERGUSON	MASSEY FERGUSON
Combine type	MF 34 RS (new machine)	MF 40 RS (new machine)
Yield measurement system	FLOW CONTROL (mass flow)	FLOW CONTROL (mass flow)
Cutting width / Engine power	4.80 m / 162 kW	5.50 m / 195 kW
Positioning	SEL GLOBOS LN 2000 (reversial DGPS, position corr.)	ASHTECH M XII (base station + TRIMBLE JUPITER / ASHTECH SENSOR (mobile stations) (online DGPS, pseudo range corr.)
Data acquisition system	CONTRON IP-Lite PC386 + SCHLUMBERGER Datalogger	CONTRON IP-Lite PC386 + SCHLUMBERGER Datalogger
Operation area	70 ha	70 ha
Number of grain tank fillings	109	60
Total yield	375 t	266 t
Number of operation days	8	4
Pre-investigation area	50 ha	10 ha

Results

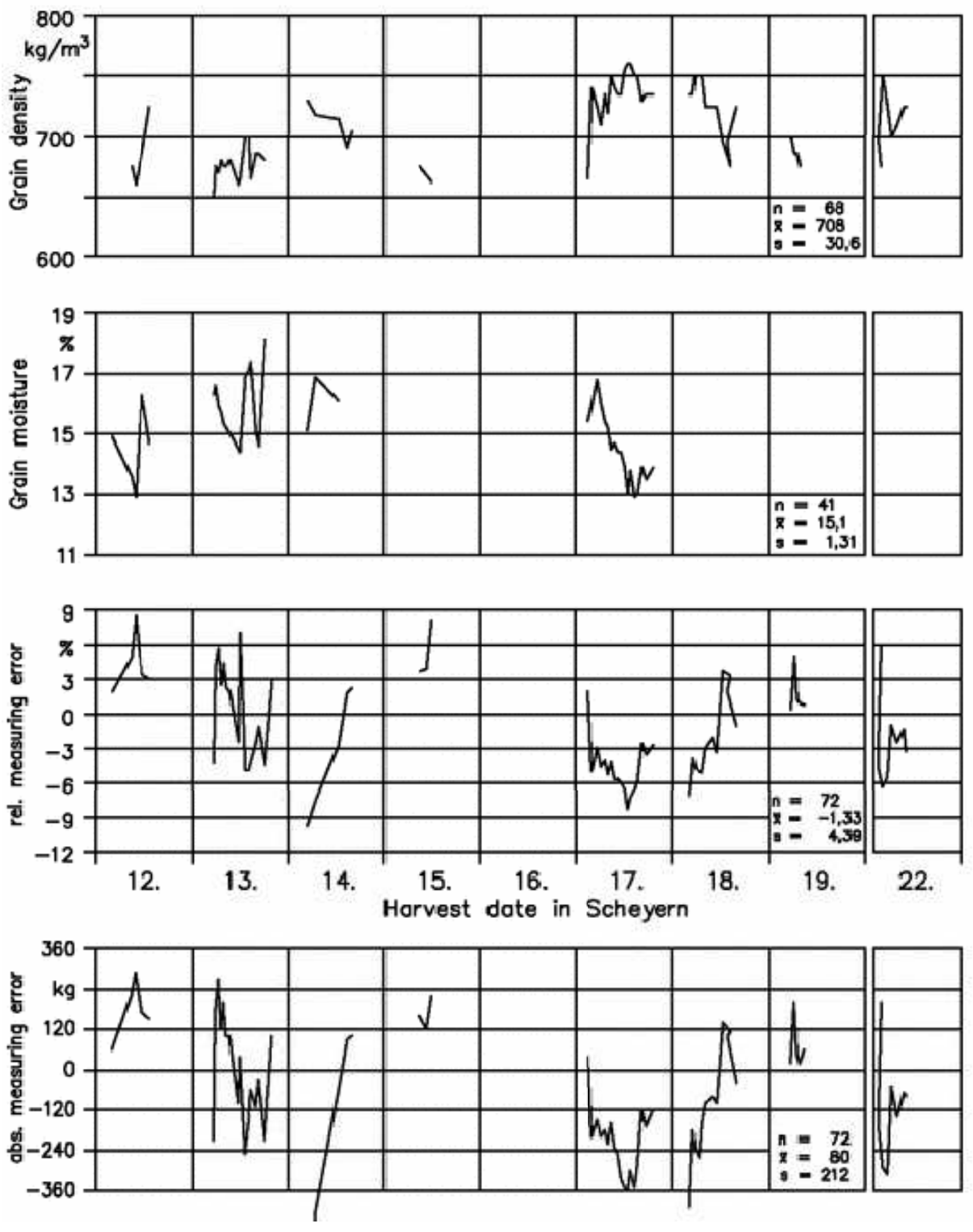
Altogether, in the main experiment, 280 grain tank loads were harvested in two test years with two combine harvesters. In this period, no malfunctioning in the measuring devices could be detected. Extensive pre investigation runs also had proceeded without any problems.

The most important data with respect to the grain tank loads (specific weight, moisture content, relative variance between measuring device and platform scales) is depicted separately per harvesting day.

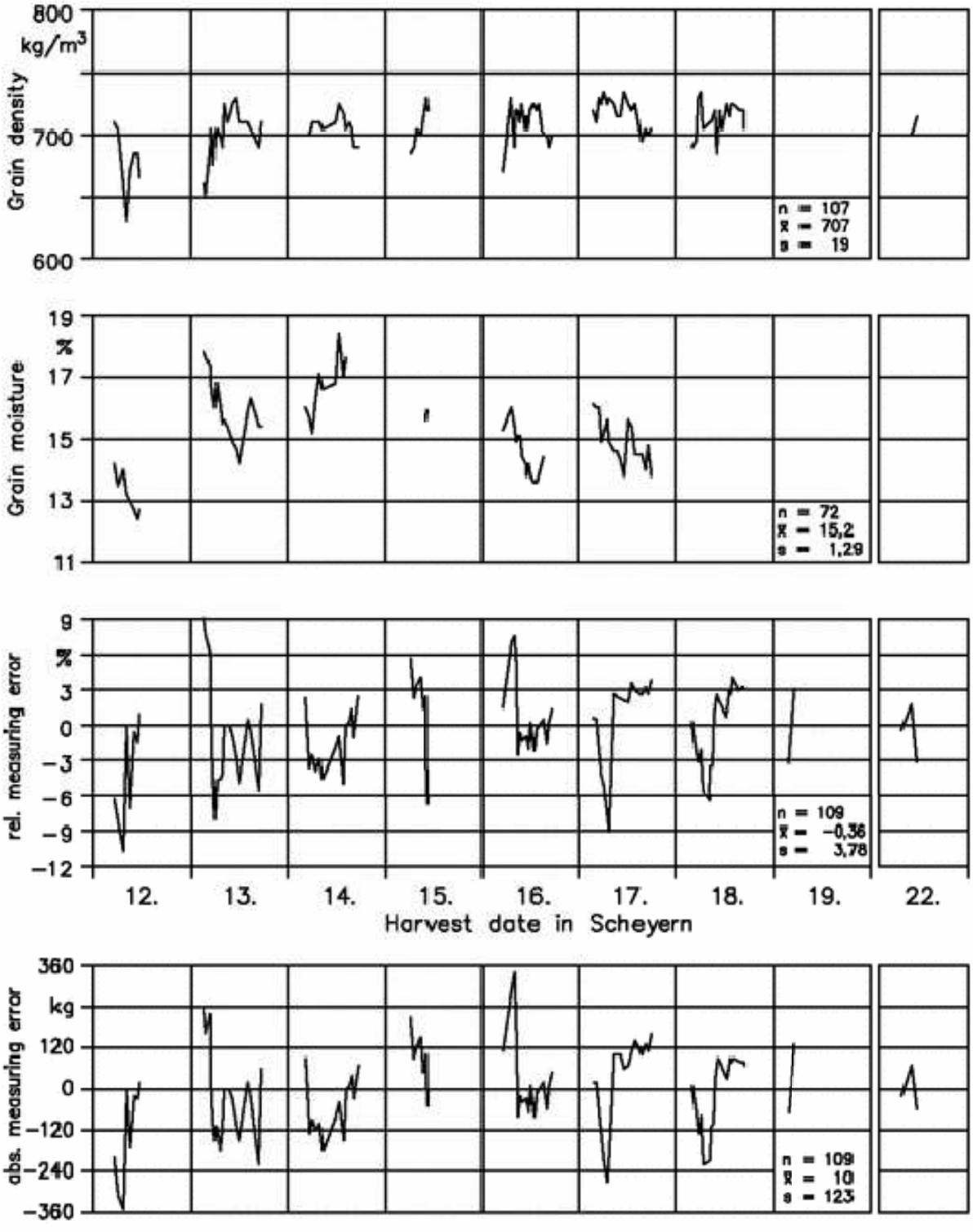
Of the total of 274 available data records about the individual grain tank loads, 75 incomplete data records had to be excluded from further analysis due to omission of certain strips for investigation purposes.

In more details the results look like this:

Grain Density, Grain Moisture, absolute and relative Errors of each Grain Tank Filling for the Volume Flow System "CLAAS YIELD-O-Meter" in 1991



Grain Density, Grain Moisture, absolute and relative Errors of each Grn Tank Filling for the Volume Flow System "DATAVISION FLOWCONTROL" in 1991



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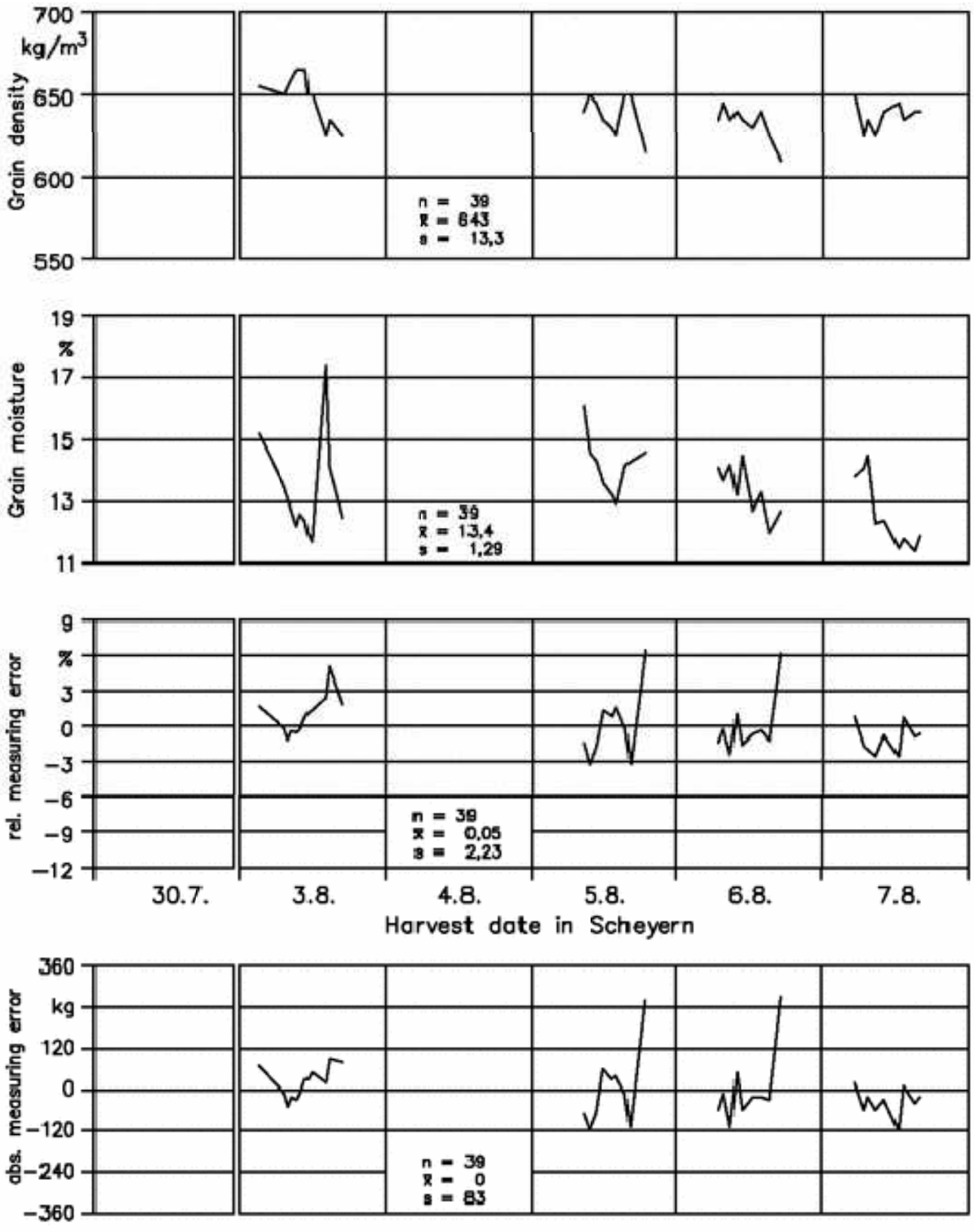
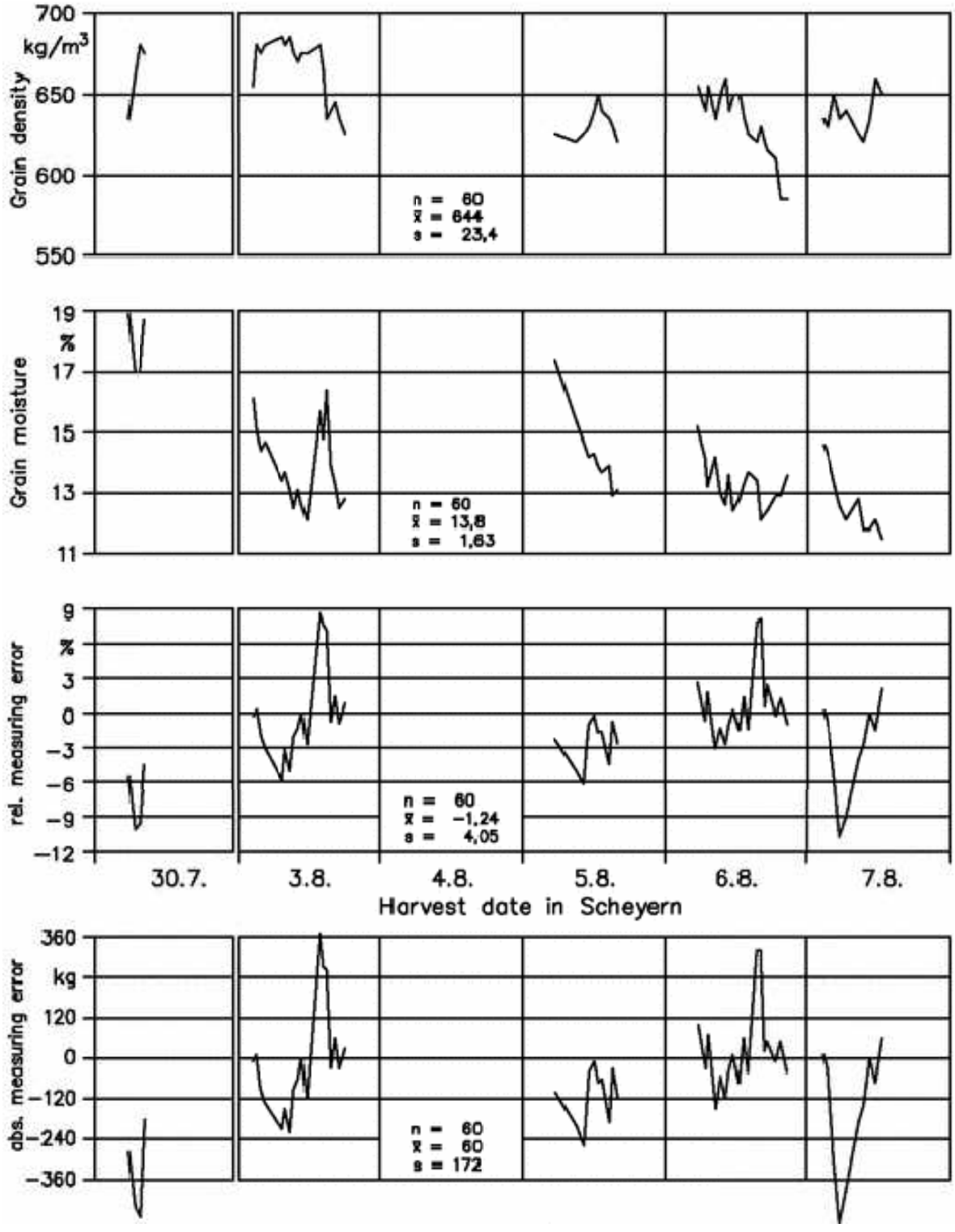
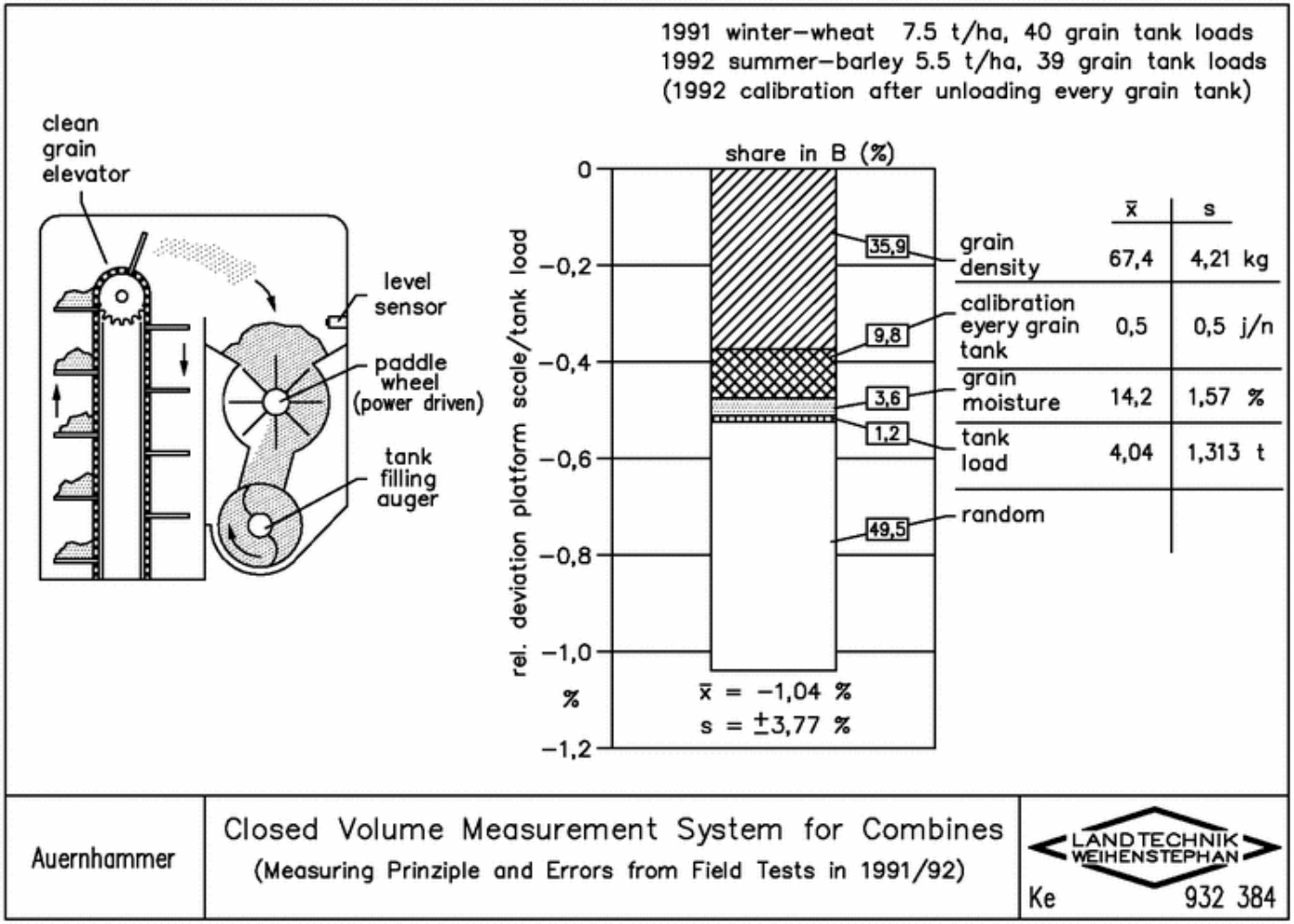


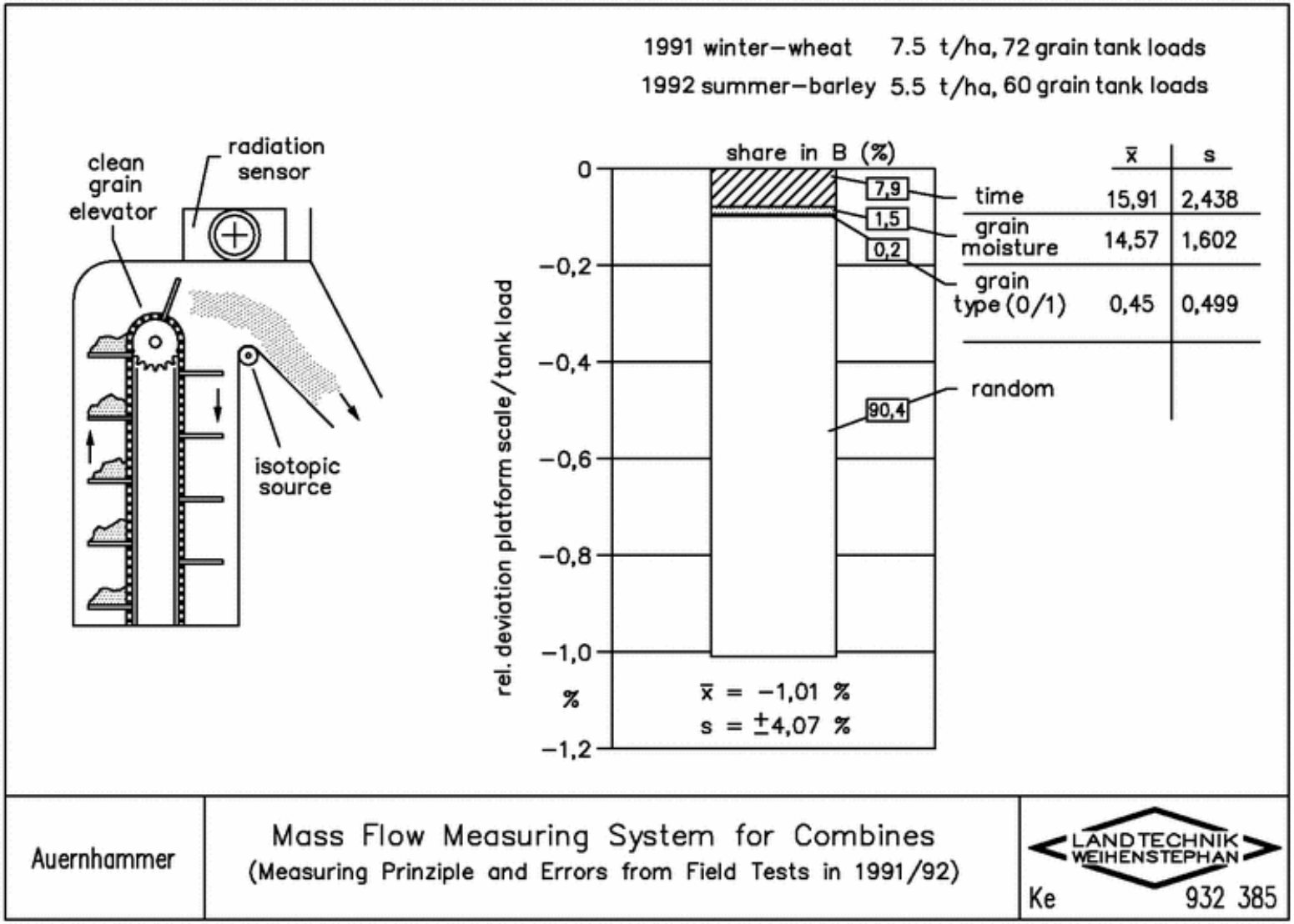
Grain Density, Grain Moisture, absolute and relative Errors of each Grn Tank Filling for the Volume Flow System "DATAVISION FLOWCONTROL" in 1992



Relative Error of Volume Flow System "CLAAS YIELD-0-METER"



Relative Error of Mass Flow System "DATA VISION FLOWCONTROL"



Conclusions

Based on extensive testing of both yield measuring systems under practical conditions, the following conclusions might be drawn:

- Functional reliability of the tested yield measuring devices is excellent. Malfunctions might be expected with the mechanical volume measuring device at the harvest of a very moist crop.
- Measuring accuracy is almost identical for both systems and meets the general standards for local yield measurement. Actual differences in yield of about 10% may be determined this way.
- With the volume measuring system YIELD-0-METER accuracy is only guaranteed if staffers perform the necessary calibrations at the appropriate time. An automatic measuring of grain density seems to be unavoidable in this context.
- The flow measuring device DATAVISION FLOWCONTROL, on the other hand, is subject to special legal requirements (anti-radiation precautions) which differ from country to country. Radioactive contamination of the harvest due to this measuring system may be ruled out, however.

Acknowledgements

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