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The Bonn plant spacing recording system

A system for laboratory or on-farm testing of precision drills

The modular construction of the recording system presented here allows its adaptation for various requirements and measurement tasks. Laboratory and field measurement systems were fitted with the same equipment and software. The mobile AAZ offers savings in time and material compared with the conventional chalk stripe method. Because of the light beam's higher dissolution and replication rate the measurement of longitudinal distribution is possible even with drills. The mobile components of the AAZ mean that, for the first time, an in-field testing system for precision drills is now available for farmers.

Alongside the research into precision drilling and the development of precision drills with the necessary research-technological testing, modern quality management in practical farming requires a system for the recording and evaluation of grain and plant seeding placement in the drill. The measurement of corn and plant placement by precision drills must be possible in real time because only rapid recording of the evaluation parameters allows a cost effective machinery test [1, 2].

The measurement system applied differentiates between direct and indirect methods. With direct, the recording is done on the object, the plant or the deposited seed in the soil. The gaps between seeds are recorded with ruler, measuring tape or on paper strips.

Indirect methods can only be used for measuring the gaps between deposited seed. The corn or seed is fixed in, or on, a medium. Methods used include the application of ground slits, chalk stripes and oil bands. Additionally the corn can be optically or acoustically recorded during its drop at the height of the theoretical seed slit or furrow bottom. Established nowadays for corn recording are rapid optical methods using frame light beams [3, 4].

The Bonn AAZ

With the Bonn gap recording system (AAZ) developed at the Institute for Agricultural Engineering, University of Bonn, the work quality of precision drills can be judged in the following aspects:

- exact trials in laboratory and field
- optimising of precision drills in the construction phase
- practical performance trials for precision drills
- implement controls after manufacture
- implement checks by farmer and contractor before drilling begins
- plant population controls, e.g. by plant breeders

Through its modular construction the Bonn AAZ easily allows adaptation for various measurement situations. During implement testing the mobile AAZ offers time and material savings compared with the conventional chalk stripe system [4].

The AAZ is applicable with a laboratory testing system comprising control unit with data storage, control unit for the seed recording equipment with frame light beam and PC and also in an in-field measurement system comprising the gap measurement wagon, the control unit with data memory and PC. Both systems operate with, and are served by, the same self-developed software [3, 4].

Through an additional hydraulic drive module, the laboratory measurement system is also suitable for testing implements out in the field.

Alongside the mobile drill testing station, an implement-testing list for the control by

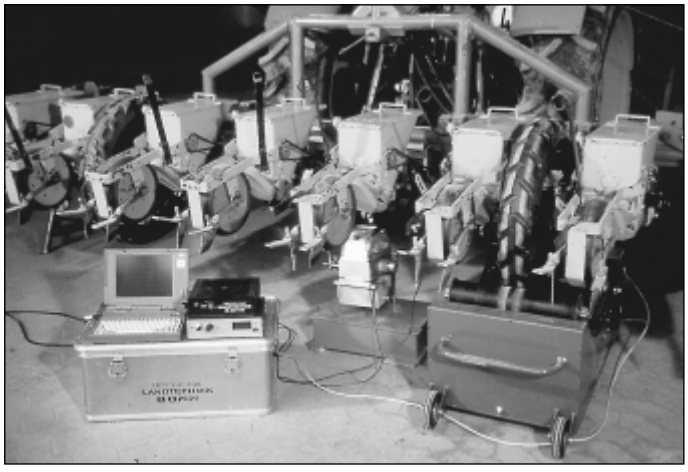

Fig. 1: Mobile test bench AAZ under operation with a precisionseeder for sugarbeets

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Keywords

Test Unit for Onfarm testing of precisionseeders, uniformity of positioning of seeds, doubles and misses

Literature details are available from the publishers under LT 01 SH 113e or via Internet at http://www.landwirtschaftsverlag.com/landtech/local/fliteratur.htm.

Speed :	5 km/h	1,38 m/s	Seed: sugar beet pelleted						Desired gap: 18,0 cm			
Row		1	2	3	4	5	6	7	8	9	10	11	12
Istabstand (cm)		17.58	17.58	17.58	17.59	17.60	17.57	17.59	17.61	17.57	17.60	17.60	17.60
Actual gap (%)[1]	98.2	95.8	97.0	97.5	98.5	95.0	96.5	93.5	96.8	99.0	80.8	98.2	
Placement precision (mm)[2]		9.7	11.4	10.7	10.9	8.9	11.7	11.3	12.8	11.2	8.4	18.3	8.7
Desired precision (%)[3]		99.0	99.6	97.8	96.3	98.5	98.2	99.2	98.3	98.2	98.6	98.8	99.8
Double placement (%)[4]		0.0	0.2	0.4	0.5	0.0	0.8	0.3	0.2	0.3	0.7	0.2	0.0
False placement (%)[5]			1.0	0.2	1.8	3.2	1.5	1.0	0.5	1.5	1.5	0.7	1.0

Table 1: Results of a precisionseeder on farm test

[1]: Proportion of gaps within tolerance zone around the actual gap or within the total (+ - 1,5/2,5 cm)
[2]: Standard error sx of the gaps for 0.5 – 1.5 times the actual gap
[3]: 0.5 – 1.5 times actual gap; 4< 0.5 times actual gap; 5:> 1.5 times actual gap

farmers has been developed and tested by the Bonn Institute for Agricultural Engineering. Apart from testing the general total technical condition of the drill, the work quality of every sowing unit in a multirow precision drill is also tested. In this, all-important parameters according to testing standards [6, 7, 8] are recorded and evaluated.

The mobile test station

The corn recording takes place with a frame light beam and the seed recording equipment fitted below, as well as with a control unit in each case for the data recording and operating the identification equipment. The control unit for data recording is linked with a PC. The system control is via software in the PC. The gap registered in each case is conveyed over the control unit into the PC and there statistically calculated and saved.

The drill is activated in the test by hydraulic belt drive. Driving speed is simulated via this belt drive, onto which the driving or running wheel of the drill is positioned. As a rule, the belt drive is activated by the tractor hydraulics and can be adjusted steplessly for speeds between 1 and 10 km/h *(fig. 1)*.

The test method

For testing the drill is lifted by tractor hydraulics until the drive wheel can be positioned on the drive belt for simulating operating speed. Enough of the rubber belt is positioned against the drive wheel to ensure slip-free operation. The frame light beam is so positioned under each sowing unit that the seed is recorded at the position of the theoretical furrow bottom, i.e. the deposition depth of each seed *(fig. 2)*.

As each seed passes the frame light beam, an impulse is produced. The beams are capable of recording seed types with 1mm diameter by a replication rate of 5 kHz with a pulse rate of 0.2 m/s. For identifying non-recorded double placements, the seed is collected underneath the light beam during the measuring in the seed identification unit and then counted after the recording [3].

Using the number of surplus seeds, a correction of the non-identified double placements is then made. The movement impulse is directly received by the AAZ mobile test station via an impulse transmitter from the belt drive. Calculated from the frame light beam seed impulse and the movement impulse, the gap between successive seed corns is given in millimetres. The recorded gaps (mm-value) serve as basis for the further data processing and saving. Alongside the technical condition of the drill and the desired gap, the test report also includes the actual gap achieved by every sowing unit. Whereas under desired gap one understands the gap adjusted-for at the drill, the actual gap is the real average gap between the seeds. Through including all drive and transference elements in the testing of the drill, eventual differences between desired and actual gaps can be determined.

Alongside the precision of seed placement. further criteria include quality of placement (desired, failed and double placements). The placement position can be recorded as percentage of the gaps within the tolerance zone or as standard error.

Results

Testing of drills before sowing enables the timely identification of damage and problems on the machines and the best possible preparation of the drill before the season begins. Results from an on-field test are presented in *table 1*.

The false placement proportion of 3.2% in row 4 of the drill indicates a defect in that individual unit. One cell in the cell wheel was no longer optimally formed. The clearly reduced placement precision in row 11 is in this case an indication of wear in the throwing lip of the seed housing.

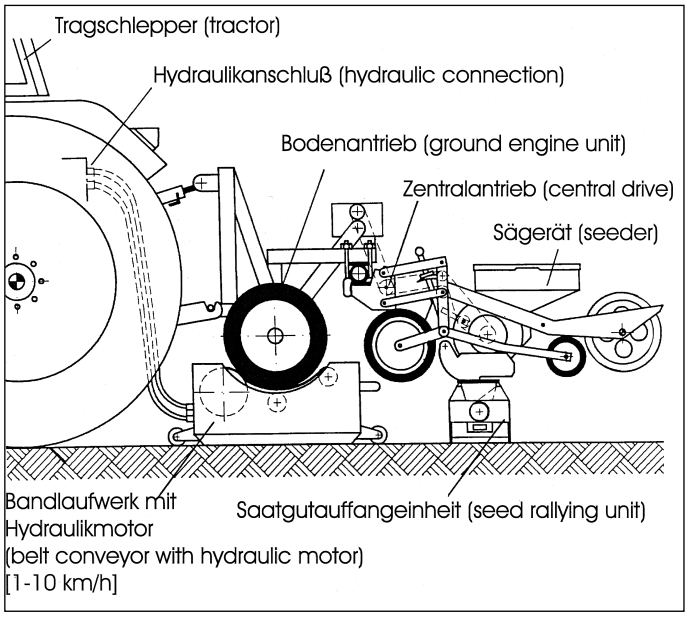

Fig. 2: Sceme of the mobile test unit for precisionseeders

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