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Customised tailoring

Associations between calibrating for pelleted beet seed and cell sizes in mechanical precision drilling systems – problems, causes, alternatives

In beet seed drilling high demands are made on the pelleted seed and the precision seeder. The mainly good results currently achieved from mechanical drilling systems depend on the absolutely necessary matching in the size of seed and precision seeder cell. Problems are caused by deviations in uniformity during seed production and faults in machinery manufacture in the drilling procedure. A dependable alternative would be more expensive pneumatic precision drilling systems.

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The firm KW-Saat AG is especially thanked for the seed batches which were made available.

Keywords

Beet seeding, beet pellet calibration, single seed drills

Every year there are beet drilling problems in farming. The discussion then is whether fault lies with the seed processor or drill manufacturer. Where there's still seed available for an official sieve analysis is possible to identify where the blame lies. But explanation is much more difficult when the damage is only discovered at emergence.

Special preparation

Standard commercial monogerm beet seed is pelleted for better drill performance with fungicide and insecticide in the pellet mass for protection of the seed. As far as the drill itself is concerned the only important seed properties are external such as grain shape, surface consistency, firmness of the pellet substance, range of corn sizes (for calibration) and thousand grain weight (tgw). The appropriate measurements are available for the processors through the seed standard in Germany with maximum calibre (according to round hole sieving) of 3.50 to 4.75 mm as well as the maximum permitted amount under and over this range (6% of batch in each case). The tgw should be around 30 g. Sieving according to slit-hole, which determines the largest diameter and is the measurement for the spherical corn form, the proportion of the individual fractions of 0.25 mm within the round hole rated calibre, and any other external properties, are all left to the individual processor. From this there results the possibility of annual variations in corn size range in seed batches according to the individual processor. Shown as an example (*fig. 1*) are the sieve results of commer-

Table 1: Influence of beet seed granularity of a seed batch on work quality of a mechanically and a pneumatically operating single seed separating device (examples)

Standardised trial seed (not commercially available)	Actual seed gap	Driving speed	Precision of seed placement*	Desired placement	Seed distribution** Duplicate placement	Wrong placement Single	Double	>Double
-	[cm]	[km/h]	[mm]	%	%	%	%	%
Mechanical precision drilling system								
Average distribution	19.1	5.0	8.7	98.8	0.5	0.9	0	0
Distribution moved to the right	19.1	5.0	7.4	97.7	0.2	2.1	0	0
		7.1	8.2	96.3	0.5	3.1	0.2	0
Distribution moved to the left	19.1	5.0	9.2	96.1	3.3	0.6	0	0
		7.0	8.0	95.8	3.8	0.4	0	0
Pneumatic precision drilling system								
Average distribution	19.0	5.0	6.8	100.0	0	0	0	0
		7.0	8.8	99.8	0.1	0.1	0	0
Distribution moved to the right	19.0	5.0	9.6	99.5	0.5	0.5	0	0
		7.0	10.0	99.2	0.7	0.7	0	0
Distribution moved to the left	19.0	5.1	14.8	98.2	0.9	0.9	0	0
		7.0	13.2	99.7	0.2	0.1	0	0

* The accuracy of seed placement is expressed through the standard deviation (mm). The standard deviation is a statistical reference value for the distribution around a measured average actual seed gap

** Seed placement distribution

Required placement ≥ 0.5 to < 1.5 times the actual gap
Duplicate placement <0.5 times actual gap
Wrong placement 1 times ≥1.5 to 2.5 times actual gap
Wrong placement 2 times ≥2.5 to <3.5 times actual gap
Wrong placement over 2 times ≥3.5 times actual gap*

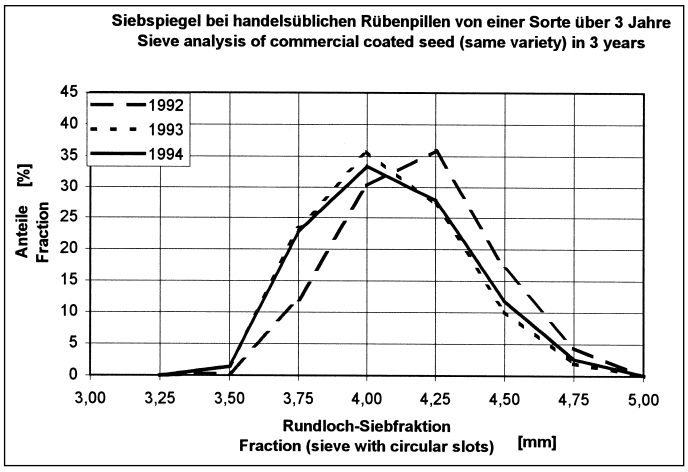

Fig. 1: Possible seed granularity of commercially coated sugar beet seed (sieve with circular slots)

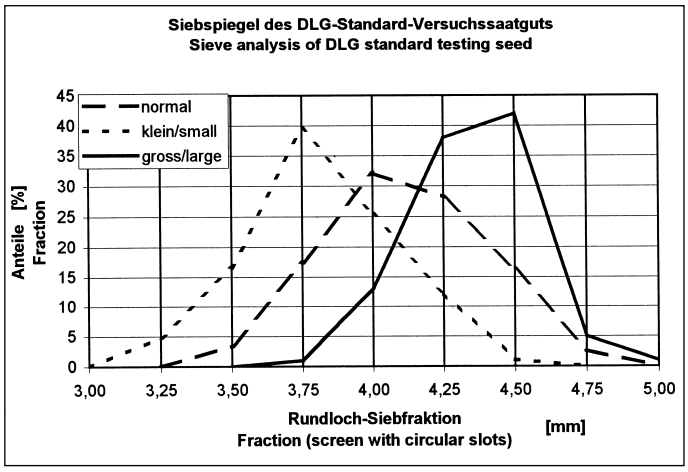

Fig. 2: Sieve analysis (circular slots) of DLG standard testing seed (not comercially available) with three special seed size fractions: normal=central distribution; small=distribution offset to the left, accentuation of small sizes; large=distribution offset to the right, accentuation of large sizes.

Table 2: Damaged beet pellets by mechanically operating single seed separating device of one variety and three varying commercially available seed batches)*

Seed batch	Actual gap [cm]	Driving speed [km/h]	Pellet damage (% of weight) Undamaged [%]	Pellet material damaged [%]	Breakage, Damage [%]
Pellets '92	17,5	5	98,26	1,46	0,28
		7	95,65	3,99	0,36
Pellets '93	17,5	5	99,04	0,74	0,22
		7	97,72	2,00	0,28
Pellets '94	18,5	5	99,67	0,24	0,09
		7	99,17	0,34	0,48

* Note: A pneumatic precision drilling system causes no beet seed pellet damage

cial standard beet pellet batches for a variety over three years. These differences in one seed batch can have an effect on the work quality of the precision drill.

This was why the DLG used, along with commercially available seed batches, so-called standard testing seed (not commercially available) with a specially controlled range in seed sizes so that their possible effects when used with respective machines can be tested. With the three different ranges of grain sizes, the aim was not to exceed the given limits and permitted tolerances (*fig. 2*).

Precision seeding technology for beet

Of primary importance in beet drilling are very precise mechanical precision drills. The cells or hole sizes of the grain separation instrument must, through agreement between the machinery manufacturer and the seed processor be closely matched to grain size (seed standard) so that a single corn placement of at least 95% can be achieved. The remainder of the cells contain two grains or none at all.

Origin of the problem

From trials and experience there are two focal points which require closer attention: the seed and the corn separation equipment of the drill.

As an example the upper part of *table 1* shows the influence of different corn size ranges on the work quality of a mechanical corn separation system. The seed batch with the range pushed to the right, when compared with the 'zero line' with average separation, leads to higher false placements, that with the size range shoved to the left to increased double placements. At the same time, undersized seed within a batch and oversized seed lead respectively to increased double placement or empty cells.

Where a pneumatic seed separation technique (*table 1, under*) is used, different ranges of corn size have no influence on double and zero placements. In the example the zero placements and the double placements are both under 1%. To a large extent this also applies to over and under sized seed. In the context of seed placement precision, however, the seed which is shoved to the left and to the right leads to unsatisfactory results (higher standard deviation).

Table 2 features an example of pellet damage in different batches (*fig 1*). In batch '92 the pellet damage increases substantially with a sieve performance shoved to the right. This effect is added to through higher driving speed. Moreover it could also be caused by a greater angling of the machine from the horizontal (over 10 to 15% in all directions).

A pelleting material which is too soft can lead to increased wear and therefore to mistakes in the seed separation.

With the machine, serious placement mistakes are possible where the maximum circumferencial speed of the corn separator is exceeded. Wear on the separator, and the parts associated with it, means that functional problems are programmed and these can become apparent through duplicate and missed placements, imprecise positioning and through corn damage.

Alternatives to standard precision seeding technology

Alternatives to mechanical grain separation are precision drills with pneumatic separation systems – although they are not yet perfected. Technically, the latter are more complicated and the construction is therefore more expensive. But they can manage larger grain sizes and greater differences in form (*table 1, lower part*). Otherwise they offer no extra advantage for beet drilling. Regarding seed placement precision in the upper speed ranges (over 6...5 to 8 km/h) they are actually less efficient.