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Profitable separation

Top quality through freedom from clods and stones

To a large extent, the best way of protecting oneself from the turbulence of the potato market features a field free of stones and clods. This creates the preconditions for top tuber quality which in turn greatly helps to secure a good return. Almost every potato producer has experienced how quality faults such as rotting, rhizoctonia, spoilage through damage or blackspot rapidly lead to business losses. In the following report, the standard system for potato production is compared with one utilising soil separation.

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Stony and cloddy soils usually produce good yields. When, however, these hard soil components come into contact with potatoes during separation, tuber damage is a possibility, a fact which is not altered even by optimised procedures on the harvester and in handling technology.

A new possibility for harvesting in absolutely stone and clod free conditions is offered by soil separation before planting. This procedure was developed a good 20 years ago in Scotland where nowadays around 80% of potato growing land is separated – the credit for which goes to the agricultural machinery manufacturer Netagco Reekie based in Forfar, north of Dundee in east Scotland. In the meantime advanced farms in Germany have also adopted the advantages of the procedure and have been using it successfully for years.

Simple principle – sieved seedbed

Soil separation features the forming of furrows 20 cm in depth and breadth, at spacings of 160 to 180 cm in the dry land in spring. These furrows or drills, which at first glance resemble asparagus rows, are completely sieved in the following operation. Stones, clods, rough clumps or organic substances and – especially important – any adhering soil, are laid in the next following furrow. Left after this is a seedbed without other substances into which seed potatoes are planted and the drill formed in a single operation.

Presented briefly, the main values, as compared with the conventional system in *table 1*, are: a seedbed of around 130 to 150 cm in width is produced between a track width of 165 to 180 cm. The sifted soil layer is about 25 cm deep. Two rows of potatoes are planted in this stone and clod free seedbed at spacings of between 75 and 80 cm. Depending on their varietal properties, the seed potatoes are placed about 7 cm above the sole of the drill/furrow and about 15 cm from the drill crown drill on average. The important point is that the stolons and therefore the young potatoes grow only in the sieved soil area, because this is the requirement for a tare-free harvest without problems.

More growth room from less field area

What is advantageous for one production region need not apply without any reservations to another. As far as sceptical experts are concerned, the only results that count are those created in the area and the conditions in question. Because of this, comparative growing demonstrations were organised in 1999 on 12 farms with differing site and climate conditions in nine federal states throughout Germany. On all sites , a standard system A (75/150 cm row spacing) was compared with the Scots-developed system B (80/180 cm) in the same field in each case. With a predetermined track width of 180 cm, two rows at 80 cm spacing were laid .

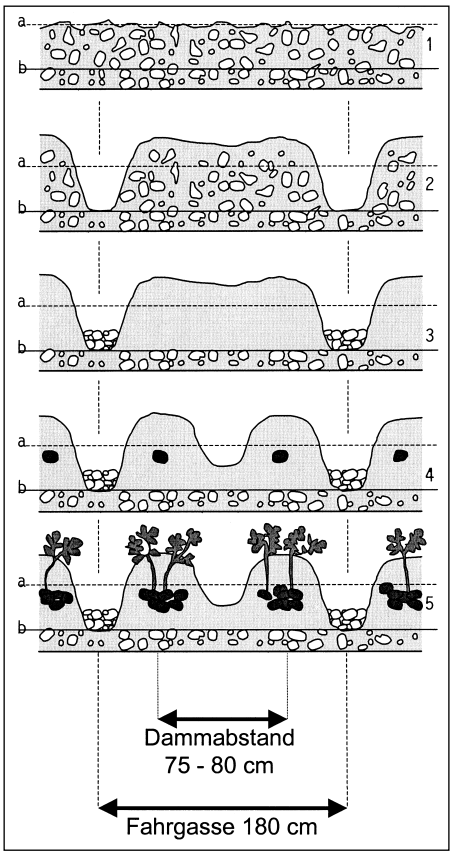

Fig. 1: Work procedures in the de-stoning system B: 1 original soil profile; 2 soil profile following ploughing; 3 soil profile after sieving; 4 soil profile after potato planting; 5 development of potato root system in the de-stoned drill; a zero point, b plough sole

Parameter	Standard	de-stoned growing environment
Drill spacing (cm)	75	75 to 80
Track width (cm)	150	165 to 180
Drill sequence (cm)	75/75	75/90 or 80/100
Determined drill cross sectional drill area (cm^2)	850	1085 (at 80/100)
Drill lengths (m/ha)	13333	11111
Available drill volume (m^3/ha)	1133	1205
Relative (%)	100	106
Planting spacings at 40,000 plants/ha (cm)	33	28

Table 1: Potato production in de-stoned drills compared with the standard procedure.

Noticeable during the separation is the apparent loss of available furrow or row length per field. In fact, only overall area is lost whilst there is a gain in the much more important growing space for the potatoes. About 2000 m in drill length are lost per hectare. Through the system's larger drills, however, a gain of 6% more growth area is made available per hectare.

A speciality of the system B is that the separated stones and clods are lain into the wheeltrack alongside the potato drills and therefore not lifted during harvest operations. Technically, it is possible to adapt an elevator so that stones can be immediately loaded after separation and transported off the field. There is the danger here, however, that organic matter and adhering soil could be carted-off at the same time.

The one year trial results on the 12 farms led to the following results:

- The potatoes flourished in the loose, well aerated growing medium. Following different rates of growth the crop stand closed rows at the same time as in the standard procedure.
- Natural maturation was slower under dry conditions in areas of low rainfall and here, the large-volume drills were of advantage.
- On all the sites the yield of marketable ware was 14.2% higher with a greater proportion of similarly-sized tubers.
- Few and in some cases no, rhizoctonia scabs and no scurf were apparent as well as substantially less harvest damage.
- On all sites, the harvest took place more efficiently in that the harvest speed was increased on average by 40% and it was possible to reduce the graders by 50%.
- The yield increased by up to 24.5% and by 12.3% on average.

Fig. 2: The separation implement REL 5154S deposits clods and stones via a lateral conveyor belt.

The technology of the system

The de-stoning systems comprise: a seedbed former, with the option of mechanical or hydraulic stone damage prevention; a seedbed cultivator which, where required (for instance in rough, unbroken-furrowed, soil) cultivates via a slow-running rotavator and then reforms the drills – generally, such an implement would only be required for heavy weathered soils and also for areas featuring clay ridges. Additionally required: a Reliance Multi-sieve Chain Separator with from three to five sieve chains, a lateral depositing belt and optionally an extra-large separator with stone bunker as well as a two-row planter and drill former with ridging bodies or drill-forming plates and the option of equipment for precision fertiliser placing and /or wet seed dressing application equipment.

The harvest itself can be carried out with simple machines such as loader or bunker harvesters. The harvesters already on-farm can be suitable where the stone/clod separation equipment can be dismantled or put out of use. Even with 80 cm row spacing the pick-up width of a standard harvester is sufficient.

In most cases, the ground is prepared without ploughing following the potato harvest, for instance with shallow grubbing or disking and immediately sown – this represents an enormous saving. Those that continue to cultivate without the plough have no stones in the tillage horizon in the next few years.

Parameter	Plough	Seedbed cultivator	Separator	Planter
Tractor power (kW)	up to 100	up to 90	up to 90	up to 60
Tyres	large-volume	max 14"	max 14"	12"
Track (cm) in system 180/80	standard	180	180	180
Hydraulic connections	1 x efw[1]	1 x efww	1 x dw[2]	standard
Performance based on 10 hour shifts (ha/h)	0,7	0,5	0,5	0,65

Table 2: De-stoning system performance parameters

System profit in figures

Where potato growing is concerned, the most interesting aspect is naturally the economic efficiency of the procedure. The extra input at the spring has, after all, to be compensated for. Based upon machinery ring costings and contractors' rates, the total procedural costs for de-stoning (without subsequent potato planting) runs at around 500 DM/ha. The key machine here is the separator. *Table 2* indicates system B performances in shifts.

Where the systems are compared (*table 3*), de-stoning operations cost an extra 180 DM/ha. These are completely paid-for, however, by the end result. For this reason, some of the trial farms changed to the de-stoning procedure from one year to the next.

Table 3: Comparison of system costs (DM/ha) (based on 100 ha potato area)

System	A 4 x 75 cm	B 80/100 cm
Power harrow (DM)	80,00	--
Planting 4 rows (DM)	150,00	--
Ridging (DM)	80,00	--
Harvest (0,3 ha/h)	540,00	--
Maintenance (DM)	120,00	100,00
Seedbed former (DM)	--	70,00
Seedbed tiller (DM)	--	50,00
Separator (DM)	--	450,00
Planting 2 rows (DM)	--	180,00
Harvest (0,5 ha/h)	--	300,00
System costs (DM/ha)	970,00	1150,00
Additional costs/ inputs De-stoning procedure		180,00
Input reduction/profit:		
Damage reduction (5 % at 35 t/ha and 150 DM/t)		262,50
Reduction in transport costs through 8% less foreign material (8 % at 35 t/ha, 1 DM/t and km, 5 km average distance)		140,00
Higher market value – premium (14.2 % at 35 t/ha und 150 DM/t)		745,50
Yield increase (12.3 % at 35 t/ha and 150 DM/t		645,75
De-stoning effect according to one year trials on 12 farms		1793,75
Advantages of the de-stoning procedure (DM/ha)		1613,75