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Test of a Harvester-Seeding-System for Winter Wheat in a Self Propelled Six Row Sugar Beet Harvester

by

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Summary:

Reducing costs, energy involved, work time, harmful soil compaction and weather risk the combination of seeding winter wheat and sugar beet harvesting was developed. In field experiments this new harvester-seeding-system called „lifter-seeding“ was tested.

Keywords:

Seeding system, winter wheat, harvester, sugar beet harvest.

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Introduction

To make sure around the competitiveness of the plant production in Germany, in future is consistent cost saving absolutely required. One method decreasing costs is the combination of operations. That reduces work time need, use of energy and harmful soil compression. A possibility is the joining of the harvest of the one fruit with the seeding this one consequence fruit, provided that harvest time and seed time largely agree. The combination of sugar beet harvest and seeding winter wheat, which follows usually in the crop rotation, complies with these conditions. Harvesting of sugar beets is done from the middle of September until the end of November. Late harvesting is often prefered due to higher beet and sugar yields. At the same time the uncertainty in soil preparation and drilling winter wheat increases because of the weather risk [1, 2]. Besides the working peak in the months of autumn can be minimized with the combination of sugar beet harvesting and winter wheat seeding.

Methods

In field tests a self-propelled 6-row sugar beet harvester was equipped with three different seeding systems (Fig. 1). The field trials of the harvester-seeding-system „lifter-seeding" were carried out on two different locations in South-Bavaria in the vegetation period 1996/1997. An area of about 0,5 ha was available to each test variant. The area of each variant was divided in four plots for statistic safety of measurements. All measures of wheat cultivation as fertilizing and chemical plant protection were constant out of the seeding system. On the location B a mounted mechanical seed drill with disc coulters and a working width of 3 m was used in the back of the harvester (Fig. 1, variant I). The coulter spacing was 0,14 m. The seeds were placed in the soil, which was sifted from harvested beets and rolled by harvester wheels. However on the location A the winter wheat was sown as broadcast seed with a pneumatic seed distributor. With 24 flexible tubes, which reached shortly over top of the soil, the seed was spread over the whole working width of harvester. The broadcast seed was carried out on two different positions. On the one hand broadcast seed took place in front of lifting unit (Fig. 1, variant II) and on the other hand the seeding position was in back of the lifters (Fig. 1, variant III). The seeds of winter wheat was covered with the earth from the cleaning units and pressed on by the harvester wheels. The complete working width of the harvester about 3 m could be rolled, because the sugar beet harvester had a swiveled rear axle. All three test plots was covered with chopped beet leaves by the harvester in next parallel drive. The beet leaves, lain on the top of the soil, have two functions. They serve as an isolation layer, which has an positive effect on temperature conditions in top soil for a quick germination. Moreover the leaves give good protection from soil erosion during the winter months.

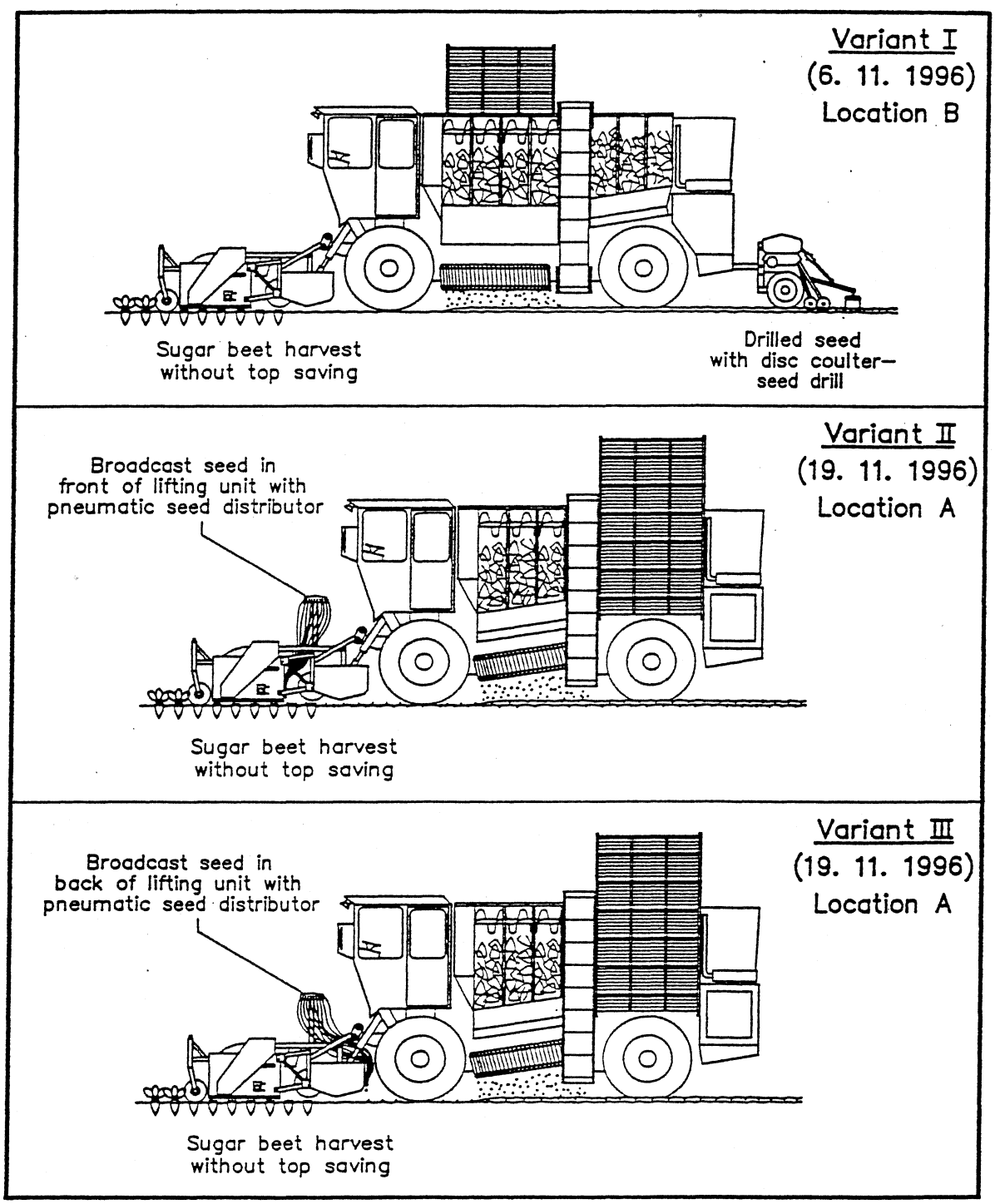

Fig. 1: A 6-row sugar beet harvester equipped with three different seeding systems

At the same day was put a comparison area conventionally drilled winter wheat next to the test plots. The conventional drilling on location B was done by rotary harrow and a seed drill with shoe coulters after cultivating. On location A a rotary cultivator with subsoilers in front and a seed drill with shoe coulters were used. Location A was cultivated with the winter wheat variety „Batis". The seed rate was 220 kg/ha. Against it on location B the variety „Tambor" with 180 kg/ha was sown. Besides the judgement to the quality of seeding the experimental field was observed during the whole vegetation on important growth stages. The growth stages of plant development was determined by the international known BBCH-Scale [3]. Finally the yields of the different variants were measured and for comparison corrected by moisture content. The values are pointed out at 14 % moisture.

Results

The determination of seeding quality was done by the reached seed depth. Figure 2 shows the reached seed depths from all variants. The seed depths had the same level as the conventional plot out of the variant „lifter-seeding as broadcast seed in front of the lifting unit", because the harvester shares cultivated the soil behind the seed application position. After seeding the ground cover with sugar beet leaves came to 60-95 %. So it is really a good protection against soil erosion. By these ground covers of beet leaves it was found, that the wheat in the harvester-seeding-system germinated about 5 days earlier due to the insulating layer of beet leaves. At the emergence and the beginning of tillering it turned out, that between conventional and the „lifter-seeding" variants was a significant difference by the number of plants/m^2 (Fig. 3). The harvester-seeding plots had 7-30 % less plants/m^2.

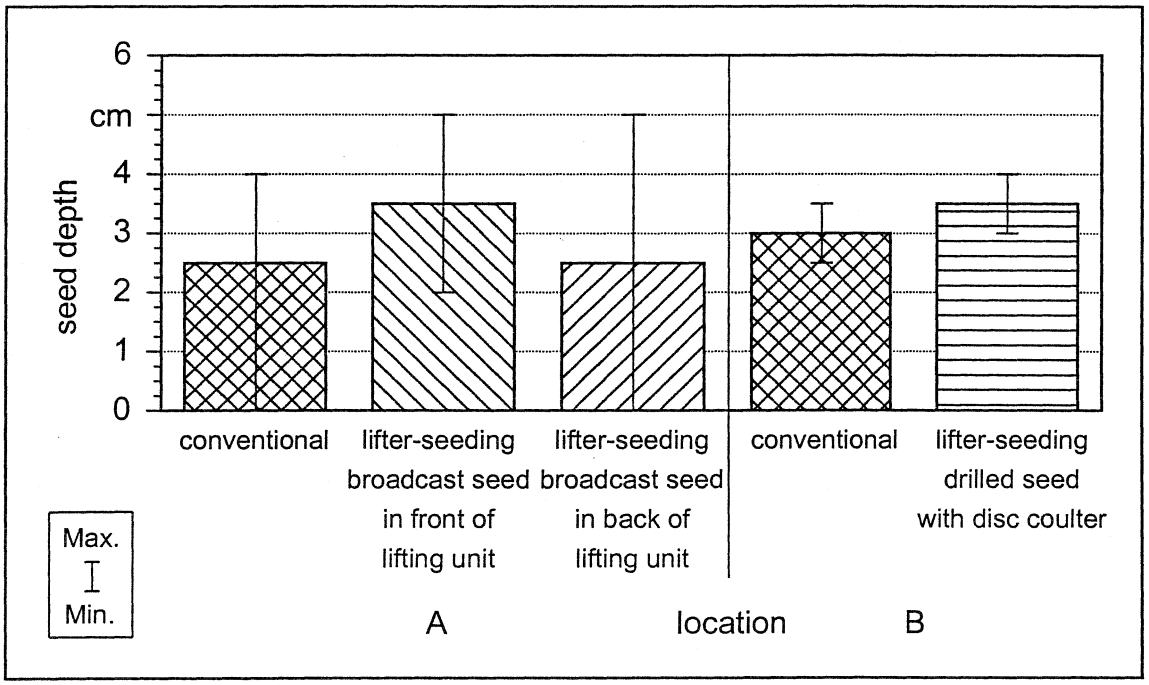

Fig. 2: Seed depths of winter wheat, harvester-seedings-tests, November 1996

But on the stage of fruit development the differences between the variants with regard to ears/m^2 were insignificant (Fig. 4). Also in numbers of grains/ear were observed no significance differences (Fig. 5). That shows, that during vegetation period the plots of harvester-seeding caught up on the lower number of plants/m^2 at the beginning by developing more tillers/plant with ears compared to the conventional plots.

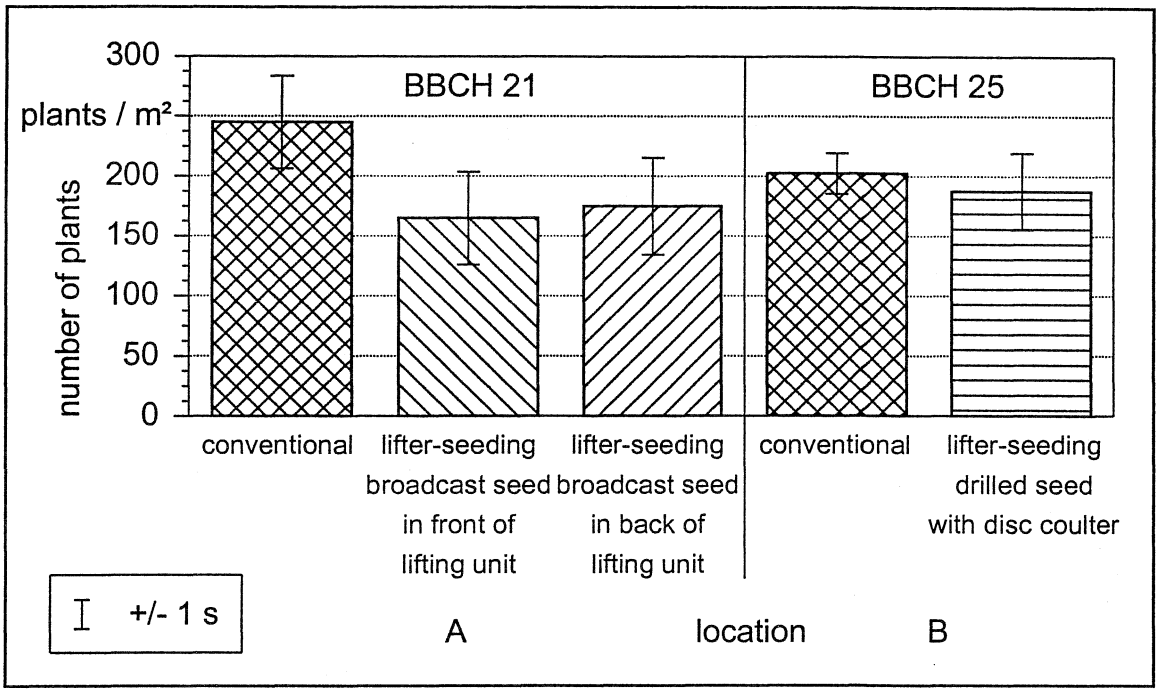

Fig. 3: Number of winter wheat plants in the growth stage starting of tillering, 1997

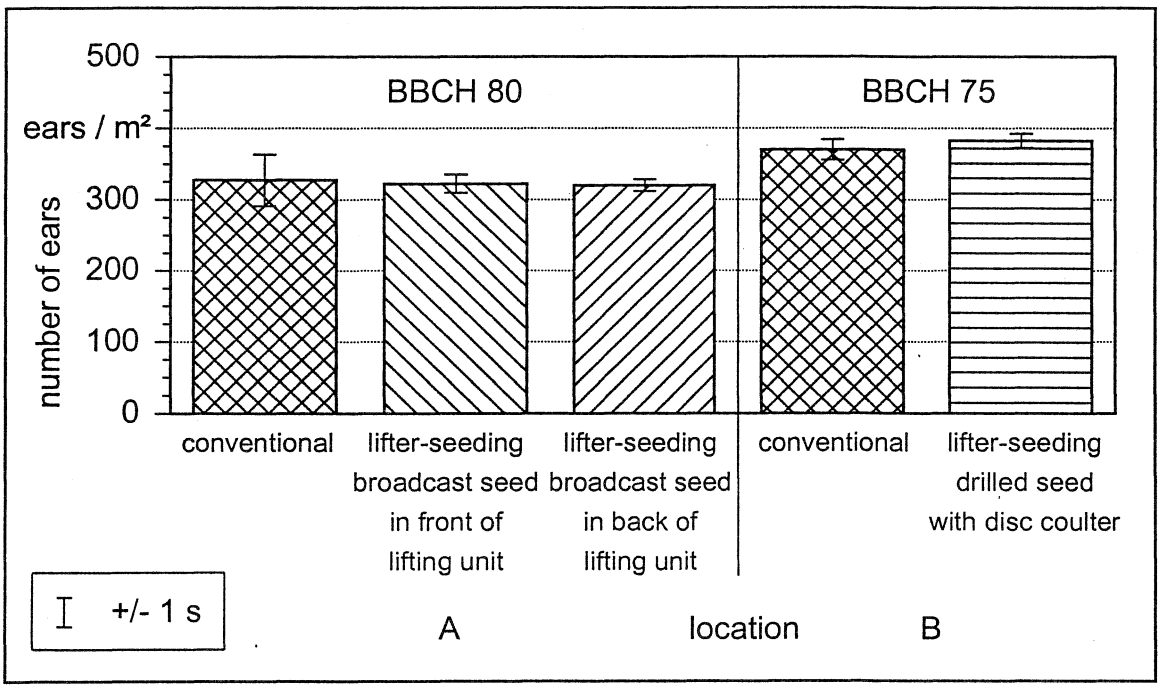

Fig. 4: Number of winter wheat ears in the growth stage of fruit development, 1997

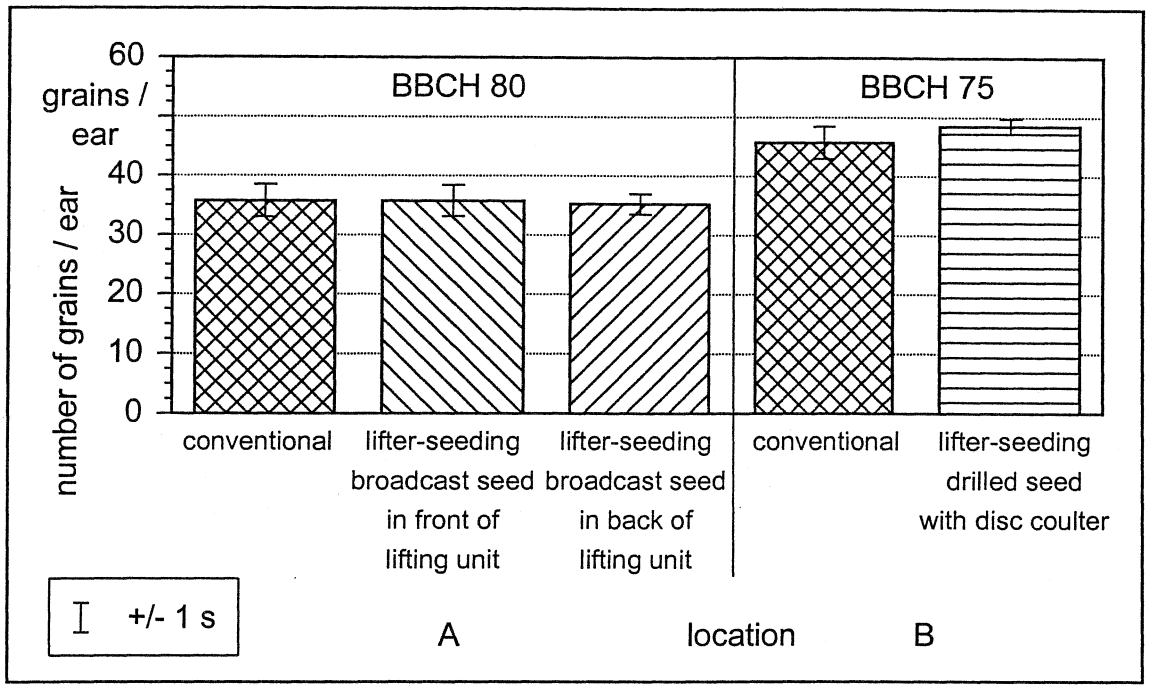

Fig. 5: Number of winter wheat grains/ear in the growth stage of fruit development, 1997

The harvested yields show no significant differences (Fig. 6). The plot „lifter-seeding broadcast seed in front of the lifters" produced 8,53 t/ha and the seed application in back of the lifters reached 9,24 t/ha compared to 8,92 t/ha in the conventional plot (location A).

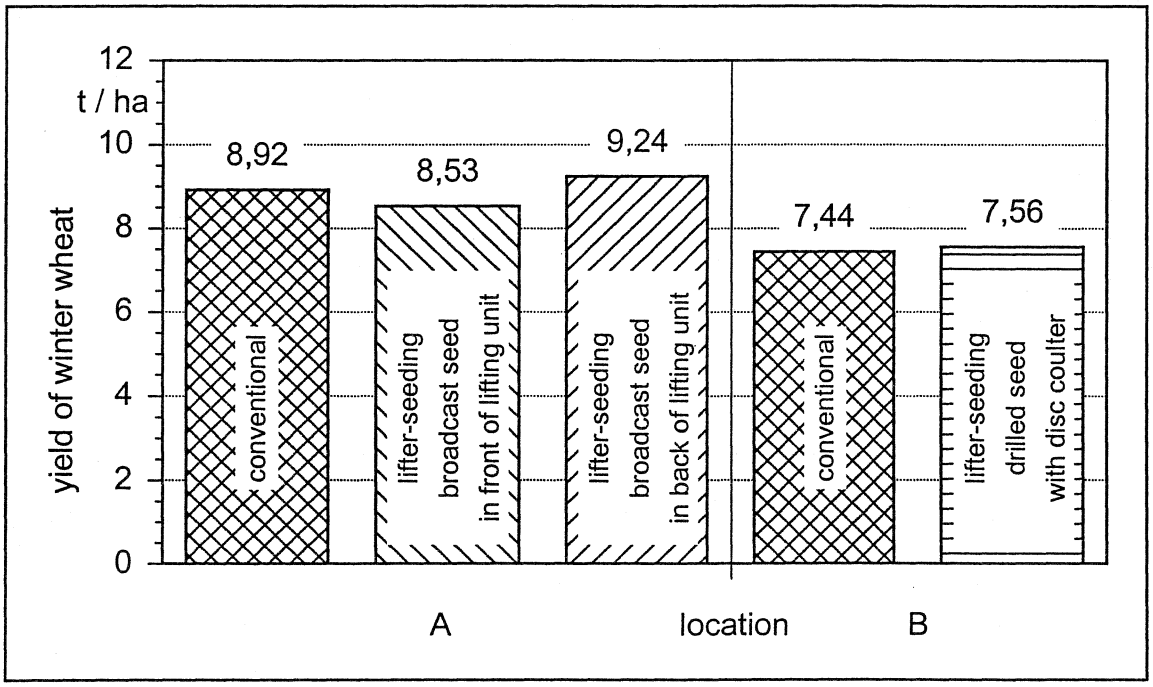

Fig. 6: Yields of winter wheat, harvester-seeding-tests, harvest 1997

On the location B the harvester-seeding-system with mounted seed drill got a yield of 7,56 t/ha compared to 7,44 t/ha in the conventional plot.

During the whole vegetation period between the different plots were found no significant differences in weed species and weed density.

Discussion and conclusions

The results of the tests show, that seeding winter wheat during sugar beet harvesting has no significant influence to the produced yields. Moreover this kind of seeding impedes not the work of harvesting. Only the seed hopper has to be filled up from time to time dependent on hopper capacity. The filling up can made in time of emptying the beet hopper on headland next to a country lane. If the seed is applicated in back of the beet lifters and is covered with the earth from the cleaning units and the chopped beet leaves, so it is a good seedbed for a regular germination. The beet leaves on the top of the soil make a contribution to soil conservation. They protect the soil from erosion during winter and raise the content of organic substance in topsoil.

The harvester-seeding-system not only reduces work time in autumn but also makes possible winter wheat cultivation by late beet harvesting and problematic soil conditions. The alternative is to cultivate spring barley or spring wheat in spring of the next year. These cultures have a lower yield potential and a lower financial profit than winter wheat. This new seeding system it is not practical to seed winter wheat in headland, because on acount of soil compaction by turning manoeuvre of filled harvester its soil structure is not right for it.

Further trials are necessary to optimize the seeding quality and seed distribution of this new seeding technology. Besides the questions are to clarify, which influence have the seeding time and the soil type and which of the winter wheat varieties are the best for the lifter-seeding-system. After that economic investigations about the harvester-seeding-sytem will follow.

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