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Pre-harvest drilling of winter oilseed rape

Because of the increasing discussion on alternative energy carriers (biodiesel) oilseed rape is being spoken about everywhere. However its cultivation has become less viable economically through the Agenda 2000 reduction of the rape premium towards the level of cereals. This means that cutting of costs can have scope in making the crop more profitable.

In pre-harvest drilling of winter oilseed rape (PHD) [1, 2, 3] the seed is distributed in the standing cereal crop by an exact dosage broadcaster. The daylight germinating seed uses the residual moisture in soil to be able to produce a complete cover of new crop after the cereal harvest.

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A user-oriented project featuring pre-harvest drilling of winter oilseed rape – i.e. some time before combining of previous cereal crop – had as a target, alongside investigating the technological requirements, also the expected labour-saving, economical, crop husbandry and ecological soil-protection relevant advantages of PHD in practical conditions.

Investigations

In a practical trial, after choice of trial area with recording of weed and slug density as well as grain and straw yield of opening crop, the hypocotyl length of the pre-winter crop development and green biomass yield as well as the plant biomass in spring, was carried out.

Investigations of soil N_{min}- at drilling time, the pre-winter and spring development stages as well as physical soil parameters were to give, in comparison with conventionally-sown areas, information on Nr. mineralisation during the vegetation in association with the drilling systems.

The recording of the yield parameters and a concluding system cost analysis with the help of farm recording (crop protection actions according to time, materials, costs) permitted an economical comparison of the systems.

The winter rape was drilled by PHD system in Hüttenberg near Gießen (site 1) on 20.7.1999 and in Knüllwald (site 2) on 20.8.1999 with 6 kg/ha of variety Capitol with a broadcaster spreading in maturing winter wheat crop. On the PHD area (site 2) slug pellets (5 kg/ha) were spread with the seed. Basic fertilising took place at the same time with 50 kg PK (16-16). On site 1 the wheat harvest took place on 28.7.1999 and on 22.8.1999 on site 2 whereby the chopped straw was left lying-on the areas. In the conventional system, seeding rate was 3.5 kg/ha.

Application amounts and timing of herbicide, fungicide and insecticide hardly differed between the locations. On site 2, because of a high slug density a second dressing of molluscicide was required. The husbandry of the conventionally drilled comparison areas was carried out as with the PHD areas.

Worthy of note was that no herbicide (Butisan) was applied on the PHD (site 2) area. The low weed density could have been the result of the chopped straw on the soil surface which could have suppressed germination, or even held it up.

Crop stand

Whilst the PHD area on site 2 in comparison to the conventional area showed nearly the same value for crop density (*fig. 1*) both trial variants on site 1 were characterised through larger differences between PHD (33 pl/m^2) and conventional (58 pl/m^2). The lesser emergence on PHD system could have been caused by the dry soil conditions at the time of drilling on site 1.

Volunteer cereal density on the individual trial areas was low to average on the PHD area site 1. The conventionally drilled area was free of these plants.

The PHD area on site 2 had very noticeable amounts of germinated grain along the combine tracks die to sieve losses. An average weed density was recorded for the conventionally-drilled area (*site 2*).

Pre-winter plant development was investigated according to dry matter, growth height, and root neck diameter (fig. 1).

With a crop density of 33 pl/m^2 the PHD variant on site 1 showed a dm of 2 g/individual plant and a growth height of 33 cm. The plants had already developed side shoots and a root neck diameter of 1.3 cm. Density on the conventional variant, on the other hand, was determined at 58 pl/m^2 with 50% less dm per individual plant (1g) with a growth height of 45 cm (no side shoots and pronounced growth in the length).

Differences on site 2 were less. Here the dm weight was 0.7 g/individual plant. The height of the PHD variant plants (48 pl/m^2) was 36 cm and thus 6 cm more than the conventional variant (41 pl/m^2).

The lesser crop density on site 1 led to a stronger development of the individual plants (development of side shoots and reduced height).

The plant-bound Nr. in kg/ha as a product of total Nr. in the individual plant and the crop density lay for both trial variants on site 1 at 116 kg/ha (*fig. 2*). On site 2 due to the plant density of the PHD variant there was 37.5 kg/ha more Nr. bound as on the conventional variant.

According to this, plants resulting from the PHD system bound as much, or up to 38

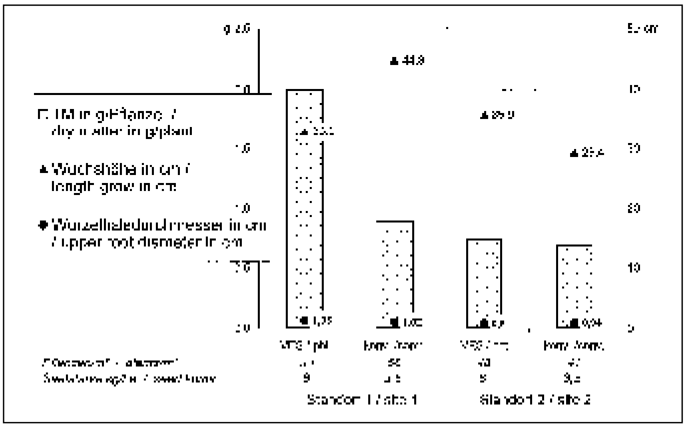

Fig. 1: Pre-winter development condition of winter rape PHD and conventionally drilled crops in comparison

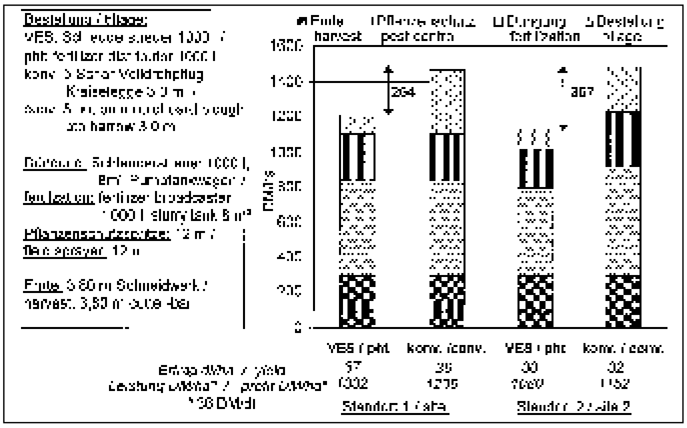

Fig. 3: Comparison of system costs for winter rape in PHD and conventional systems

kg/ha more N, compared with the conventional system because of higher Nr. content in the individual plant and despite less plant density. This meant that residual nutritional material in the soil could be used up.

Because of the mild winter, the crop in spring was only slightly reduced in plant density in total on site 1 to 26 (PHD) and 50 pl/m^2 (conventional) respectively, and on site 2 the plant density had increased to 51 pl/m^2 (PHD) and 46 pl/m^2 (conv.) respectively.

Soil Nr. (N_{min})

After drilling, in pre-winter development stage and in spring, the soil was sampled at three depths in each case for N_{min} content.

On site 1 there were clear differences in Nr. mineralisation at the beginning of vegetation between the comparison variants. Whilst on the ploughed ground, a total of 80 kg mineralised Nr. was found, the largest proportion of which was at the 30 to 60 cm depth, the soil N_{min} value in the soil with the PHD system was only 36 kg/ha.

At the beginning of winter 117 kg/ha Nr. was bound in the plant mass in the conventionally established rape crop and 114 kg/ha in the PHD system (fig. 2). At that time, only minimum amounts of Nr. were found in the soil. According to this, a substantial portion of Nr. was deposited in deeper soil layers as a result of intensive soil cultivations.

Yield parameters

For determining yield, ten plants were taken from every variant and the number of side shoots classified according to their position was determined as well as the pod production on main and side shoots.

With the site 1, PHD plants an impressive pod count of 1,057 per plant was determined, 63% more as that from the plants in the conventional system. The higher proportion of pods per plant is attributable to a 38% higher proportion of side shoots of the first classification, and a 88% higher one of the second classification.

Because of the similar plant density between the PHD and conventional systems on site 2 such a difference could not be determined. The average pod count per plant with both variants was 120.

On both sites there was only a slight difference of yield between the two drilling systems whereby the yield on site 1 was in total around 0.6 t/ha above that on site 2.The reason here could be the considerably postponed combine harvest because of rainy weather which subsequently led to more shedding.

System costs

A comparison of system costs (*fig. 3*) shows that on site 1 where all fertilising and plant protection operations were similar on both variants there was a cost-saving effect of 264 DM/ha for the PHD compared with the conventional system. The reduced herbicide application on the PHD plots on site 2 meant that the saving effect here was 357 DM/ha.

With a performance of 1,332 DM/ha (3.7 t/ha • 360 DM/t) on the site 1 PHD variant and 1,080 DM/ha on site 2 costs of 1,205 DM/ha (in the case of ÜMV work) and 1,130 DM/ha was to be expected on site 2. With this, a margin of 127 DM/ha was to be expected on site1, whilst because of the lower yield almost no margin could be expected on site 2 and there remained for this site only the premium of 966 DM/ha [4].

Thus, the conventional variants showed a great disadvantage from a purely economic point of view with, on site 1, a difference between costs and performance of -173 DM/ha and -334 DM/ha on site 2.

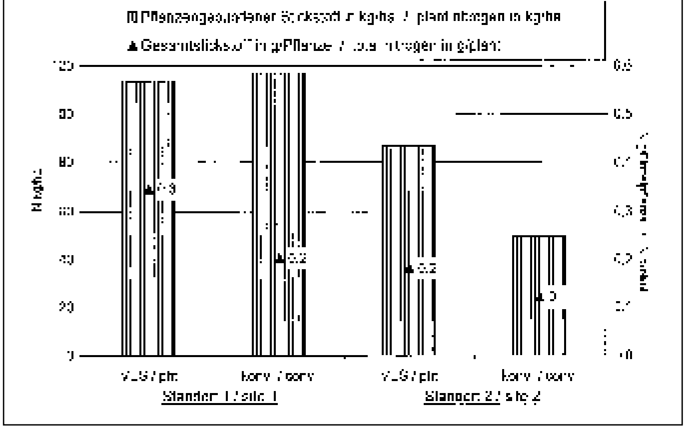

Fig. 2: Plant-bound Nr. after PHD and conventional cultivation and drilling

Literature

[1] *Tebrügge F.* und *M. Wagner*: Vorerntesaat von Raps in Getreidebestände – Erste Ergebnisse und Erfahrungen. Landtechnik 51(1996), H.4, S. 192-193

[2] *Tebrügge F. , A. Wagner* und *H.-P. Schwarz*: Ökonomische, bodenökologische und pflanzenbauliche Aspekte der Vorerntesaat von Winterraps. KTBL-Referententagung, KTBL-Schrift 250, 1998

[3] *Tebrügge F. , A. Wagner* und *H.-P. Schwarz* : Raps in stehendes Getreide säen. DLZ H 49 (1998), H. 8, S. 38-41