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Hohenheimer Measuring Methods on Stubble Cultivation

Evaluation Method for Vertical Straw Incorporation

To evaluate the work process quality of tillage implements, the even incorporation of straw is an important parameter. A soil profile is cut across the driving direction with an asphalt floor saw and then exposed. Classification of the straw portion is done visually with the standardly used lattice screen [1]. The coefficient of variation (CV) is a measure of the straw distribution evenness. Through it similarly designed tillage implements can be compared quantitatively, too.

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For comparing different tillage implements, evaluation methods have to be revised and refined for enabling a fast measurement and repeatable comparability. Thereby not only a possible application on different locations is important but also the comparability of tillage implements with a similar style of construction. Comparative and comprehensive measurements of tillage implements have been carried out for the „Arbeitsgemeinschaft Organisationsgebundene Landpresse (AOL)“ syndicated agricultural weekly papers and within the scope of a DLG-FokusTest for determination of working quality.

Measuring method

The aim of tillage is beside the overall cultivation the even distribution and incorporation of straw remains of the precrop. In order to determinate the horizontal distribution of straw, it can be easily done with the covered soil quantity by measuring the straw content at different test points or areas on the surface [2]. The vertical incorporation of straw is another criterion of the working quality of a tillage implement. Here, the soil is cut crossway to the driving direction at previously determined points at which the precrop was harvested and distributed uniformly by the combine. Redistribution of straw can occur by applying the common method of using a sharp hoe with which the soil is dug up [1]. Furthermore, the effort of time of up to 60 minutes is relatively high considering the necessary repetitions.

In an optimised method the soil is cut open to a depth of 30 cm by an asphalt floor saw, which is normally used for civil engineering (*Fig. 1*). Because of the high circumferential speed of the cutting disc, as well as the slow feed the soil-straw-mixture is cut without an additional movement of the material. Also stones and straw laying in any angle to the cutting direction are cut through. A profile is

Fig. 1: Large and small asphalt floor saw for different working depths

Fig. 2: Preparing of the cut open profile wall, splitted stones and straw

excavated by digging along one side of the cutting area after the slit. As a 3 to 5 mm thick lubricating film results from the cutting along the profile, this film has to be removed with a trowel or a knife (*Fig. 2*).

With this method the soil is cut clearly deeper than the working ground of the tillage implement so a lattice screen for classifying the straw content can be lean against the surface in the correct height. According to the already introduced method the straw content is classified with four 50 cm wide lattice screens having a resolution of 5 to 5 cm and an overall width of 2 m [1]. Furthermore an evaluation in the well known ordinal scale of 0, 10, 25, 50, 75 and 100% is possible.

Assessment

The classification of the vertical incorporation of straw was carried out with four repetitions. Consequently the straw content of each tillage implement is classified at a width of 10 m for each particular depth from 0 to 5 cm, 5 to 10 cm etc. For testing the influence of the classifying people, each profile was classified by four persons. Therefore in the horizon from 0 to 5 cm for example 800 lattice values for each tillage implement were available for assessing.

Studies of the assessment of straw content have shown that through subjective assessment of the classifying people the results show a high variation [2, 3]. That is why the absolute values were compared between the people. A further problem of this method is the varying absolute straw mass at the respective test points, whereas the even distribution crossways to the driving direction is considered. For being able to carry out now an objective assessment of the vertical straw incorporation, the coefficient of variation CV is calculated. Therefore for each person, each profile, and in each horizon the CV is calculated using the mean values and standard deviation. From this another mean value can be calculated again. For one tillage implement for example in the horizon from 5 to 10 cm from four people, that means four CV's out of 200 values one mean CV for this horizon can be calculated. With those mean CV's another mean value for all horizons can be calculated. To test the significance of these values the interaction of the variables tillage implements and classifying person was calculated using variance analysis in a mixed model. Here, a remarkable higher significance of the tillage implements according to the CV was observed in comparison to the influence of the classifying people. Therefore the CV is an suitable value for assessing the straw distribution of tillage implements.

Results

With the application of an asphalt floor saw soil profiles can be prepared without an additional redistribution of straw in a very short time. Therefore soil texture and moisture have no influence on the cutting quality, as measurements on different places had shown. The calculation of the coefficient of variation offers the possibility to compare tillage implements of a similar construction independently of the classifying person In *Figure 3* the deviation of the mean CV of two three girder cultivators and two with disc harrow combined more girder cultivators is shown as an example. The lower is the value the more even is the vertical straw incorporation. A tendency of a more even straw incorporation by a higher intensity of tillage can be recognised.

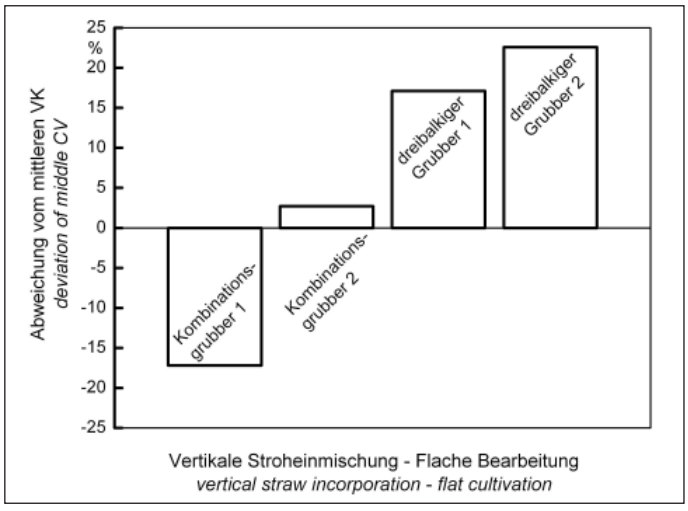

Fig. 3: Deviation of middle CV of the vertical straw incorporation of four cultivators

Literature

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