Universität Kassel

Fachbereich Ökologische Agrarwissenschaften

UNI KASSEL VERSITÄT

1. Prüfer: Prof. Dr. K. H. Köller
2. Prüfer: Prof. Dr. Oliver Hensel

Effects of work depth in conservation farming -
Auswirkungen variabler Arbeitstiefen auf pflanzenbauliche Parameter bei teilflächenspezifischer Bodenbearbeitung

Doktorarbeit vorgelegt von: Thomas Schüle

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Summary

Economical and ecological motives cause farmers to increasingly reduce the intensity of cultivation. Doing without the plough is one aspect and the first measure to be taken towards conservation farming and which involves another fundamental aspect; cultivating at an optimum depth. Farmers often determine the proper work depth by judging from the degree of compaction or cohesiveness of the soil, which is down to the extent air and water can circulate. Any research that is undertaken in this context centres on finding the right work depth that offers the best potential for achieving highest yield in a given field by promoting nearly full emergence and unconstrained growth of roots and shoots.

In blanket cultivation, farmers determine the proper work depth by using a number of parameters, the median form of which is obtained by estimate and experience. However, this method is not very effective when applied to large fields with varying soil conditions. This is the situation where localised farming becomes important. In localised farming a field plot is not defined by the borders of the field but by the varying soil conditions within the same field. After conducting extensive surveys on work depth variation relative to the degree of compaction or cohesiveness of the soil there is evidence that work depth variation has a positive effect on profitability, because it leads to a reduction in tractive power required and fuel consumption as well as to an increase in work rates.

Another aspect is erosion, although this poses different requirements on work depth variation. These are influenced by topography, the amount of crop residue left on the surface and soil structure. Therefore, an approach was developed to prevent erosion relative to the degree of slope and amount of crop residues left in a given plot. This method aims at controlling work depth by an algorithm so that a defined amount of organic material is left on the surface of the field. This way, it is possible to give areas susceptible to erosion special treatment and adapt the work depth accordingly to ensure sustained farming. As the differences in yield potential of any given field inevitably lead to variations in the amount of crop residues, the work conceptualizes and evaluates two methodologies to determine the amount of such residues. To do that, we modified one active and one passive implement in such a way that it was possible to control the depth of the work via an electronic spool valve.

In-field testing took plaee at three different sites in Gennany for aperiod of three years. These tests provided the database far the evaluation of the effeet of variable work depths on agronomie parameters. We defined a depth range as weIl as depth variants far eaeh individual test to take weather and soil eonditions into aeeount, whieh have an inevitable effeet on eultivation.

The tests revealed that gennination deereased in partieular in those plots where eultivation had been shallow and where larger amounts of straw had been left in the seedbed area. However, redueed gennination had no impact on the eventual yield, a phenomenon that is explained by the ability of eereal erop to eompensate. While work depth had only a marginal effeet on the tillering height of the individual plants it did have a signifieant effeet on yield levels at two test sites. The extensive in-field tests give evidenee that there is no immediate eorrelation between yield levels and eultivation depth, yet at the same time they show that a eombination of work depth and weather eonditions does have a major effeet on yield levels .. As a result, shallow eultivation involves a signifieant risk with respeet to sustained yields.

In summary, site-speeifie eultivation offers new and hitherto unexploited options to proteet the resourees of the land while optimizing eosts and yields. It is in partieular the eombination of loealised eultivation and planting teehniques that holds an extensive potential in an overall setting of changing weather eonditions.