Ina Bruhn, Kiel

# Repair costs of tractors and combines

*The data on tractor and combine repair costs on large arable farms and in agricultural contractor enterprises show a very broad variation. Investigations into different factors of influence using covariance analyses determine the age of the machines as measured in total working hours as a relevant factor for an explanation of repair cost trends.*

*Comparisons with older statistics show a decrease in repair requirements with machines. Additionally, the investigation confirmed currently-used calculation aids, even where used for large farms.*

Dr. Ina Bruhn was, until February 2000, a member of the scientific staff at the Institute for Agricultural Procedural Technology, Christian-Albrechts-University (director: Prof. Dr. Edmund Isensee), Max-Eyth-Str. 6, 24118 Kiel;
e-mail: ibruhn@ilv.uni-kiel.de
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Machinery in the upper power class is often applied on cereal farms substantially above the German or regional average for size. Such machines with greater power or working width also tend to be used more throughout the year. When calculating machinery or operational costs difficulties can occur because, as a rule, the available calculation data has been determined based upon smaller farms and with machinery which is less powerful and utilised to a lesser extent. This thesis was tested against a review of tractor and combine repair costs on arable farms in Schleswig-Holstein and Mecklenburg-Vorpommern. Following a few general observations concerning repairs, the results of this assessment are presented in the following paper.

In this work, the wide-reaching definition of the term "repair" is used. Along with the putting of a machine back into working order after a breakdown, this also includes precautionary repairs. The grounds which can lead to machine breakdown are many. On the one hand they can be independent of the farm, e.g., the machine construction, the quality of a part, or the age. On the other hand the grounds could be connected with on-farm conditions, e.g., working hours, the operating staff or the quality of servicing and maintenance. For an analysis of repair costs the individual grounds for the repairs must be known and able to be quantified, or must be constant in the case of machine comparisons.

For this assessment the total repair data and business details were recorded from 35 farms averaging 1000 ha and from four agricultural contractors. This made available information from 210 different tractors and 89 combines.

### Results from tractors

With the investigated tractors a strong variation in repair costs was noticeable even from a year's data. These averaged 4.42 DM/h whereby individual cases included costs of 32 DM/ha or 0 DM/ha. The investigated tractors were comparatively young with an average age of 4.15 years or 3223 working hours.

From the 210 tractors with available repair data, around 80% consisted of the makes Case, Fendt and John Deere. Only data from tractors of these three makes were used in the analysis of repair costs because there was little information available regarding the other makes.

Given in *figure 1* are the repair costs per working hour for the three makes of tractors in association with their annual workload. Because of their large presence in the spot tests the average values of the repair costs and the annual working hours hardly differ from those of the total spot tests.

The presentation underlines the already-described large variation in repair costs. Also noticeable is a decrease in repair costs per working hour in-line with increasing use of the tractor. From this it can be deduced that some repairs are due once per year independently of the number of working hours. The cost of these repairs are naturally divided by a larger number of working hours where the

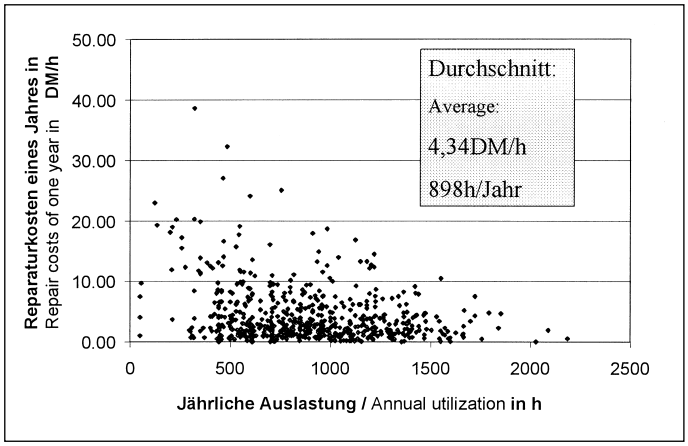


*Fig. 1: Repair cost of tractors with different annual utilisation*

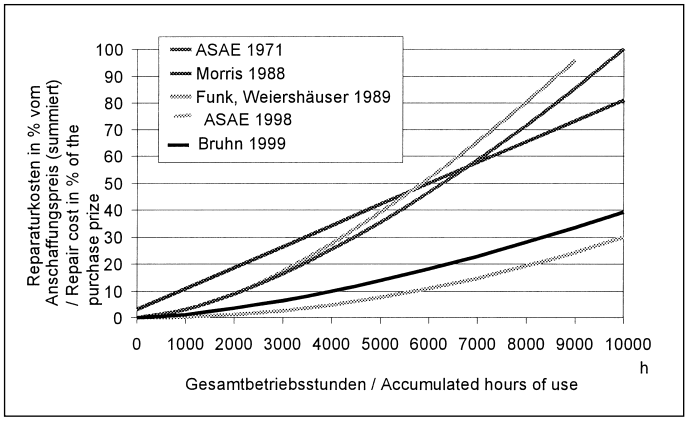


*Fig. 2: Results of tractors in this sample compared with others*

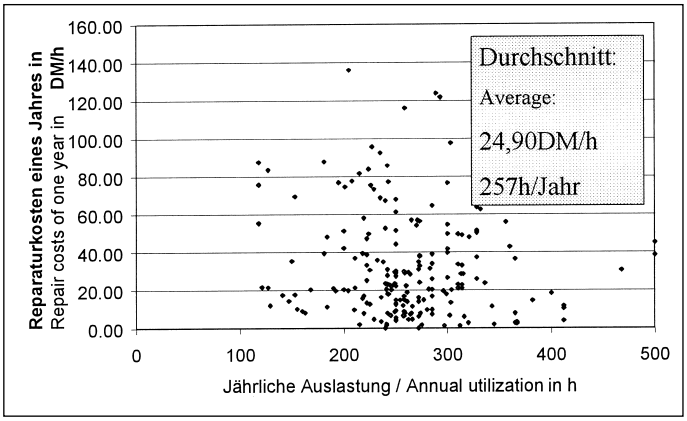


*Fig. 3: Repair cost of combines with different annual utilisation*

tractors are utilised more. However, in a comparison of the average repair costs from groups of tractors with different annual working hour totals no statistically significant differences were shown.

The repair data was also grouped according to other factors for assessment. Alongside the number of hours worked, grouping was according to parameters including size of farm, personnel per 100 ha, the number of seasonal workers and the size of fields. All factors were individually analysed through comparisons with the group average, and in combination with one another with covariant analyses. In these it was shown that the only relevant factor was the age of the tractor reckoned in total working hours. Because of this, the application of covariance analyses was dropped in favour of regression analyses.

A variety of function forms were chosen for the regression analyses. Matching the data material best was the function with the dependant variables "Repair costs as a percentage of purchase price" (y) and the independent variables "Total working hours" (x):

$y = 0.000039 \cdot x^{1.5}$

This function gives the average trend of repair costs for the investigated tractors. The repair costs trend for individual tractors showed, in part, substantial deviations from the average line. Especially farms where the repair costs of machines have been recorded over a few years often have repair costs below the average trend.

Comparing our own figures with those of other authors indicated (*fig. 2*) differences with older investigations. On the other hand there was agreement with investigations which had been carried out in recent years. This indicates that tractor repair requirements has substantially decreased in the passage of time.

The repair costs of tractors in different engine power classes were taken from the KTBL and with the help of correction factors were matched with the increasing ages of the machines. In that the average engine power of the investigated tractors was 131 kW, the sector in which this engine output fitted was taken from the KTBL handbook for comparison purposes. The values for 1999 showed a similar trend for repair costs. On the other hand, a comparison with older data showed a notable reduction in repair requirements in the course of the period.

### Results with combine harvesters

Average repair costs with the combines were 24.90 DM/h. The span here was, however, 0.00 DM/h to 122.90 DM/h. Thus the differences are even more clear than with the tractors. The investigated combines were also very young with an average age of 4.7 years or 902 working hours.

Around 90% of the 89 investigated combines were from the makes Claas and New Holland so that further analyses remained confined to these makes. The presentation of the repair costs per working hour in association with annual working hours showed a strong variation in values. Contrary to the tractor results, the span of the combine's annual working hours is considerably less. Comparisons of repair costs grouped according to combine working hours showed no significant difference in average repair costs between the groups. As with the tractors, different influence factors were investigated individually through comparisons of the group average values and in combination with one another using covariance analyses. The factors with the combines were supplemented with the average yield level of the farm. Here too, the only relevant factor proved to be the total working hours. Thus, in the regression analyses the best matching function was that with the dependable variant "Repair costs as percentage of purchase price" (y) and, as independent variable, the "Total working hours" (x):

$y = 0.00021 \cdot x^{2.1}$

Comparisons with other authors and with the KTBL with the functions for the average repair trend showed, as with the tractors, agreement with the investigation results in recent years and a noticeable decrease in repair costs compared with older investigations.

### Summary

The analysis of repair costs for tractors and combines on large cereal farms indicated that their requirements for repairs can be greatly reduced. Moreover, no difference was found in the average repair costs for tractors and combines on large and small farms, where the repair costs were presented as a percentage of purchase price.

Additionally, the investigation showed that regular recording of the repair costs and comparisons with the average values have a positive effect on the amount of repair costs. Through such comparisons, the grounds for cost variations which can occur can be analysed and, where required, avoided.

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