Dr. H.W. Jack,
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Dear Dr. Jack:

I was interested to receive the coconut results. Unfortunately you do not tell me whether the land was arranged in randomised blocks, or randomised over the entire area; else I could send a complete analysis.

What I have had done is shown first on Sheet A, where you will see two tables for the unmanured and the manured periods, giving average yield per tree for 3 plots each of 17 treatments and 6 plots of the control.

In the second period one of the control sets is the best, which of course speaks against manural advantage, and as this set, though good, is not the best in the previous years, we cannot safely ascribe it to this group having inadvertently better land or trees.

On the same page are analyses of variance for the two periods, and their analysis of covariance. You will easily see what has been done if you turn up Chapters VII and VIII of my book on Statistical methods.
The sum of the squares for between treatments is the sum of the products of the totals and the means for the 18 treatments less the product of the grand total by the general mean. This has 17 degrees of freedom, and leaves 39 for within treatments with the remaining fraction of the sum of squares column. If the land is arranged in 3 blocks, with one plot of each manural treatment, and 2 control plots in each block, you could further deduct 2 degrees of freedom for blocks, with a corresponding sum of squares freed from totals and means as before, leaving 37 degrees of freedom for true error after eliminating the block effect.

The fact that in the first period the mean square within treatments is distinctly higher than that between suggests that you have a block effect, but I cannot identify which plots belong in each block.

If you have a block arrangement, make the adjustment to each total. The covariance table is just like the others save that one takes at each stage the product of the mean for one period with the total for the other.

The purpose of the analysis of covariance is to enable one to make allowance in the manural comparisons for the previous cropping of the plots, analagously to but more
precisely than the method of taking the straight differences. On page 8, is shown how this is done. The regression, , is found by dividing the covariance by the variance in the first period, in the lower line. To find the new within treatment figure, after making the allowance, one deducts from the old figure 7822.67, the product of \( \frac{c}{x} \times \text{times the covariance figure} \ 3649.00 \), so finding 4081.03, which corresponds to 38 instead of 39 degrees of freedom, since 1 has been used in the regression. For the corresponding figure between treatments take

\[
1819.37 - 2 \times (323.24) - \frac{c}{x} (925.05)
\]

giving 2129.09.

I am going over this in detail because, if you have a block effect to deduct, it will have to be done again with the new figures for 37 degrees of freedom, giving a final table

<table>
<thead>
<tr>
<th></th>
<th>Degrees of freedom</th>
<th>Sum of Squares</th>
<th>etc.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Treatments</td>
<td>17</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Blocks</td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Error</td>
<td>36</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

As it stands the allowance reduces the mean square from 200 to 110, so nearly doubling the value of the experiment. Unless there is a block arrangement, however,
the manurial effects are still insignificant.

If there is anything more to be done, I should be glad to go over the material again, as it would, I think, make a good example of analysis of covariance for the next edition of my book.

Yours sincerely,