

19 July 1932.

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Nr Boston,
Lincs.

Dear Mr. Wallace:

I am returning herewith the bulb data. I have made some tests on Emperor Narcissus, which may interest you. Treating the plots as though they had been arranged at random, the analysis for weights lifted comes to

	Degrees of Freedom	Sum of Squares	Mean Square	
Blocks	2	16997.46	8499.7	
Treatments	24	31623.69	1317.9	
Error Controls	5	2561.12	512.2	} 622.6
Remainder	58	36659.88	632.1	
Total	89	87847.15		

The different controls of the same block differ among themselves by just about as much as one would expect from the discrepancy between the performances of different treatments in different blocks; this is shown by the good

agreement of the last two mean squares. The variance for a single plot is 622, and for the mean of 3 plots 207.5 giving a standard error of about 14 ounces. Deviations from the mean of 30 ounces or more ^{will} ~~could~~ therefore be significant, even if we ignore weight planted.

To find what use, if any, should be made of weight planted, I have made a similar analysis of these weights:

Weight planted.

	Sum of Squares	Mean Square
2	0.27	0.13
24	361.32	15.06
5	28.28	5.66
<u>58</u>	<u>593.73</u>	<u>10.24</u>
89	983.60	9.873

and an analysis of the covariance of ~~the~~ two things (*variates*) weight planted and weight lifted.

Covariance.

	Sum of Products
2	+ 25.20
24	+1680.71
5	+64.22
<u>58</u>	<u>+ 378.80</u>
89	+2148.97

The average effect on weight lifted of an extra ounce planted is then given by the ratio of 443.02 to the corresponding entry 622.01 in the table for weight planted.

This comes to .7122. It is interesting that this is actually less than unity, so that there would have been a slight over-allowance error taking straight increases in weight and a considerable over-allowance taking proportional increase for this allows about $3\frac{1}{2}$ ounces for each extra ounce planted.

The effect of making the allowance calculated above (.7122) is shown below:

Weight lifted adjusted for weight planted.

Degrees of Freedom	Sum of Squares	Mean Square
2	16961.72	8480.9
24	29417.85	1225.7
Error 62	38905.46	627.5

One degree of freedom is lost to the error by the adjustment. The precision is practically the same as before, certainly not improved. Consequently, I should be inclined to cut out all the percentage calculations, and to take the straight increase in weight over that planted. This should simplify the calculations considerably.

Yours sincerely,