5 October 1934.

J.B. Hutchinson, Esq.,
Institute of Plant Industry,
Indore,
C. India.

Dear Hutchinson,

I was much interested to read your letter to Ramamathan, as you will have expected, and to hear something further of your progress with cotton problems. If I have understood you rightly, some of the algebra from the foot of page two has got out of gear, though without affecting the comparison in principle, e.g., for the co-variance of an F₂ plant with the mean of its progeny from a back-cross with the + parent my calculations are as follows:

<table>
<thead>
<tr>
<th>f</th>
<th>x</th>
<th>y</th>
<th>fx</th>
<th>fy</th>
<th>fxy</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>-d</td>
<td>h</td>
<td>-d</td>
<td>h</td>
<td>-dh</td>
</tr>
<tr>
<td>2</td>
<td>h</td>
<td>½(h + d)</td>
<td>3h</td>
<td>h + d</td>
<td>h² + dh</td>
</tr>
<tr>
<td>1</td>
<td>+d</td>
<td>d</td>
<td>+d</td>
<td>d</td>
<td>d²</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td></td>
<td>2h</td>
<td>2(h + d)</td>
<td>d² + h²</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>½ h</td>
<td>½(h + d)</td>
<td>½(d² + h²)</td>
</tr>
</tbody>
</table>

giving

\[
\frac{1}{4}(d^2 + h^2) - \frac{1}{2}(dh + h^2)
\]
$$-\frac{1}{4}d(d-h)$$

for the co-variance, and the mean of the two co-variances will be just $\frac{1}{4}d^2$ in place of your expression 3.

About the layout, I am not quite clear what you were aiming at in modifying Ramanathan's plan. You give him 5,000 plants to be picked individually in place of 4,500 and abolish 250 plot yields. I think you are right to be concerned to get as accurately as possible variance values for the different $F_4$ progenies, and the 95 degrees of freedom within your 5 sets of 20 should, I should anticipate, sort them out pretty well in this respect. But you want also to sort them out in respect of mean values, and for this I suppose the average of your 20 plants will not be so good as the aggregate of the 75 plants proposed by Ramanathan.

It is really a question of the economical use of labour, and you and he are obviously in a better position to judge of it than I am. It may be that his programme would be beyond the capacity of his supervisors, but if he can obtain plot values for plots of 75 plants while maintaining economy in the labour of picking, I think there is a good deal to be said for doing so.

One last point: on page 4 you suggest the selection for high parental $F_2$ value with low progeny variance. Is not the mean value better estimated from the progeny than from
the parent, both from the point of view of precision and of avoiding recessive defects.

Yours sincerely,