August 26, 1942

Dear Milne,

I got your paper from Finney, and of course I am very glad for you to make use of the quotation from my letter.

About the blanket test, there is quite a simple formulation which you might find applicable to your experience. Suppose that, in dragging the blanket, there is an accretion of <u>a</u> ticks per yard on the average, and a loss ~~dependent upon~~ proportional to the number of ticks carried at the moment.

On this basis one has the differential equation

$$\frac{dy}{dx} = a - ky$$

where <u>x</u> is the distance traversed, <u>y</u> the number of ticks at any stage, <u>a</u> the rate of accretion measuring the tick population of the pasture, and <u>k</u> a factor representing the rate of loss, and probably dependent on the roughness of the pasture and other conditions. Putting in the condition that <u>y</u> is 0 when <u>x</u> is 0, the solution of this differential equation is

$$1 - \frac{k}{a} y = e^{-kx}$$

so that if one has values $\frac{73}{36}$ & $\frac{103}{36}$ for two valued of x, of which the second is double the first, one has the equation

$$\left(1 - \frac{k}{a} \cdot \frac{73}{36}\right)^2 = 1 - \frac{k}{a} \cdot \frac{103}{36}$$

or simply

$$\frac{k}{a} = \frac{43 \times 36}{73^2} \, .$$

Using now the fact that the average number $\frac{73}{36}$ was attained after 25 yards drag, one has

$$e^{-25k} = 1 - \frac{43}{73}$$

$$\text{or} \quad k = \frac{1}{25} \log_e \frac{73}{30} \, ,$$

whence $\underline{a}$, which measures the number of ticks per yard of pasture which get into the blanket is

$$\frac{73^2}{43 \times 36 \times 25} \log_e \frac{73}{30} \, .$$

This comes to .12245 ticks per yard, or 3.061 per 25 yards, or 6.1225 per 50 yards, and so on.

This seems at least a logical way of dealing with loss of ticks in the course of the drag, and, as the arithmetic to which it leads is easy, I do not see why it should not be used.

Yours sincerely,