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Poulton, P. R., Johnston, A. E. and White, R. P. 2022. Response of three cereal crops in continuous arable or ley-arable rotations to fertiliser nitrogen and soil nitrogen at Rothamsted's Woburn Ley-arable experiment. *Soil Use and Management*.
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Appendix A

N_{\max} is the amount of nitrogen applied to give the maximum yield, Y_{\max} , according to the response curve as an exponential plus a linear trend. This is found by differentiating the expression for the curve and equating the result to zero

$$y = A + B.R^N + C.N$$

Hence,

$$\frac{dy}{dN} = \ln(R).B.R^N + C = 0$$

Rearranging this gives

$$N_{\max} = \ln\left(-\frac{C}{B.\ln(R)}\right)/\ln(R)$$

Note that this is a maximum iff B and C are < 0 .

Substituting N_{\max} into the exponential plus linear expression gives

$$Y_{\max} = A + B.R^{N_{\max}} + C.N_{\max}$$

Or in terms of the parameters A , B , C and R

$$Y_{\max} = A + B.R^{\ln\left(-\frac{C}{B.\ln(R)}\right)/\ln(R)} + C.\ln\left(-\frac{C}{B.\ln(R)}\right)/\ln(R)$$