A validation study of Victoria's superphosphate optimizing model "Superate".

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Due to the increasing price of super, the reduction in pasture responses due to long term super use (1, 2.) and the continued fluctuation in animal prices, it has become imperative to find some means of objectively predicting optimum economic super rates for pastures. To this end, the Western Australian (3), N.S.W. (4) and Victorian Departments of Agriculture have developed computer models based on local and interstate data. I know of no validation on these models except that implied in the inherent errors of the relationships used in the models. This paper outlines a validation study carried out on the Victorian "Superate" model. Compares predicted responses and economic returns with the responses and returns actually recorded at experimental sites over three years.

Method

Pasture yields at a range of superphosphate rates, obtained from 53 sites located in a very varied environment, were used as a test set of response data. An exponential function of the form y= a-a*b*exp(-c*P) ...(i) was fitted to the data from each site and the optimal phosphate (P) rate for each site was calculated from the equation Optimum P=1n(a*b*c/Vx/Vy)/c ....(ii) where y = yield of pasture dry matter (DM) kg/ha. y opt = at optimal P, a = maximum yield fertilizer non limiting (kg DM/ha), b= response to P as a proportion of "a" (range 0-l),c= curvature of response curve (ha/kg DM), P= rate of elemental phosphorus applied (kg/ha), Vx= price of elemental P(0/kg), Vy= value of pasture produced, for this exercise valued at 2?/kg DM except for drought years when it is valued at 40/kg DM. The profit from using the optimal P rate at each site was calculated from - nett return (Nr)=(y opt-y zero) *Vy..(iii). Where y zero = y at zero P.

In the Superate model, yield in response to applied P is calculated from equation ...(i) using values predicted from average annual R, "available" soil phosphorus z(Olsen method) aDd soil texture such that a= 9.5*R, b=0.12+0.88 exp (-0.25*z) and c= 0.15 for sands, sandy loams and loamy sands and 0.055 for all other textures, i.e. fine sandy loams to clays. In the validation exercise predicted a,b and c values for each site were inserted into equation ...(ii) in order to calculate the predicted optimum P rate. Since an average season must be assumed, Vy was fixed at 2?/kg DM and profit was calculated as in equation ...(iii).

The standard District recommendation for this Region was 80 kg super where Olsen was 10 ppm or less, and nil super where 0lsen exceeded 10 ppm. Yield at the appropriate P rate for each site, using these criteria, was calculated using equation ...(i) then profit using equation ...(iii).

Results

The average profit from all 53 sites, using optimum P, Superate and the District recommendations were compared using the 1980 super price (70?/kg P). The profits were: "perfect knowledge" $12.83/ha, Superate $11.00/ha (90% of perfect knowledge) and District recommendation $7.74/ha (63% of perfect knowledge). Superate performed well because it allowed for a range of responses depending on soil test, differentiated in response between soil textural categories and gained marginally by allowing for the potential differences in yield associated with the range of rainfalls. No previously available Victorian method had objectively taken these factors into account.

1. Curll, M.L. and Smith, A.N. 1977. Aust.J. Exp.Agric. and An.Husb. 17,969-975.

Potter, J.S. and French, R.J. 1971. J.Ag.S.A. 74,131-138.

Bennett, D. and Bgwden, J.W. 1976. In Proc. D.N.E. Symposium, 'The efficiency of phosphorus utilization', editor Blair, G.J.

Helyar, K.R. and Godden, D.P. 1977. J.Aust. Inst.Ag.Sci. 53. 22-30.