

Colwell J D. The estimation of the phosphorus fertilizer requirements of wheat in southern New South Wales by soil analysis.
Aust. J. Exp. Agr. Anim. Husb. 3:190-7, 1963.
[Division of Soils, CSIRO, Canberra, ACT, Australia]

Wheat yield data from fertilizer experiments are used to establish direct relationships between soil phosphorus analyses and economic fertilizer requirements. Problems due to effects of variations in growing conditions amongst the experiments are reduced by the use of yield response to fertilizer as a dependent variable for regressions. [The *SCI*® indicates that this paper has been cited in over 140 publications—the most of any paper published in this journal.]

Jeffrey D. Colwell
Division of Soils
CSIRO
GPO Box 639
Canberra, ACT 2601
Australia

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The research described in this paper was carried out at a time (circa 1960) when the use of simple methods of soil analysis to obtain so-called soil test values that could be used to estimate fertilizer requirements was regarded with a general scepticism, particularly in Australia. Crop yield levels are obviously affected by many factors, such as the weather, so it was reasoned that direct and simple relationships could not exist between fertilizer requirements and a simple variable like a soil test, except in special situations as with glasshouse-grown plants. Moreover, although soil testing services existed in many countries, they were mostly not based on direct or convincing scientific relationships but rather on quasiscientific rationalisations from results of glasshouse studies or relationships to relative or percentage yields obtained by dividing real yield data by an estimate of the maximum attainable yield at ex-

periment sites.¹ A project was planned accordingly to show problems in using soil tests to estimate fertilizer requirements. The results also showed, however, a means of coping with the problems and indicated a direction for soil fertility research that is still being followed 23 years later.

For the project, 27 experiments were carried out in a variable region to measure the effects of a range of fertilizer application rates on wheat yields. Some test analyses for the experiment sites showed the expected poor relationship with yields, but it was noted that there were relationships with the yield responses to the fertilizer applications. Unacceptable levels of experimental error were also noted in the soil test determinations by most of the available procedures because of the low amounts of extractable phosphorus in the soils, especially with a sodium bicarbonate (NaHCO_3) extraction procedure.² These errors were reduced by adopting a then-new method of P analysis that had been developed for sea water, and, in the case of the NaHCO_3 test, by modifying the extraction procedure. The soil tests then showed good relationships with the yield-response data, the best being for the tests with the modified NaHCO_3 extraction procedure. Moreover, these relationships could be used for direct calculations of optimal fertilizer rates.

The results attracted considerable attention at the time because of the prevailing scepticism and led to the use of the new NaHCO_3 P test procedure in many other projects. The most important result for me was not, however, the new soil test method, but rather the discovery that problems due to variations in yield level could be simply overcome by the use of yield-response data for correlation with soil analyses.

Subsequent research has led to much more sophisticated statistical procedures for relating the data of fertilizer experiments to factors that affect crop yield.^{3,4}

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3. Colwell J D & Morton R. Development and evaluation of general or transfer models of relationships between wheat yields and fertilizer rates in southern Australia. *Aust. J. Soil Res.* 22:191-205, 1984.
4. Colwell J D. *Computations for studies of soil fertility and fertilizer requirements*. Slough, England: Commonwealth Agricultural Bureaux, 1978. 297 p.