A SUCCESSFUL PASTURE SOIL NUTRITION PROGRAM

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Summary. Previous attempts to encourage correction of soil nutrient deficiency in pastures in a 20 million ha region of Northern and Central inland NSW have failed (1). Land holders, researchers, advisers and agribusiness dismissed the issue as not feasible in these erratic and lower rainfall districts. A program began in 1983 to address this situation. It involved 79 experiments and a major extension program (1, 2). Data from these trials, combined with ground cover and erosion studies by the Department of Land and Water Conservation (DLWC), provided the platform for the extension program. The program, in the last three years titled *Saleable Stock from Stable Pastures*, aimed for substantial adoption of fertiliser use to correct deficiencies and promote better plant cover to reduce erosion. The extension program included large numbers of field days, meetings, seminars, production of videos, publications, radio and TV presentations, repeated over a 10 year period. Adoption from less than five to over 60% has occurred in some districts. The estimated eventual annual value of the program to NSW is over $200 million, together with substantially improved sustainable land management.

INTRODUCTION

Superphosphate and introduced legumes such as subterranean clover were first used commercially at the turn of the century in higher rainfall favoured areas of NSW (1). By the 1950's adoption of sub clover and superphosphate spread to the tablelands, southern slopes, and some central slopes areas. However, the *pasture revolution* failed to affect most of the north western slopes and plains, the upper hunter and most of the northern half of the central west slopes and plains (1), presumedly because of less favourable climatic conditions.

A small number of pre 1980s' trials indicated major soil deficiencies existed throughout the area (3, 4). However the information was largely ignored because rainfall was considered too erratic and too low to obtain economic responses to fertiliser. As recently as 1992 (5) and 1995 (6) pasture extension publications targeted at this and adjoining regions totally ignored soil nutrient deficiencies in pastures, or reported the environment was too dry or unreliable to consider fertiliser application. Research had also failed to examine what soil nutrients were deficient and how much would be required over a period of time to correct these problems (3, 4).

DLWC researchers had highlighted the need to improve plant ground cover to reduce erosion problems on grazing lands (7). Clearly there was a joint need to correct soil deficiencies and to increase ground cover in pastures throughout the region.

METHODS

Between 1983 and 1994, 79 pasture-fertiliser experiments were conducted by extension and research agronomists across the region. The area included Condobolin in the south west, Coonamble in the north west, Narrabri and Yetman in the north, Tamworth and the Upper Hunter in the east and Mudgee, Wellington and Parkes in the south (1, 2).

Most of the experiments addressed phosphorus, sulphur and molybdenum deficiency in permanent legume based pastures (1). Most soil types of the region were represented. Generally relatively low rates

of nutrients were tested, 10-20 kg/ha P, 10-45 kg/ha S and 25-50 g/ha Mo. Several trials examined long-term residual benefits of fertiliser (e.g. 10 kg/ha P, 42 kg/ha S over eight years on high P but low S soils, and 10 kg/ha P plus 13 kg/ha S on low P, low S sites).

Data from these trials were combined with results from research conducted by the DLWC (7) on plant ground cover and soil erosion risk, to form the basis for an extension program, to promote the need for soil nutrient correction and better pasture management. The program, given the formal title *Saleable Stock from Stable Pastures*, included economic analysis of the trials, field days, seminars, video production, TV and radio segments, publications, and surveys (1, 2). The extension program was carried out for over a decade. Agri-business, bankers and farmers were targeted using the above techniques, while one to one follow up visits were also important.

RESULTS

Fertiliser trials

Almost all of the trials responded to fertiliser. On average pasture dry matter yield was doubled by conservative rates of fertiliser (e.g. 10 kg/ha P, 13 kg/ha S) (1). Where pasture quality was measured, protein and digestible energy showed large improvements (1).

Almost 90% of sites responded to S. Just over 50% showed major responses to P. On the relatively low P responsive sites the addition of a small amount of P with S nearly always resulted in improved yield compared to a straight S fertiliser. Mo responses were common, but generally not large and not confined to acidic soils.

Higher rates of P and S fertiliser (20 and 26 kg/ha of P and S compared to 10 and 13 kg/ha respectively) increased yield by a further 27%. Because of bias against expenditure on fertiliser and the large response to the lower rates, it was felt that extension efforts should be concentrated on promoting the lower rates.

Trials also examined long term residual value of the relatively low rates of fertiliser. These trials showed residual benefit to pasture where previous research had not (4). For example in a trial at Ulamambri, 15 km south-east of Coonabarabran, 100 kg/ha SF45 (5.6% P, 42% S) applied in 1987, continued to show a good response six years later (Table 1). Repeat applications of SF45 after five to seven years indicates however that the responses are decreasing.

On low-P, low-S sites, applications of 10 kg/ha P and 13 kg/ha S generally responded well for the first two seasons, less well by the third, and almost no response by the fourth year (Table 2). One trial, at Tamworth, measured ground cover levels after a severe drought in 1994 (8). Fertiliser greatly increased ground cover levels. The no fertiliser treatment carried inadequate ground cover to prevent significant erosion (49% verses well over 80% for regularly fertilised areas).

Estimated increases in livestock income from fertiliser programs, based on the above results, are $30 to $45/ha/year, for an annual outlay of $6 to $8 (1).

Extension program

Table 3 shows the increase in adoption of fertiliser for the Coonabarabran district. Adoption in the early years was almost non existent, yet farmers attended field days and seminars in large numbers from the beginning. Adjoining areas such as Dubbo, Mudgee, Scone, Wellington, Narrabri and Manilla, have also experienced increased rates of adoption resulting from the program.

Table 1. Pasture production (dry matter, kg/ha) from a moderate/high P, low S site (near Ulamambri). Spring measurements of Autumn, Winter, Spring productivity.

Year	No Fertiliser	100 kg/ha SF45 1987 only	100 kg/ha Single applied annually,
1987	300	500	500
1988	1100	5900	6900
1989	1100	7400	5700
1990	700	1800	8000
1991	600	1800	2100
1992	400	1100	1700
1993	700	3900	5500

Table 2. Pasture production (dry matter, kg/ha from a low P, low S site (near Binnaway). Spring measurement of autumn, winter, spring productivity.

Year	No Fertiliser	100 kg/ha Single 1988 only	100 kg/ha Single annually
1988	900	4200	4200
1989	1100	3800	5200
1990	1100	2500	4900
1991	500	1000	2200
1992	900	1100	1800
1993	900	1400	4800

Table 3. Adoption of fertiliser usage on pastures - Coonabarabran Agronomy District. Data compiled from fertiliser sales figures, fertiliser agent inquiry, and Coonabarabran NSW Agriculture agronomist's annual report estimates.

Year (a)	Farms (%)	Year	Farms (%)	Year	Farms (%)
1983	<5	1988	15	1992	45

1984	<5	1989	20	1993	55
1985	<5	1990	30	1994	60
1986	7	1991	40	1995	65
1987	10				

Surveys conducted in 1993 and 1995 (9) show that farmer attitude towards better pasture management to reduce soil erosion has changed positively (Table 4).

Anecdotal evidence (10) indicates that productivity and quality of produce have improved as a result of the project. At Binnaway, a major stock selling centre 25 km south of Coonabarabran, auctioneer Bill Tatt (pers. commun.) reports that in 1983 Binnaway was only a store market with hardly any quality animals. Today the market is rated as a quality one for domestic feedlot and export animals. Evidence from other project centres supports the fact that the best finished and the best quality stock consistently come from fertilised pastures.

Table 4. Producer survey: Knowledge of required ground cover to prevent significant soil erosion (% of respondents answering each category).

Minimum ground cover needed to prevent significant erosion		
Survey	Less than 70%	70% or greater
1993	52	48
1995	30	70

Source: McDonald (9).

CONCLUSIONS

The successful adoption of a technology once considered impossible to promote can occur if a well researched and promoted program is undertaken. Generations of previously held beliefs require changing, including that of agri-business and professional agriculturalists.

The success of this program is believed to be because it is based on local research , the message was tailored to the market (cash strapped land holders) and the message was repetitive for over 10 years. That relatively low and infrequent rates of fertiliser were economically attractive was an important finding. The need to continually promote the message over a long period, including one to one extension, cannot be underestimated. If the program had ended under 10 years it would have failed. Farmers need to be convinced fertiliser not only works in good years but that they will also get a good return on their investment following dry times. The program is simple but its lessons have enormous implications.

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