Risk reduction one of many benefits from manuring

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RESEARCH BY CONSULTANT ROBERT PATTERSON SUGGESTS BROWN-MANURING LEGUMES CAN REDUCE RISK AND INCREASE THE RESILIENCE AND SUSTAINABILITY OF CROPPING PROGRAMS WITHOUT LOSS OF PROFITABILITY.

Can growers without livestock afford not to use green or brown manures?

Peter McInerney, principal of 3D-Ag Consulting, poses the question in the context of production systems under pressure from herbicide resistance and increasing fertiliser costs and in light of the experiences of clients who are using green or brown manuring.

Peter, who is based in southern NSW, believes manure crops could be the key to genuinely sustainable continuous cropping.

Robert Patterson, a principal of Rural Management Strategies, also questions whether continuous cropping sequences involving only canola and wheat, which are common in central NSW and many other regions, are sustainable.

Both men see green – and brown – manuring as a good risk management option.

"Extending the rotation to include a legume manure stand reduces production risk by reducing input costs and providing a buffer against price volatility," Peter said.

He sees many similarities between manuring and pastures.

"Manuring is in many ways pasture without the livestock, although it is possible to graze during the manure phase. A legume-based manure crop can contribute nitrogen and provides opportunities for weed control and a disease break.

"A legume-based manure crop can mimic many of the important attributes of a pasture phase while giving 98%-plus control of weeds."

Green manuring involves working growing vegetation into the soil. Brown manuring involves spraying out growing vegetation and leaving it to break down on the soil surface.

Both methods provide similar benefits but Peter is inclined to think green manuring provides greater biological benefits in the soil than brown manuring. He has no scientific data to support that at this stage, but results from paddock-scale field trials conducted by several of his clients suggest there are differences in favour of green manuring. And green manuring does not require use of a herbicide unless follow-up spot spraying is needed; a significant consideration in a production environment in which herbicide-resistant weeds are increasingly common.

"A manure phase can help improve whole-farm profitability," he said.

"The move away from mixed farming to continuous cropping has seen a decline in legumes in the farm system, which has increased the need for nitrogen fertiliser. Research shows that two years of legume or pulse crop in a seven-year cropping cycle are needed to sustain a continuous crop rotation in the medium to longer term."

While there is a tendency to focus on legumes and their capacity to supply nitrogen for subsequent grain crops, there

is evidence of biological benefits from green or brown manuring any stand of vegetation, leguminous or not.

And in an environment in which the risk of weed populations developing resistance to herbicides is increasingly more common and significant, timely green or brown manuring can, like cutting hay before embryo formation, reduce weed seed set by more than 98%, he said.

"Many growers reject the idea of manure crops on the basis that they make no cash contribution to the business in the year they are grown, but this overlooks the wider benefits including risk management, nutritional and soil health benefits, weed control and the disease break. And there are options that will generate an income in the manure year without significantly reducing the benefits from a manure stand provided it is well managed and terminated before weed seed set.

"These options include cutting the stand for hay then terminating any regrowth, or value-adding by grazing the manure paddock, whether you have your own breeding program, buy in stock for finishing or agist animals from a neighbour.

"Businesses that have adopted manuring as part of their continuous cropping programs are increasingly agisting stock or buying in trade stock, provided the prices are right, to make use of the available feed.

"Reducing the biomass with stock has some management benefit because it improves herbicide coverage when it is time to spray out the stand, assuming brown manuring is the technique being used, which improves the level of weed control with the 'manuring' spray.

FIELD PEAS ARE A GOOD BROWN-MANURE OPTION BECAUSE THEY COMPETE WELL WITH WEEDS AND PRODUCE PLENTY OF BULK.

"An appropriate choice of manure crop species or mix can make hay a viable option if there is a market for it and the price available justifies the cost of hay making.

"The key is not to lose sight of the objectives of the manure crop and to be sure to terminate the stand at the growth stage required to gain the nitrogen, soil health, weed control and herbicide resistance benefits."

A decision to use green or brown manure needs to be based on clear management objectives and the timing and placement of a manure stand needs to be planned to maximise the benefits of it, Peter said.

For many of my clients, choosing between green or brown manure comes down to the equipment available.

"A manure stand is not a 'set and forget' option. It needs the same level of planning and management as any other crop. That includes identifying the appropriate timing for a manure stand within the crop sequence to achieve the maximum benefit in the season it is grown and from flow-on effects in subsequent seasons.

"And it needs to be monitored closely and terminated at a stage that will maximise the biological 'manure' benefits' and the weed control and herbicide resistance benefits.

"Choose the species and varieties that fit your district, the intended purposes and budget. A high-density legume mix can provide a good bulk of biomass suitable for grazing or making into hay and can be a cost-effective choice.

"Any of the pulse varieties can be used as long as the stand is terminated as planned. A late decision to allow a manure stand to run through to harvest will let all the weeds in it set seed and increase the weed seed bank instead of reducing it."

Whatever the specifics of the program, timing is critical, Peter said.

"The more vegetation the greater the biological benefits, but to reduce seed set and the selection pressure for herbicide resistance the stand needs to be terminated, or hay made, if that is part of the program, before weeds can set seed.

"For many of my clients, choosing between green or brown manure comes down to the equipment available, with access to an offset disc or similar implement making green manuring an option.

"The up side of green manuring is achieving a good level of weed control without using a herbicide plus the improvement in soil health and subsequent availability of nutrients. However, a single cultivation may not achieve the desired 98%-plus weed kill and a spray is often needed to kill regrowth.

"If brown manuring is the preferred option, growing a legume-based manure stand allows the use of herbicides with different modes of action as well as providing a break that disrupts cereal pests and diseases."

He sees green or brown manuring legumes as an efficient way of providing crops with what he describes as 'home-grown, slow-release' nitrogen.

"Manure stands with a high legume component can make significant contributions to soil nitrogen, with legume nitrogen becoming available to following crops over several years, with the amount of nitrogen and when it becomes available influenced by the choice of legume, the bulk of the legume stand, soil type, rainfall and temperature.

"Growing a leguminous manure crop will reduce the need to apply fertiliser nitrogen to following grain crops and avoids the risk of problems from excess nitrogen because a legume-based system tends to be self-regulating, with the legume stand performing at the same level as cereal crops in the same growing environment.

"Applying urea, for example, will provide crops with a sudden 'hit' of nitrogen. The release of 'organic' nitrogen from biological sources such as legumes tends to be regulated by temperature and moisture levels that relate closely to growing conditions, so leguminous nitrogen tends to become available at the rate needed by crops growing in that environment.

"Biomass is the key to nitrogen accumulation and the amount of biomass produced is determined by rainfall, soil fertility and sowing time. A legume manure should produce enough soil nitrogen for two to three crops in any given rainfall zone."

This extended 'nitrogen effect' can make

it difficult to define the dollar benefits from a manure crop without analysis over the length of the rotation, he said, but he has no doubt that manures are a good tool to minimise production and financial risks.

They can also contribute carbon that, with the right balance of nitrogen, phosphorus, potassium and sulphur, can improve the soil environment and can improve the amount of soil moisture available for the following year's grain crop.

"Terminating a manure stand at the right time, usually early in spring at the very start of flowering, limits the amount of moisture it uses and leaves more water in the soil for the next season's crop," Peter said. "Brown manuring also provides surface cover that serves as a mulch, minimising evaporation and keeping the soil cool."

According to Robert Patterson, who is based in Cootamundra, volatile rainfall patterns and less available moisture, coupled with an increasing reliance on artificial nitrogen fertiliser and selective herbicides, has significantly increased the risk profile of farm businesses relying on continuous cropping.

"Actual farm data from recent years suggest businesses with brown manure legumes as part of their farming systems are more resilient in dry years and more sustainable overall because they are less reliant on selective herbicides for weed control and artificial nitrogen for crop nutrition," he said.

"Continuous croppers focus on achieving a cash return from each paddock each season but a crop production system comprising brown manure legumes, canola, wheat and barley can be as profitable as continuous cropping with less production and financial risk.

"For growers who prefer not to engage in mixed farming involving livestock, it appears that a brown manure legume system can produce acceptable financial results with a lower risk profile than continuous cropping."

Vetch is a common brown manure crop but Robert favours early-sown field peas because they can be more competitive with weeds and can produce more dry matter than vetch, particularly from later germinations.

"Higher dry matter production should lead to more nitrogen accumulation while more cover provides more shade on the soil surface, reducing evaporation and the amount of sunlight available to germinating weeds."

A MANURE CROP CAN BE CUT FOR HAY WITHOUT GREATLY DIMINISHING THE FLOW-ON BENEFITS FROM IT PROVIDED THE MANURE STAND IS WELL MANAGED AND THE HAY CUT WELL TIMED, SAYS PETER MCINERNEY.

Brown manure legume crops provide three major benefits over long fallowing, Robert said.

"Manure stands compete with weeds, reduce the need for knockdown herbicides during the growing season, lead to accumulation of soil nitrogen and provide ground cover during the growing season and over summer ahead of the next crop. In addition to reducing moisture evaporation from the soil surface brown manure residue reduces wind erosion and provides a better environment for germinating weeds over the summer, opening the way for maximum weed control.

"No nutrients are exported from a brown-manured paddock in the 'manure' year unless the paddock is cut for hay or grazed ahead of the manuring process."

The major disadvantage of brown manure compared with long fallowing is the cost of the grain legume seed, usually $30 to $35/ha, plus the cost of sowing, he said. However, these costs are low in the overall scheme of things.

"Manure crops should be sown early and legumes sown for manuring are not usually fertilised at sowing unless soil phosphorus levels are low because early-sown legumes show relatively little response to phosphorus."

He favours phases of two successive years of broadleaf crops – a manure stand followed by canola, for example – because one year of wild oats control does not reduce weed numbers sufficiently to eliminate the need for grass control in the following wheat crop.

"It is becoming increasingly common for growers to sow canola following a brown manure because the manure maximises the opportunity to establish canola early with stored soil moisture and adequate nitrogen to optimise yield potential," Robert said.

"Growing canola following a legume-based brown manure enables almost complete prevention of wild oat seed set in two successive years, which depletes the seed bank to levels that may eliminate the need for grass control in the following two crops. This has significant cost savings and reduces risk of cereal crop damage from post-emergent wild oat herbicides.

"The incidence of yellow leaf spot in wheat crops has been observed to be substantially less following two sequential broadleaf crops."

Growers in the Lockhart district are increasingly using a crop sequence of brown manure legume followed by canola, wheat and feed barley, Robert said. Where this sequence is being used field peas are generally the first brown manure crop grown in a paddock and vetch the second to minimise the risk of pea disease build up from having only a three-year break between manure crops.

An economic analysis of two farming systems – continuous cropping of wheat

and canola and continuous cropping plus brown manure field peas grown on 25% of the arable area – in 450 mm annual rainfall country in southern NSW showed 25 to 30% yield increases for canola and wheat crops grown in the two years following brown manure pea crops.

It also showed that wheat following peas-canola or peas-wheat has elevated grain protein levels, which can result in price premiums.

The analysis, using actual farm data and based on a 1,680 hectare property that is 95% arable and run by two family labour units, assumes a conservative 20% increase in yield above average in the first two crops following brown manure peas and wheat prices were adjusted to reflect protein levels, he said.

"And the continuous cropping requires more working capital than the brown manure peas system because the larger area of cash crop requires higher herbicide, fungicide and artificial nitrogen inputs.

"The amount of working capital required is a measure of the degree of risk of the system because, while the costs of continuous cropping will almost certainly be higher, there is no guarantee the gross income will be better," Robert said.

"This means the potential for loss is greater if seasonal conditions are unfavourable, leading to the potential for the additional working capital to be capitalised into long-term debt.

"The brown manure system is considered to be relatively robust and low risk in drier seasons because there is less need to spend money on crop inputs in pursuit of elusive higher crop yields."

Earnings Before Interest and Tax (EBIT) is a measure of profitability after allowances for plant replacement and family labour, Robert said.

"In the study, with the assumptions used, predicted EBIT from continuous cropping is slightly higher than from the brown manure legume system but there is little difference between the financial ratios. However, the lower EBIT margin of the continuous cropping program suggests a higher degree of risk associated with this system."

It also highlights the significance of fertiliser price on in determining cropping profitability.

"At the settings used in the analysis, a $100/tonne increase in the price of urea would increase the continuous cropping costs by $19,200 a year but the cost of the brown manure legume system by only $5,200.

"In the comparison the annual cash surplus from continuous cropping is slightly higher than that from the brown manure legume system but to achieve an extra $6,653 the continuous cropping program required $115,000 greater outlay prior to harvest than the program with manuring in the cropping sequence.

"With income from both systems reduced to a third (33%) of the average by very low spring rainfall and late frost after all crop inputs had been used they both have an annual cash deficit, with the deficit for the continuous cropping program $71,930 more than for the brown manure legume system."

In the second year of the cropping sequence the working capital requirement for the continuous cropping program is likely to be about $187,000 more than for the brown manure legume system – close to $200,000 with interest added – which highlights the much higher downside financial risk of continuous cropping in years with dry springs or late frosts, he said.