



Managing changes to poultry manure availability in Western Australia

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Background

The majority of vegetable growers around metropolitan Perth have used poultry manure for many years. Growers recognise its value as a low cost source of a wide range of plant nutrients, especially nitrogen, and they also value its soil conditioning effects.

Locally, nationally and overseas, there are a number of concerns that are increasingly challenging the continued use of all forms of poultry manure in horticulture. These are:

- Stable fly - a problem that is confined to Western Australia and largely to the coastal sands around Perth;
- food safety - fresh food retailers are requiring HACCP based quality management programs and the use of raw poultry manure is of increasing concern because it can contain human diseases;
- groundwater quality - poultry manure is a low analysis fertiliser that needs to be applied at high rates to be effective. It also has an inappropriate nutrient balance for crop production. These factors combine to create significant potential for groundwater contamination with all major nutrients, particularly nitrogen.

The Stable fly problem has steadily increased in recent years and in 1996, a program was initiated to identify all sources of breeding and to develop solutions. These investigations have:

- identified the use of raw poultry manure on irrigated crops, particularly vegetable production, as the major breeding source of Stable fly; and
- found that changes to current management practices are not able to reduce levels of Stable fly to acceptable levels.

To solve the Stable fly problem, poultry manure must either be treated so that it can continue to be used without the associated Stable fly breeding or alternative uses or methods for its disposal need to be developed.

Solutions

Processing poultry manure will significantly increase its cost to growers and any cost increase is of concern. However, it must also be accepted that Stable fly breeding associated with the use of raw poultry manure in horticulture is a significant cost, both financially and socially to other important rural industries and to the rural community.

Progress with implementing processes that would solve the Stable fly problem have been delayed because of difficulties with developing alternatives for disposing of or using poultry manure.

The proposed power project, fired by poultry litter, would provide such a facility. It is currently undergoing environmental assessment and with the constraints of planning approval and construction time, is unlikely to be ready to receive poultry litter before winter 2003.

Investigations into the production and use of Conditioned (composted) poultry litter as an alternative to raw poultry manure were completed last year.

Recognising the need to implement a more immediate solution to the Stable fly problem, as well as the need for an alternative to the power generation proposal, the former government's Ministers for Agriculture and Health formed an inter-agency task force.

This group, chaired by the Health Department, has met with stakeholders, including the Horticultural Poultry Litter Users Committee and developed a strategy that was presented to cabinet in June 2001. The strategy and accompanying recommendations were endorsed in early July 2001. The strategy proposes that:

Within Stable fly affected areas, the use of raw poultry manure will be permitted between May and August inclusively. Outside of this period, only the use of approved processed poultry manure products, including Conditioned poultry litter, compost and some pelleted products will be permitted.

Outside of this area the use of raw poultry manure will be allowed all year round.

Stable fly affected shires are: Gingin, Wanneroo, Joondalup, Armadale, Kwinana, Cockburn, Rockingham and Murray.

The limitations on the use of raw poultry manure will come into effect on 1 September 2001. It is also anticipated that the allowable four-month period of raw poultry manure use will be reviewed and adjusted if necessary in relation to on-going Stable fly problems. The Local Government areas to which the restrictions apply can also be expected to change.

Strategies to replace raw poultry manure

Although the current strategy allows restricted use of raw poultry manure, it is **possible** that its availability to horticulture will eventually cease. Replacing the use of raw poultry manure requires consideration of:

- its nitrogen content and its ability to release nitrogen over four to possibly six weeks;
- its benefits in new land vegetable property development;
- its contribution to soil quality;
- its potential to contribute to nutrient enrichment of groundwater; and

- its potential to compromise food safety.

Options include using approved treated or processed poultry manure based products in combination with changes to fertiliser use, or switching to a fertiliser only program.

Alternative poultry manure based products include, Conditioned poultry litter, compost, pelleted products including Multigrow®, Dynamic Lifter® and Neutrog®.

Using alternative poultry manure based products

Nutrient content, particularly nitrogen, and its availability must be taken into account.

Conditioned poultry litter has less nitrogen (around three per cent compared with 3.5 per cent to 4.5 per cent for raw poultry manure), and it is less available.

Compost has considerably less nitrogen, typically 1.0 to 1.5 per cent, and it is also less available than that in Conditioned poultry litter. Pelleted products have similar or higher nitrogen levels compared with raw poultry manure, but they are used at much lower rates and the time taken for the pellet to physically break down may also reduce its availability.

Growers wishing to continue to use an organic poultry manure alternative may find that Conditioned poultry litter is cost effective. It also has the potential to provide a more flexible, and more easily managed nitrogen application strategy that may allow reduction in overall nitrogen requirements.

Inevitably, though, solutions to replacing raw poultry manure and overcoming potential nitrogen leaching problems will impose some additional costs and will mean that growers will need to learn new fertiliser management techniques.

Recommendations for Conditioned poultry litter

Conditioned poultry litter should be used at half the current recommended rate of raw poultry manure.

Apply Conditioned poultry litter at

- *12 to 15 m³/ha in established situations;*
- *24 to 30 m³/ha in new land situations; and*
- *6 to 8 m³/ha in side banding situations.*

As indicated, additional nitrogen is also required in many situations.

Cost considerations

Cost is a major concern. The cost of Conditioned poultry litter is likely to be similar to compost and around \$35 per cubic metre.

Using Conditioned poultry litter at half the rate of raw poultry manure coupled with nitrogen application strategies that reduce N requirement will lessen cost increases.

In some situations it may be possible to reduce total costs by the combination of correcting irrigation inefficiencies and reducing the overall fertiliser program.

Nitrogen application strategies

The major benefit of raw poultry manure is its ability to steadily release nitrogen over a period of four to possibly six weeks. This is particularly important during crop establishment and when either rainfall or excessive irrigation leach nitrogen from the crop's root zone.

Fertiliser nitrogen, with the exception of some expensive controlled release products, is water-soluble and readily leached. For vegetable production on the sands of the coastal plain, the very low soil moisture holding capacity adds to this leaching problem.

To effectively replace raw poultry manure, with either fertiliser only or with an approved product such as Conditioned poultry litter, requires nitrogen to be applied in ways that replace the nitrogen bank effect of poultry manure.

During the dry months of the year and with well managed irrigation, this nitrogen can be applied in weekly applications of 4 to 7 kg/ha of nitrogen (10 to 20 kg/ha of Agran®).

The basic principle for applying additional nitrogen is to apply it over the period from either crop establishment with pre-plant situations or following normal side band applications until the fertiliser nitrogen applications would have normally commenced.

This weekly nitrogen application strategy is not suitable if leaching occurs from rain (mainly during winter months) or from irrigation that is either not sufficiently uniform or is incorrectly applied. This is because the nitrogen provided is invariably leached away before the plant can use it.

Strategies to manage potential nitrogen leaching include:

- apply smaller, more frequent amounts of nitrogen during both winter and crop establishment;
- re-apply nitrogen immediately following rainfall that is sufficient to cause leaching;
- improve irrigation system uniformity to reduce this source of leaching; and
- in crop establishment situations, apply no more than 2 to 3 mm irrigations.

As a guide to the re-application strategy, we suggest that the critical rainfall limit above which nitrogen needs to be re-applied is three to five millimetres. The final decision will need to make adjustments for the amount and intensity of the rainfall, relative to the soil moisture content and the stage of crop development, which determines the crop's rooting depth.

The installation of electronic tensiometers at shallow (100 to 150 mm) depths could be used to more accurately predict when rainfall is likely to have caused nitrogen leaching. The need to re-apply nitrogen can then be assessed.

Replacing raw poultry manure in new land situations

In new land situations the application of raw poultry manure at relatively high rates (typically of 80 to 100 m³/ha) before establishing the first two to three crops contributes to conditioning the soil and raising its cropping performance to that of established vegetable land.

In addition to providing a slow release nitrogen source and a wide range of plant nutrients, this practice is likely to accelerate the development of more effective soil organic matter that in turn contributes to improved soil water holding capacity and possibly other attributes.

An alternative strategy to increase levels of effective organic matter could be to incorporate a cover crop such as Gunguru white lupins, before establishing the first two to three vegetable crops. The

best time for planting lupins is May and they need to be incorporated in August, before flowering. Irrigation requirement will be minimal and for best results a 15 to 20 m³/ha application of compost should be incorporated in conjunction with the cover crop.

Maintaining soil quality

Many growers attribute the regular use of raw poultry manure to improved soil quality.

In established vegetable growing properties, the regular return of crop residue from the previous crops, without the addition of raw poultry manure, is probably sufficient to maintain organic matter at levels that growers associate with this good soil performance.

This is supported by observations of the performance of vegetable growing soils that do not receive raw poultry manure applications. It is also true that relatively high nitrogen applications, as are associated with typical application rates of raw poultry manure, potentially reduce rather than increase soil carbon or organic matter build-up. This is because the relatively high nitrogen levels create excessive biological activity that in turn accelerates the conversion of organic carbon to carbon dioxide.

Other considerations

The continued use of raw poultry manure is contributing to, rather than reducing, the potential for adding nitrogen and other nutrients to groundwater.

An application of 25 m³/ha of raw poultry manure provides around 300 kg of nitrogen and at least half of this will be available within four weeks of the application. Therefore in pre-plant situations it is likely that the majority of this nitrogen has the potential to contaminate groundwater.

The application of half rates of Conditioned poultry litter and the adoption of more frequent low rates of nitrogen fertilisers will significantly reduce this nitrogen loss and therefore reduce costs.

Food safety in relation to the use of raw manures is also becoming an increasingly significant issue throughout Australia and internationally. An advantage of using Conditioned poultry litter and compost is that the composting process can eliminate human pathogens that may be present in the raw poultry manure.

Summary and future considerations

The major change required is to develop fertiliser strategies, particularly nitrogen application methods, that will replace the nutrients supplied by raw poultry manure.

In some situations it may also require improvement to irrigation if the amounts of fertiliser are to be minimised.

A number of information sheets are available to provide details on replacing raw poultry manure with fertilisers only.

When available, Conditioned poultry litter potentially offers the best immediate option for growers who wish to continue to use a poultry manure based product.

The additional application of nitrogen will depend on particular situations and considerations of

crop, time of year with respect to rainfall, and irrigation performance, as outlined.

In the longer term, it is likely that compost, not necessarily made with poultry manure, will prove to be more effective than Conditioned poultry litter.

A vegetable industry funded project has recently started to investigate the use of compost in vegetable production on both sands and heavier soils. The work will include the development of changes to management practices that are aimed at improving soil organic matter levels, with the objective of maximising the potential range of production benefits that the use of compost promises.

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