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Opportunities for High-ash Meat Meals as Organic Fertilisers

The market opportunity in aquafeeds for low-ash, high-protein meat meals as a substitute for fish meals has been clearly demonstrated. The brochures in this series entitled 'Nutritive Requirements of Meat-meal-based Aquaculture Diets' and 'Preparation of Meat Meals for Inclusion in Aquaculture Feeds' have demonstrated how the rendering industry can benefit from the substantial growth occurring in the aquafeed industry and the requirements to produce a suitable low-ash, high-protein meal for this industry.

Market demands for low-ash meat meal

The aquaculture feed industry requires a meat meal that is high in protein (55+% protein) and low in ash (<22% ash). Most conventional meat meals produced in Australia are to a minimum 50%-protein specification. To produce a 55+% protein meal, the raw materials available, or the meal produced, must be fractionated to produce two products. The first, as required by the aquafeed millers, would be a high-protein, low-ash meat meal. The second, by necessity from the raw materials available, would be a low-protein, high-ash meal.

A 50%-protein meat meal would be fractionated into, say, 65% as a meal containing 57.5% protein; and 35% as a meal containing 36% protein. To realise the benefits of the opportunity to market the high-protein meal into the aquafeeds industry, a market must be found for the low-protein, high-ash meal. The value of this meal is in the phosphorus content and the limited protein available. There is considerable difficulty, and little point, in trying to reduce the protein content below about 36% by directing it further into the high-protein fraction. Even rendered clean bone contains at least 30% protein.

For every tonne of high-protein meal sold to the aquafeeds industry, another approximately 0.5 tonne of low-protein meal is made available. If the notional value of meat meal to the aquafeed industry is realised, then it is possible that the entire Australian meat-meal production of some 450,000 tonnes per annum could be fractionated for this purpose. This would generate some 150,000 tonnes of low-protein, high-ash meal per annum in Australia.

Notional values for high- and low-protein meat meals

High-protein meat meal

High-protein meat meal will be competing against fish meal in the aquafeed industry. Fish meal at a price of A$1,350 per tonne for 70% protein meal is equivalent to a A$1,930 per tonne price for its protein. By contrast a current price of A$450 per tonne for 50%-protein meat meal is equivalent to A$900 per tonne for its protein. At 55+% protein it is realistic to set, on the aquafeed market, an expectation of 75% of the value of fish meal protein. This will set the value of meat meal at A$1,445 per tonne of protein or about A$795 per tonne of 55% protein meal.

However, this value accounts only for the value of the protein to the buyer. Meat meal for aquaculture also contains other components of significant value to the aquafeed industry such as phosphorus, cholesterol, unsaturated fats and lipids and gelatine for binding. By adding in the value of these, a more equitable notional value of meat meal can be obtained as in Table 1.

At these notional values the aquaculture industry could easily be expected to outbid the stockfeed industry and it is reasonable to predict that all meat meal could in future be fractionated to high- and low-protein meals.

Low-protein meals

In theory, a large uptake of meat meal into aquafeeds will reduce availability of meat meals for the pig and poultry stock-feed industry. In these circumstances the stock-feed industry should take up the low-protein meal available as a reliable source of phosphorus and protein nutrition. In this case the phosphorus and protein value create a notional value as in Table 2.

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There is no surety that the stock-feed industry will take up this option as, to date, it has shown little interest in this product. However pressure from the aquafeed industry may make it do so in future.

Table 1. Notional value of high-protein meat meal

Constituent per tonne of meal	Value of meal based on protein @A$900/t	Value of meal based on protein @A$1455/t
550 kg of protein	A$450	A$795
33 kg of phosphorus @ A$2500 /tonne*	A$82.50	A$82.50
10–15 kg of cholesterol @ A$75 per kg **	A$750–1125	A$750–1125
Unsaturated fat & lipid	Value not yet determined	Value not yet determined
Gelatine	Value not yet determined	Value not yet determined
Total	A$1282.50 to A$1657.50	A$1627.50 to A$2002.50

Note: * based on di-calcic phosphate, containing 22% phosphorus, currently used in aquafeeds

** based on pure cholesterol currently used in aquafeeds

Table 2. Notional value of low-protein meat meal.

Constituent per tonne of meal	Value of meal based on protein @A$900/tonne
360 kg of protein	A$324
90 kg of phosphorus @ A$2500 per tonne *	A$225
Total	A$549

Low-protein meat meal as a fertiliser

The nitrogen content of high-ash meat meal is of particular relevance to the organic farmer who has access to few products with these relatively high nitrogen levels, and none with such valuable accompanying levels of calcium and phosphorus. Important trace elements are also present including magnesium which is highly desirable—especially for livestock producers.

The high-ash meat meal resulting from the fractionation of current 50%-protein meat meal fits within the regulatory description of 'Blood & Bone' fertiliser. 'Blood & Bone' fertiliser is currently only sold in relatively small quantities but at a price of around $400 per tonne. 'Blood & Bone' is an excellent fertiliser of high repute and long recognised as such among gardeners and horticulturalists. However it is nutritionally incomplete. It contains relatively low levels of potassium and for some applications is deficient in magnesium, trace elements and even calcium. It also contains almost no humus.

One or more of the above nutrients or soil conditioners can be added to the 'Blood & Bone' to fortify it and enhance its efficacy with respect to particular soil types and particular crops. For example, additional potassium and magnesium, and possibly trace elements, might be added to enhance its performance as a fruit and vegetable fertiliser. Alternatively, trace elements could be added to improve its performance as a cereal fertiliser, or compost, and additional calcium added to fortify its soil-conditioning properties.

Except for the trace elements, which are added in minute quantities, and the sulphate form of potash, the materials that are required for fortification are of lower price than the indicated price for 'Blood & Bone'. Most of the materials required such as gypsum, lime, bentonite and compost are greatly cheaper than the indicated 'Blood & Bone' price. As a result there is a real prospect of enhancing the efficacy of the product while reducing the cost to produce it. Assuming that the improved efficacy can be converted to a slightly increased sale price then the opportunity exists to significantly improve the return to the renderer on this product. A typical fortified 'Blood & Bone' fertiliser could be as shown in Table 3.

Table 3. A typical fortified 'Blood & Bone' fertiliser

Ingredients / tonne of fortified 'Blood & Bone'	Indicative cost of ingredients /tonne	Cost of ingredients in 1 t of fortified 'Blood & Bone'
642 kg of high-ash, low-protein meat meal	$549 (notional value)	$352.46
120 kg of bentonite @ 8% magnesium	$80	$9.60
100 kg of compost	$60	$6.00
93 kg of potassium chloride	$335	$31.16
30 kg of gypsum	$60	$1.80
15 kg of trace elements	$1500	$22.50
Total		$423.52

All of the active ingredients can be added in a way that complies with certification of fortified 'Blood & Bone' as a registered organic fertiliser. Where potassium chloride is not acceptable for organic certification, it can be substituted with potassium sulphate ($585/tonne) with a cost penalty of $23.25 per tonne of fertiliser produced raising the cost to $446.77 per tonne of fortified 'Blood & Bone' fertiliser. This would require a potentially significant improvement in return against the current indicated sale value of non-fortified 'Blood & Bone' at $400 per tonne.

Issues to be addressed in preparing a fortified 'Blood & Bone' fertiliser

The following issues need to be considered when investigating the opportunity for production of a fortified 'Blood & Bone' fertiliser.

- This product could be used for a wide range of applications including the production of cereals, fruit and vegetables, cut flowers (and home gardens), forestation tree seedlings, lawns and greens. Each have a different set of requirements so that the horticultural target must be determined before the fortification is considered. Soils in different regional areas also have different requirements so that the sales area must be considered.

One approach for determining a suitable fortification formulation is simply to review the compositional data on the products currently available and emulate these. Another is to use the services of an experienced plant nutritionist who has experience with formulating for local conditions and local crops. It is important to be able to identify the availability of cheap local resources for fortification.

- Some States have regulations regarding the production and sale of fertilisers. These regulations are quite specific about the use of the term 'Blood & Bone'. Renderers proposing to produce a fortified 'Blood & Bone' need to check local regulations regarding the appropriate fortifications, labelling and advertising of this product. The term 'Blood & Bone' has strong marketing value and it may be necessary for there to be a review of some State regulations to ensure that the term is appropriate to the organic products that can be produced. An alternate name to 'Blood & Bone' may be necessary if suitably fortified products cannot fit the current regulations.
- The traditional 'Blood & Bone' fertiliser that has a strong market reputation has been neglected over the years and has been downgraded by the use of rock phosphate as a substitute for the phosphate derived from bone. Rock phosphate is less readily available to plants than bone phosphate and has, in part, damaged the 'Blood & Bone' reputation. This neglected sector of the rendering industry needs to be re-established and strengthened to ensure that the potential exists to sell the volume of product that could be produced in response to aquafeed needs for high-protein meat meal.
- Certification and approval may be required for access to some markets, particularly in the organic farming sector. This can be obtained through a number of certification organisations. The process of certification involves on-site inspections on an annual basis and a small (0.5%) levy on sales. Approval status requires a desk audit, an annual fee (around $150) and inclusion on an approval list. Both certification and approval require adherence to the Australian Code of Practice for certified organic produce that conforms to the Basic Standard of the International Federation of Organic Agricultural Movements (IFOAM). Before targeting product to the farming sector, as distinct from the general public market, the Code of Practice for Organic Farming (obtainable from AQIS) should be considered to ensure that all fortifying ingredients are acceptable.
- The low-protein, high-ash meat meal component of fortified 'Blood & Bone' is not texturally compatible with other fortifying agents such as compost. Producing a suitable blended material is not simple and pelletising may be required to produce a product that will not separate during processing, handling and spreading. Pelletising costs should be considered both in terms of capital costs and the maintenance of equipment.

Market strategies

In 1996 the total compounded organic fertiliser market, in Australia, was identified at some 100,000 tonnes per annum plus the current 'Blood & Bone' market of a further 6–8,000 tonnes per annum. Assuming a growth of about 10 to 15% per annum since then, the market in 2000 is estimated to be approximately 146,000 to 175,000 tonnes.

In Australia, renderers will be required to market an additional 75,000 tonnes of 'Blood & Bone' or 100,000 tonnes of fortified 'Blood & Bone', over the short development period predicted for growth in high-protein meat meal for aquaculture. To market an additional 100,000 tonnes on a market of 150,000 to 175,000 tonnes would require stealing market share from the chemical fertiliser industry, as well as from elsewhere within the compounded organic-fertiliser market. The challenge is to achieve this major task while a profitable price in excess of $400 is to be maintained.

The agriculture industry, including the organic agriculture sector, is technically advanced so that the marketing of fertilisers needs to be technically based. Chemical analysis and performance data from field trials is required to confirm the efficacy of the fertiliser products from the rendering industry. The good reputation of 'Blood & Bone' needs to be rebuilt in these sectors where its value is recognised. Unfortunately some organic farming organisations do not recognise 'Blood & Bone' as a useable product and may need to be targeted to develop the correct image and level of support across the organic fertiliser user base.

The development of suitably fortified 'Blood & Bone' products will not be enough to provide the necessary level of market growth. A concerted marketing effort by all renderers will be required to provide the necessary level of growth to complement the potential growth in the supply of meat meals to the aquafeed industry.

Further reading

This information is a summary of information from the following projects funded by the Meat Research Corporation.

- Project COPR.001: The Development of High-ash Fraction Meat Meal as Fortified Blood and Bone Fertilisers,
- Project COPR.006: High-ash Fraction Meat Meal and its Potential as a Fertiliser in the Organic Industry
- Project M.743: Utilisation of the Ash Component of Meat Meal.

Further detail is available from the final project reports for these projects which are available from Meat and Livestock Australia.

Related information is given in the following MLA Co-products brochures.

- Nutritive Requirements of Meat-meal-based Aquaculture Diets
- Preparation of Meat Meals for Inclusion in Aquaculture Feeds
- Techniques for the Separation of Meat Meal into its Components

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