Feasibility & Sustainability of (Extensive) Free-Range Egg Production

Peter Brown

Agri-Link
Support for Profitable Farming...

These notes are intended as guidelines only. The aim is to assist those wishing to take advantage of the currently available market niche in protecting and further developing the credibility of "Free-Range" as a truly animal considerate and environmentally sustainable production system.

Introduction

In general, the poultry industry has not succeeded in developing a good public image for itself and consumer demand has shifted strongly towards produce derived from more animal considerate and environmentally sustainable systems. However, the conventional view is that these systems suffer from significantly reduced economic feasibility and so the rate of adoption remains low. The aim of this report is to make some attempt at reviewing these two apparently conflicting issues and see how they balance out in actual field application. To do this we have focused on what many consider to be the least economically feasible, but most environmentally responsible alternative – Extensive Free-Range Egg Production.

A proper assessment of sustainability requires an understanding of how poultry differ from other classes of livestock and how this impacts on ‘grazing’ and pasture management; the nutrient Mass Balance relationship; and the opportunities for integration of Free-Range Poultry with other potential farm enterprises. It is only from this viewpoint that a realistic assessment of economic feasibility can be made. However, there is also a need to understand the distinction that is now developing between “Intensive” and “Extensive” Free-Range, since the assessments that follow are based on the latter system only.

In other livestock industries, the distinction between intensive and extensive is based on the requirement for “Supplementary” feeding. That is, highly intensive industries are of a “Feed-lot” type, with housed or confined animals fed either largely or wholly on supplements such as hay, silage or pellets. For this reason, many consider all poultry enterprises to be intensive – assuming that extensive Free-Range would rely on pasture and not supplements. However, poultry are different from other classes of livestock and although they do utilize pasture, as we will see, their requirement (as a proportion of the total ration) is very small.

For this reason, we define “Extensive Free-Range” here as that in which animal densities are maintained at (or below) the standard stocking rate (in DSE/ha) for Extensive Ruminant (sheep or beef cattle) Production in a given area.

What makes Poultry different?

Birds differ from other livestock in several ways:

- They are non-ruminant mono-gastric animals
- They are more prone to stress disorders
- They have some specific nutritional requirements

Hens can (potentially) get a good deal of their requirements from pasture, but not all. Apart from grass, they will also take insects and seeds, but will still require ‘supplementation’. In practice pasture has only a small impact on nutrition since hens are estimated to utilize pasture for only about 5% of their total intake.

This has been estimated from comparison of measured feed intake with known animal requirements. That is, for birds with an intake of 130g per day and feed with an average energy density of 10MJ/kg DM, intake in 1300 kJ/d (0.13kg x 10MJ = 1.3MJ = 1300 kJ). Industry standard requirement for a 2kg bird is 1320 kJ/d, so there is a 2% difference. If this is provided by pasture, the requirement is for only 1% of the ration, but birds living outside are assumed to have a higher energy requirement and so this estimate is increased to 5%. In fact it cannot be increased further as pasture does not have a high enough energy density or protein content to provide adequate support for birds at intake levels above 5% or so.

To see what this means in management terms, let's compare Free-Range Poultry with pasture-based Dairy. Given stocking rates of 250 hens/ha (consuming 5% of 130g/d each), pasture consumption will be around 590kg (as fed)/ha (ie. 130 x 5% = 6.5g x 250 birds x 365 days = 590 kg/ha/yr) will be consumed from pasture.

In converting this to DSE we must work in energy terms. One DSE represents an intake of 7MJ/d, so 250 birds/ha (in terms of their overall requirement) will be 46 DSE/ha. However, only 5% of their intake is pasture, so from a management perspective, such a flock has a pasture-stocking rate of approximately 2.5 DSE/ha. In spite of this, it has been shown that under a set-stocking regime, population densities much higher than this inevitably lead to pasture collapse.

So how does this relate to pasture consumption by Dairy cattle? A cow has an intake capacity of about 15kg DM/d, with only about 2-5kg as supplements required only to assist with herd management in the Dairy. Her energy requirement (assuming production of 20 litres of milk/d) of around 168MJ/d. At 2 cows/ha, this represents a stocking rate of 48 DSE/ha (at peak of lactation). This level of grazing can only be sustained under a rotational system. The set-stock limit (assuming rainfall of approximately 800mm) would be closer to 20 DSE/ha.

The reason for the disparity lies in the way hens impact pasture. They do not graze in the conventional sense of the word, but utilize pasture in an extremely selective manner and in doing so affect the pasture in ways more similar to that of insect pests. In short, chooks don't have teeth! They do not bite and chew grass, rather they pick the most nutritious bits – inevitably, and this means young shoots and expanding leaf tips. This has two effects. Firstly it means their intake will be of a significantly higher nutritional quality than that of the pasture over all. Secondly, by selectively removing this type of material, they are forcing the plants to be continually using their carbohydrate reserves. In effect, this is a "Back Grazing" effect in that it exhausts the capacity of the pasture to re-grow, but does so without visibly reducing the apparent quantity of pasture available. As a result, poultry pasture tends to first become long and 'rough' looking and then progressively less and less dense. In effect, while pasture utilization suggests that 250 hens/ha represents 2.5 DSE/ha, the effect on pasture is closer to 30-40 DSE/ha, especially given the tendency to manage Free-Range flocks in a more or less set-stocked fashion.

Nutrient Mass Balance

This is simply defined as the total nutrient input (NPKS) from all sources, less produce removes and environmental losses. The main reasons for determining this balance are to optimize nutrient inputs and minimise environmental impacts. For extensive Free-Range poultry production, the major sources of nutrient input are the supplementary feed materials. These nutrients are transferred to pasture via manure deposition and removed from the farm in eggs. The movement of livestock to and from the property is assumed to have a negligible impact and so is excluded from calculations. Night droppings are normally deposited in a roosting shed rather than on pasture, but could sometimes also be spread back to the same pasture. The following table gives annual nutrient input to pasture (kg/ha from 250 hens/ha) where these night droppings are diverted to other uses, compared to spreading them back onto the same pasture as the flock has been ranging over and compares this with Dairy cattle:

	Nitrogen	Phosphorus	Potassium	Sulphur
Poultry manure	**5%**	**2%**	**1%**	**0.5%**
With night droppings	445 kg	175 kg	88 kg	44 kg
Without night droppings	178 kg	70 kg	35 kg	18 kg
Dairy cattle (35 DSE/ha)	*120 kg*	*43 kg*	*23 kg*	*24 kg*

Clearly, the total nutrient input from a flock of 250 hens/ha represents excessive nutrient input and this quantity of manure would probably carry sufficient salt to cause direct damage to pasture. On the other hand, following removal of night droppings, the remaining nutrient input to pasture is roughly equivalent to that provided for high intensity dairy production. However, given the limited extent to which poultry will utilize pasture, the prospect must be for nutrient accumulation over time. This would indicate that integration with one or more other enterprises (e.g. ruminant cross-grazing) would be advisable, in order to ensure sustainability.

Egg production also removes nutrients, but this will not compensate for inputs, since pasture is such a small component of the ration.

Integration with other enterprises

Following on from the nutrient mass balance, there are four main opportunities for integration with other enterprises:

1. Application of manure from night droppings

From the example above it is clear that annual output of manure as night droppings, per hectare (250 birds), will represent 267 kg N, 105 kg P, 53 kg K and 26 kg S. Assuming Potassium is the more limiting nutrient, this would be sufficient to support 2ha of moderately stocked ruminant grazing. In areas where Potassium is less important, it could be applied to as much as 3ha of ruminant pasture.

2. Alternate Grazing

The poultry pasture itself, will tend to become highly fertile and so a small area of poultry could be ‘rotated’ around the farm, to improve the productivity of pasture for other classes of livestock. It is likely that 2 or 3 years under Free-Range poultry would be sufficient for this purpose.

3. Pasture Renovation

Utilising poultry for longer periods of time (perhaps 4 or 5 years) would likely see the pasture in need of renovation. By selecting an area already in need of renovation, poultry can be used as a productive alternative – increasing farm output while building fertility and reducing both the time and cost subsequently needed to establish new grass.

4. Cropping (Horticultural)

Finally, rather than renovating pasture, a crop phase could be introduced to take maximum advantage of the abundant nutrients available. In selecting this option, however, allowance should be made for provision of a small amount of phosphorus with the seed when subsequently re-establishing pasture. Following 4 or 5 years of poultry, it is likely that only one crop cycle should be included without requiring significant input of additional nutrients, however, soil testing would be advisable prior to planting any crop.

Economic Feasibility

Currently, Free-Range eggs command a premium in the market. Even so, labor & capital costs are likely to quickly erode economic viability as the size of the operation increases. However, for small one or two person operations, economics appear favorable, especially when integrated with other enterprises as described above. The following estimate of Gross Margins should give a rough guide (again assuming 250 hens/ha), based one owner operation (so excluding a separate cost for labor):

Production (4,500 doz./ha) @ $2/doz.	$9,000/ha
less Total Variable Costs*	$6,000/ha
Gross Margin	**$3,000/ha**

* This figure assumes feed costs of $400/tonne and that this component comprises one half of total variable costs.

Conclusions

While perhaps not well suited to large-scale production, Free-Range Poultry could well be a valuable component in developing profitable and sustainable small farm operations, especially when considering its significant indirect benefits. Its potential for adverse environmental impact (at appropriate stocking rates) would appear to be both minimal and easily manageable.

From the preceding considerations it should also be noted that even when lightly stocked, the potential for pasture degradation is significant, however, stocking rates up to 750/ha could well be achievable with improved management systems. Notably, the development of cross-grazing and rapid rotation could improve pasture persistence. Since hens will select actively growing leaves, a potentially more sustainable system would be to allow grass to grow to its optimum length (depending on species) and quickly defoliate pre-grazing with ruminants. After a short period of re-growth, hens may be given access for a short time and the pasture then allowed to fully re-grow before the cycle is repeated. Prior to introduction of poultry, a light harrowing to disperse the manure would help prevent any health problems in the birds, but for small operations, pre-grazing could be replaced by mowing (if necessary).

Although pasture represents a valuable protein source for poultry, it must be clearly recognised that the main productive advantage in providing access to pasture is in stress reduction. For poultry only operations, significant pasture wastage will be inevitable. Furthermore, unless improved management strategies are developed the potential for significant nutrient accumulation and possible adverse environmental impacts will remain.

Potential adverse effects from long-term operation of Free-Range Poultry will include:

1. Losses of phosphorus to streams via surface run-off
2. Soil acidification (in soils susceptible to this) and
3. Potassium accumulation (leading to induced Magnesium deficiency)

As already stated, however, these are all easily manageable provided stocking rates are kept within appropriate limits and efforts are made to maintain pasture density. Even in set-stocked operations, the latter can easily be achieved by allowing for periodic resting of pastures. For example, when a flock is removed, locate their replacements on a different area of pasture. Grazing normally with other livestock for 6 to 12 months should be sufficient for recovery prior to re-stocking with poultry.

In determining the appropriate stocking rate, experience of existing operators to date would tend to indicate that (given attention to other management issues described above) anything within the range of 45 to 75 hens/ha per 100mm effective rainfall (obtain figures from your local Dept. of Agriculture) may be reasonable. In practice, monitoring of pasture response will be the best guide to the appropriate stocking rate for any given location. New entrants to the industry would be advised to start at a lower rate and build up – to avoid costly mistakes at the outset.

Acknowledgements:

We are grateful for the assistance and support of R&D Moore (Moore-Brown Eggs) and the Free Range Farmers Association of Victoria Inc (www.freerangefarmers.com.au) in the development of this information. Also, we would like to thank Dr Greg Parkinson (DNRE) for his comments and assistance.