

## **Developing an agro-forestry system for production of a commercial organic chicken flock focusing on profits on a ‘Triple Bottom Line’**

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### **Summary**

In most modern free-range poultry systems birds do not fully utilise the range provided. Knowledge of the ancestral history of the domestic chicken, and research observations suggests benefits of agro-forestry systems for chickens. A commercial organic poultry agro-forestry system was developed for Sheepdrove Organic Farm, Berkshire, UK, affording the benefits of an agro-forestry system, whilst retaining commercial viability. Five avenues of highly diverse parallel hedges incorporating tree, shrub and herb species were planted. On-going monitoring of the system was put in place to evaluate its development and help assess the types of ‘profits’ the system delivers. Conventionally profits tend to be viewed purely in terms of economic gain. However, in an organic farming system more emphasis is placed on the intrinsic and sustainable qualities it has. Organic farming adopts a holistic approach to profit, viewing it in environmental, social and economic terms. The profits afforded by the system are discussed.

**Keywords:** Poultry, agro-forestry, organic, ranging, profit

### **Introduction**

Modern poultry (*Gallus gallus domesticus*) were domesticated from the red jungle fowl (*Gallus gallus*), which still exists in its wild form in Asia. The red jungle fowl inhabits woodland and forest clearings, making use of the shelter this environment provides for covered foraging. In modern free-range poultry systems, it has been noticed that birds do not fully utilise the range provided. Dawkins *et al.* (2003) found that many birds never leave the house and a maximum of only 15% of birds in the flock were observed on the range at any one time. They hypothesise that this may be a result of the type of range available to the birds not being their preferred habitat. Other research concurred that this may be the case, as providing range structures and forms of cover can enhance range use (Lubac & Mirabito, 2001). Agro-forestry is a system of land use in which a range of different approaches to integrating trees, crops, and animals are used to the mutual benefit of all components. Knowledge of the ancestral history of the domestic chicken, combined with research observations suggests benefits of use of agro-forestry systems for chickens. These include allowing the chickens to express aspects of their innate behaviour and the provision of cover and shelter, which may encourage ranging. It provides foraging opportunities for the chickens, which could result in nutritional and medicinal benefits, as well as enriching the landscape and encouraging biodiversity.

Profit is ‘*an advantage (gain) or benefit*’ (Anon., 1994). Conventionally profits tend to be viewed purely in terms of economic gain. However in an organic farming system more emphasis is placed on the intrinsic and sustainable qualities it has. Organic farming adopts a holistic approach to profit, viewing it in environmental, social and economic terms, or a triple bottom line of profit. Difficulties arise, however, in equating these profits in terms recognised in a forum which places emphasis on economic gain as its sole measure of profit. A good starting point is to define what might be meant by environmental, social and economic profits. Environment is ‘...*(the physical surroundings, and) conditions effecting growth development and wellbeing of plants, animals and humans*’ (Anon., 1994). An environmental profit can therefore be thought of as an advantageous benefit to the physical surroundings of an organism. Social is defined as ‘...*the relationships ... (within a) community*’ (Anon., 1994) and as such social profit could be seen as an advantageous gain or benefit to a community. Social benefits or profits can be particularly difficult to measure. Economic profit can be defined as ‘...*good return for money laid out*’ (Anon., 1994).

## **Materials and Methods**

### *Case study: the development of an agro-forestry system*

A commercial organic poultry agro-forestry system was developed for Sheepdrove Organic Farm, Berkshire, UK. This development was undertaken to afford the benefits of an agro-forestry system to the table bird production system, whilst retaining commercial viability. Prior to development the Sheepdrove system consisted of mobile sheds on an open range. The range was not fully utilised with ranging localised to the areas immediately outside the sheds.

### *The site and soil*

The site is on the Berkshire Downs in Southern Britain (N51:32:05, W1:29:06) and is largely rolling chalk downland at an altitude of 170 to 200 m with an annual rainfall in the region of 800–900 mm. Within the site there are three distinct soil types: clay with flints; thinner silty calcareous clay with flints; and a deeper colluvial silty soil. The pH across the site ranges from 6.9 to 7.6. Good nutrient reserves exist across the site increasing where soil is deeper. However, despite this, nutrient availability could be limited by high pH and calcium status.

### *Changes to the system*

A variety of changes were made to the system in order for the birds to take full advantage of the woodland-style environment. Changes were made to the brood sheds to encourage and acclimatise the birds to an outdoor lifestyle, including adapting: the sheds so that the chicks can have protected access to the outside world; and playing sounds of bird songs, tractors and other live-stock to the chicks in the safe environment of the shed. Five avenues of highly diverse parallel hedges incorporating tree, shrub and herb species were planted 50 m apart. Each row will be 2.5 m wide and the central rows will have a combined width of 5 m, separated by a central fence line. This allows for management practices such as house movement and rotational cropping taking place. There is a transition from the trees, through a coppiced hedge and shrubs, to a permanent 3 m wide herbal strip. The remaining range area was sown with a grass/clover ley.

The trees were planted at 40 m spacing per avenue either side of the central fence line. The trees sizes will be 1.5–2 m in height. To ensure a good establishment the trees were planted into augured holes containing a compost mix, and staked if necessary. Tree species used in the agro-forestry system were planted for a variety of purposes. Ash, Beech and Hornbeam for timber, Field Maple, Alder, White Beam and Scots Pine for shelter and, Cherry, Wild Pear, and Apple for food and community and social interest.

The hedge was planted parallel to and at a distance of 1m from the trees, with the hedge species planted at 0.3 m spacing and likely to be 0.6–0.9 m in height. Like the tree species, hedge spe-

cies used in the agro-forestry system were planted for a variety of purposes. Quickthorn, field maple, blackthorn, pea shrub, were planted for shelter and hazel, dogwood, spindle, holly, wild plum, crab apple, dog rose, elder, blackberry, raspberry and gooseberry were planted for both food and community interest. Shrub species were planted away from the hedge in groups, and were to provide the chickens with food and shelter, but also provide harvestable fruits and wood products. The plants are similar to the hedging species but were planted at a lower density. Herb species were also planted for different purposes; Quinoa, Kale and Wild Strawberry for nutritional benefits; Plantains, Comfrey, and Marigolds for anti-inflammatory effects. Other plants were also used for their antibacterial, calmativ e and anthelmintic effects. The plants chosen and the density of planting were selected and carried out on the basis of soil type and climate. The system design is site and soil specific although the principles are transferable to other situations.

#### *Identifying profits in organic Agro-forestry system*

The programme consists of monitoring: 1) Biodiversity including, plants, birds, moths, butterflies and terrestrial invertebrates. 2) Soil nutrient status and respiration. 3) Behaviour and welfare of the poultry. This information can be used to develop a picture of the different profit strands provided by the system. These profits will be discussed in more detail in the Results.

## **Results**

#### *Profits offered by an agro-forestry systems*

As discussed above profit is normally viewed in terms of economic gain, but organic farming adopts a more holistic approach to profit, viewing it in environmental, social and economic terms. These different types of profit will be discussed in relation to what agro-forestry systems can contribute to each. Some of the examples highlighted below are vastly different systems to organic poultry agro-forestry case study, but have a common theme of agro-forestry design.

#### *Environmental profit*

Some of the suggested environmental profits afforded by the organic poultry agro-forestry system include the increase in biodiversity through the provision of alternative more diverse habitats. These include the provision of small woodland 'islands' in a vastly agricultural landscape. This encourages small woodland mammals and a more diverse range of bird species including birds of prey. A study by Acharva (2006) in Nepal has found that traditional agro-forestry aids the conservation of tree diversity, as agro-forestry farms act as biodiversity reservoirs.

In addition, improved soil nutrient and respiration status can be achieved through the rotation of livestock and crops. This is achieved by subsequent cropping on land used for poultry houses, it can mop up any excess nitrogen in the soil, as well as resting the land from poultry activity and produce high yields in subsequent crops. Another benefit, which is harder to measure directly, is the improvements to the landscape, as the system is more aesthetically pleasing. The land also has more of a dual purpose environmentally as it can provide cereal crops, livestock, and even opportunities for fruit and timber harvest. In a study of silvo-arable systems Eichorn *et al.* (2006) suggest that European mixed agricultural systems contribute towards the increased sustainability of agriculture and enhancement of biodiversity, but also preserve landscapes that are both culturally important and aesthetically pleasing. A paper by Alavalapati *et al.* (2004), investigated the effect of environmental costs and benefits on the adoption of agro-forestry in the Northern US. They propose as agro-forestry system provide both marketable goods and nonmarket goods and services, such as environmental profits, it there any cost of benefits to this non-market element. They suggest silvopasture is profitable than conventional ranching, if environmental services are included.

### *Social profit*

Some of the social profits of an organic poultry agro-forestry system include the opportunity to harvest agro-forestry products including fruits and woodland products. In addition, the system can provide an element of social conscience, as it can benefit public perception and consumer relationships with the end product. A direct social impact of the Sheepdrove Organic Farm poultry agro-forestry system is a collaborative project carried out in conjunction with a local school. In addition, to the social profits to humans there are also social benefits for the chickens in terms of improvements to animal health and welfare. The natural behaviour of the chickens can be encouraged by the presence of cover and more natural surroundings, and ranging can be encouraged (Dawkins *et al.*, 2003). This encouraged ranging could result in better leg health and welfare particularly as the birds approach their end weight. Monitoring of the chickens within the agro-forestry system has identified a very low incidence of injurious and antagonistic behaviours. The range also provides opportunities for the birds to self medicate by selecting herbs from the strips as well as providing opportunities to forage on invertebrates.

### *Economic profit*

Agro-forestry systems provide opportunities for a wider variety of economic profits. The diversification of the system means there are increased economic opportunities through the optimal use of space. In the poultry system, as the poultry are integrated with trees this allows for the production of harvestable crops. The land can be used for interspecies grazing (chickens, sheep, cattle) as well as for silage cuts. Due to the layout of the system it still allows for poultry production in rotation with arable cropping to capitalise on the nutrient rich ground. Another economic advantage of agro-forestry systems, particularly in developing countries is that they allow for large species diversity and can provide both subsistence and cash crops. This enables the farmer a variety of management option and a potential system of self insurance (Fernandes *et al.*, 1985). Husak & Grado (2002) compared the profitability of agro-forestry or silvo pastoral systems to other land use systems in the southern regions of the US. They found that when considering monetary and wildlife benefits, as well as timber and livestock sales, the profitability of the silvo-pasture systems was comparable to that of other land use systems. However, they add that in addition to being comparable as an operation, agro-forestry systems can also provide further opportunities for incorporating wildlife-related activities through hunting leases and possesses both quality and quantity of wildlife habitat not available in other systems. This refers to both other avenues of economic profit and to the environmental profit afforded by this type of system.

## **Discussion**

It is very difficult to place estimated financial values on environmental and social profits for these agro-forestry systems. Although the examples highlighted above and suggested opportunities for the organic poultry agro-forestry demonstrated the areas in which different types of profits may be delivered. As the discussion above shows, it is difficult to separate these different types of profit as there is an intrinsic link between them. This is particularly true when considering agro-forestry systems for organic farming due to the nature of organic farming systems. Organic table birds produced in an agro-forestry system fulfil a niche market and can achieve a financial premium increasing the market value of the chicken. There are, however, increased production costs incurred by the system due to increases in feed costs, lower stocking density, a higher ratio of stockmen to birds and a longer growing period. This may result in a lower financial profit margin than in conventional production systems; this will depend on the individual systems. The Sheepdrove Organic Farms poultry agro-forestry system is running as an eco-nomically viable enterprise, and early system monitoring shows it is delivering in these different areas. This paper demonstrates that agro-forestry systems have the potential to deliver not just economic profit but

profits on a multi-faceted triple bottom line: environmental, social and economic profits.

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### References

- Acharya K P. 2006.** Biodiversity and Conservation **15(2):**631–646.
- Alavalapati J R R, Shrestha R K, Stainback G A, Matta J R. 2004.** *Agroforestry Systems* **61–2(1):**299–310.
- Anon. 1994.** *The Oxford paperback dictionary*. 1st Edn. Suffolk, Great Britain: Oxford University Press.
- Dawkins M S, Cook A P, Whittingham M J, Mansell K A, Harper A E. 2003.** *Animal Behaviour* **66:**151–160.
- Eichhorn M P, Paris P, Herzog F, Incoll L D, Liagre F, Mantzanas K, Mayus M, Moreno G, Papanastasis V P, Pilbeam D J, Pisanelli A, Dupraz C. 2006.** *Agroforestry Systems* **67(1):**29–50.
- Fernandes E C M, Oktingati A, Maghembe J. 1985.** *Agroforestry Systems* **2(2):**73–86.
- Husak A L, Grado S C. 2002.** *Southern Journal of Applied Forestry* **26(3):**159–164.
- Lubac S, Mirabito R. 2001.** *British Poultry Science* **42:**S14–S15.