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Abstract. In poultry 'no input', 'low input' and commercial production can be distinguished. 'No input' implies scavenging poultry with some kitchen waste or crop residues as supplemental feed. Input is negligible and economic efficiency is high, provided there is any output. Commercial production is capital intensive and completely based on supplied feed. Birds might be given outside access for foraging, but this is for behavioural and welfare reasons, not for nutrition. Chickens are real omnivores. The feed industry utilizes all kinds of ingredients and by-products for least cost rations. Literature provides a tremendous amount of information on feeding value of a wide variety of feed ingredients. Low input systems are a difficult category for economic evaluation. Birds often have to get part of their diet from scavenging, but also receive on a regular basis (compound) feed. This can be home-made from local resources or industrial and thus out-of-pocket costs. Purchase of feed is only possible if sufficient income can be generated from sales of eggs or birds. Lack of market access (buying resources and selling products) and competition from industrially produced eggs and meat are more a barrier than knowledge on feed resources. With regard to management no input and low input systems have a tendency to 'over-graze' the resources for scavengers, with high mortality and low productivity as a consequence. Reducing numbers of birds might increase productivity.

Keywords. Poultry – Commercial production – Feed resources – Low input systems.

Ressources locales destinées aux volailles

Résumé. *Dans le secteur avicole on peut distinguer différents types de production : production sans intrants (no input), production à faible niveau d'intrants (low input) et production commerciale. La production sans intrants 'No input' est basée sur l'utilisation exclusive des déchets ménagers ou des résidus de récolte comme compléments. Les coûts sont négligeables et l'efficacité économique peut être élevée s'il y existe une production finale. La production commerciale est intensive et complètement basée sur l'apport des aliments de l'extérieur. Les volailles pourraient bénéficier d'accès à l'extérieur, mais c'est pour des raisons de bien-être, pas pour la nutrition. Les poulets sont des omnivores. Les fabricants d'aliments pour bétail utilisent différents ingrédients pour formuler des aliments au moindre coût. La littérature fournit beaucoup de données relatives à la valeur alimentaire d'une large gamme d'aliments. L'évaluation économique des systèmes à faibles intrants est considérée difficile. Les oiseaux sont souvent astreints à se nourrir sur les résidus mais reçoivent aussi et de façon régulière des aliments composés qui pourraient être fabriqués au niveau de la ferme à partir de ressources alimentaires locales ou à partir de ressources industrielles achetées. L'achat des aliments n'est possible que lorsqu'un revenu est généré à partir de la vente des œufs et des oiseaux. Le manque d'accès au marché (achat des ressources et vente des produits) et la concurrence avec la production d'œufs et de viande à l'échelle industrielle représentent une barrière plus importante que la maîtrise des ressources alimentaires. Quant à la gestion, les systèmes « sans intrants » et « à faibles intrants » ont tendance à surexploiter les ressources alimentaires issues de résidus, ce qui se traduit par une mortalité élevée et une faible productivité. La réduction du nombre de volailles pourrait améliorer la productivité de ces animaux.*

Mots-clés. *Volaille – Production commerciale – Ressources – Systèmes à faibles intrants.*

I – Introduction

Poultry is present in almost all systems in all parts of the world (Pym and Alders, 2012). The demand for animal products is increasing faster than the overall demand for food and among animal products the demand for poultry meat and eggs is expanding most prominent. (FAO, 2009). Among the poor, many families are for their livelihood dependent on livestock and

especially on poultry. FAO (2012) distinguishes industrial and integrated poultry production, large scale and small scale commercial production and village or backyard production. Non-industrial poultry production can be categorized as (modified after FAO, 2012):

(i) 'no input', the birds forage themselves, while at best some shelter for the night and some kitchen waste or crop residues are provided: free range extensive and backyard extensive systems.

(ii) 'low input', foraging is important, but the birds receive supplemental feed: semi-scavenging system.

(iii) 'high input', the birds receive a complete diet; access to a foraging area might be provided, but rather for welfare reasons than for nutrition: intensive systems (Singh *et al.*, 2011; Rushton, 2010).

McLeod *et al.* (2008) characterised no and low input systems as 'safety net' and the small scale high input systems as 'asset builder'. The so-called family poultry production systems are always small scale with up to a few hundred birds. Often they are multipurpose: providing both eggs and meat on top of a next generation, with a tendency to specialize more if input increases. Industrial poultry production is always specialized for either meat of eggs (or reproduction) and is based on high input systems. It involves much larger numbers of birds, from several thousands to up to several millions on a location. No and low-input poultry production systems are often based on indigenous, traditional breeds of chickens and on local feed resources. High input family systems still might rely on indigenous breeds and local resources, but develop into systems with commercial hybrid stock (Thieme and Besbes, 2010; Rushton, 2010) and compound feed based on ingredients, that might originate from larger distances. The small scale family farms operate in a local and informal supply chain, while large scale, industrial enterprises tend to be organised in formal, well regulated supply chains (McLeod and Sutherland (2012).

II – Local resources

Scavenging is the ultimate form of production based on local resources. This type of production requires no input in the form of capital and/or imported genotypes or feed ingredients. Goromela *et al.* (2006) reviewed the information on the diet scavenging birds collect. Scavenging diets contain about 10% protein, 1.17% Ca and 0.5% P and have an energy content of 11.2 MJ/kg. The amount of waste per day per household that can be fed to poultry is estimated at 300-600 g on a dry matter basis, with protein and energy contents comparable to the crop content. This is below recommendations for commercially producing poultry (NRC 1994). Goromela *et al*. (2007) indicated that it is also below the genetic potential of indigenous genotypes. For production according to the genetic potential supplementation is required (Goromela *et al.*, 2007). Starvation is a major cause of mortality (Olukosi and Adeola, 2010). Productivity of local poultry could be improved by supplying extra feed (Chowdhury and Luseba, 2012). The question is how this can be done in a profitable way.

During an e-conference on family poultry production, organised by FAO and the International Network on Family Poultry Development (INFDP) (Chowdhury and Luseba, 2012) local feed resources and interaction with other production systems were explored. Some general conclusions from this e-conference are that it is expected that the amount of scavengeable feed will reduce due to urbanisation and climate change and that there is a lack of knowledge on how to use commercial feed in a scavenging system. Many contributors indicate that commercial feed might be too concentrated for indigenous poultry and that it is in general too expensive for profitable production with indigenous breeds. A more or less successful strategy is to feed young birds for a limited period on commercial feed and later on dilute commercial compound feed with local available grains or grain products (Chowdhury and Luseba, 2012; Sonaya and Swan, 2004). The overall tendency among the comments is that for higher productivity

commercial feed is required. However, commercial poultry has a much higher inherent production potential than indigenous birds and consequently 'standard' commercial feeds contain too much protein, resulting in poor performance and waste of protein, especially in laying stock. Poultry has an inherent capacity to select adequate diets themselves. Faruk (2010) found good results with choice feeding or roughly mixing a premix of essential amino acids, vitamins and minerals with a locally available energy source (fi millet).

In poultry production feed costs are about 70% of the total production costs. Goromela (2009) did a cost benefit analysis for supplying extra feed and for management strategies of laying hens. He calculated that supplemental feed gave a net profit, but management of laying hens in such a way that they are not involved in hatching and rearing chicks was much more profitable. Mutayoba *et al.* (2010) estimated in Tanzania the revenues of supplementation of scavenging birds. With a homemade complete diet the performance of a commercial diet was approached and both gave about 25% more output than scavenging only, but the extra costs for the feed supplied were not outweighed by the revenues from extra production, Sonaya and Swan (2004) indicate that if balanced feed, good health-care and day-old chicks of hybrid varieties are locally available, intensive poultry management is an option. If these are not available, then local breeds under scavenger free-range systems is still the best choice.

A limited number of participants in the e-conference emphasised the role of poultry in integrated production systems to control weeds and insects. Then not only meat and eggs are produced, but also 'labour'. Knowledge on how to handle such integrated systems is limited. The same is true for the value of poultry manure, which can be considered as an important local resource for crop production.

From the discussions it became clear that there is a lack of knowledge on how much can be produced on local available resources. If only local resources are available, managing the number of chicks being hatched in order to increase survival rate and the number of eggs available for consumption might be a more profitable strategy than increasing input. The general tendency is however to find ways to shift to commercial compound feed and hence a shift from no or low input to high input systems.

There is a wide body of knowledge on feeding value of possible ingredients available at the compound feed industry. These data become publicly available through internet and internet. Among others the Working Group Nutrition of the WPSA (1989) published feeding values for a large number of ingredients on-line. Less is known on nutrient requirements of indigenous strains. For growing birds the NRC tables for growing White Leghorns are a reasonable approach (NRC, 1994). The NRC also gives indications for laying hens in relation to adult body weight and egg production that can be used to estimate the energy requirements of indigenous birds. Sonaiya and Swan (2004) summarize information on available feed ingredients. Combined with the calculation programmes it is possible to compose a diet from available ingredients (Thomson and Nolan, 2001). Based on this information and programmes and with some training in farmer field schools it should be possible to produce locally compound feed.

III – Transition from no or low input to high input systems is critical

Due to an increasing demand for animal products and to increasing urbanisation there is a pronounced tendency to shift from poultry keeping for subsistence to commercial poultry keeping. A gradual growth to commercial production is a difficult transition (Rushton, 2010). Commercial poultry production is going into a value chain with many different interests (Thieme and Besbes, 2010). Besides technical performance and economics, also ethics, animal health, and environmental concerns enter the overall picture.

Commercial production can still be based on indigenous (traditional) breeds. However, with indigenous breeds the production potential is too low to afford complete commercial feed (Olukosi and Adeola, 2010). With free range/scavenging and some supplemental feed it is possible to have a positive margin between costs and value of eggs and meat, provided labour is not taken into account. If a choice is made to go for higher production levels decisions have to be made on how much capital is available and how logistics can be organised. Thieme and Besbes (2010) and Hamon (2010) indicated that for higher production levels besides commercial feed also a shift from indigenous to commercial genotypes might be required. A shift to high input, intensive systems implies investments in purchased feed and purchased genotypes. Because of the value of these investments, also investments in housing and veterinary care (vaccination and medication) become necessary, which make the production system capital intensive. For commercial production many different types of resources (birds, feed, veterinary care, capital, labour, logistics and market access) have to be available locally. Feed might be the easiest one. Simulation studies might help to get indications which conditions are required to make a shift from low or no input to high input systems profitable.

Rushton (2010), however, indicates that economic models for no and low input family poultry production are extremely complex, because of the variety of inputs and often lack of data on output, even more so as most no and low input poultry production is multipurpose: eggs and meat plus delivering the next generation. Systems with commercial genotypes are in general single purpose, either eggs or meat and do not breed the next generation on the production farm. Due to the complex logistics (buying feed, laying hens or broiler chicks, veterinary care, get products to the market and find a market for the products) and introduction of formal quality systems it is difficult for small scale family farms to compete with the industrial farms (Pym, 2010; McLeod and Sutherland, 2012). Industrial poultry production is often highly integrated and controlled by one party, while family farms are only one link in the production chain.

Labour is an important factor in poultry production. With family poultry often women, children, or older generations take care of the chickens. If the time they spend with the chickens does not compete with other productive tasks, the income from poultry is an extra. If it does compete the value of the time spend in other tasks determines the costs of labour in poultry production. Industrial poultry farms by definition work with hired labour.

IV – Options for production based on local resources

Transition from no or low input poultry production to commercial production should be considered as a complete change of system; a change that is in fact a giant leap. For family farmers shifting to commercial production market access both for inputs and for outputs is essential. If the logistics are lacking to get birds, feed and products at the right time at the right place a transition to commercial production does not make sense. Not only the feed has to be available locally, but also all the other types of resources, capital and labour included. No and low input poultry production is in such a situation still a profitable enterprise, which can be optimised by managing the number of chicks hatched and by supplying extra feed. Selecting indigenous stock for higher productivity is theoretically possible, but approaching the genetic potential of current commercial stock is virtually impossible. Gradually shifting to commercial production is therefore not an option.

Opting for a niche market might be interesting. In several countries eggs and meat from indigenous birds can be marketed for a premium price compared to eggs and meat from commercial production. In a mixed crop livestock production system, where the chickens feed on insects, weeds, crop residues and kitchen waste and produce manure for crop production, poultry is very valuable.

In conclusion no and low input poultry systems can be optimised to generate more profit by optimising management of the birds, in principle manage reproduction: use more eggs for

consumption and less for reproduction, raise less chicks with some supplemental feed and thus much lower mortality (Sonaya and Swan, 2004; Singh *et al.,* 2011; Chowdury and Luseba, 2012). Due to the inherent capacity of chickens to select their own diet, also egg production can be increased with local resources without very detailed knowledge on those resources as feed ingredient. Low input production systems are essentially very little affected by changes in other production sectors and thus food and feed prices. With no and low input systems niche markets with premium prices might be accessible. Such a strategy might be much more profitable than trying to compete with industrial productions systems.

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