Strategies for Improving the Production of Scavenging Chickens

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ABSTRACT: The purpose of these papers is to identify ways in which scavenging village poultry production can be improved at little or no cost. There has recently been much recognition given to this system, particularly amongst the very poor, because of its major role in food security, nutrition and income. Scavenging chickens are normally unmanaged with few or no inputs. Here, focus is on improving bird nutrition and health, reducing the high attrition rate of young chickens, and on breeding options.

Key Words: Village Poultry, Scavenging Chickens, Poultry Production

INTRODUCTION

There has been renewed interest in village chicken production in Asia. This was demonstrated in a highly successful electronic conference organised by FAO last year (Guèye, 1999). The main focus was on scavenging fowl. There are a number of reasons for this renewed interest in village poultry; not least was the serious economic downturn which started in July 1997 in some countries in Asia. As a consequence the poultry industry experienced a severe decline, or collapsed completely as occurred in Indonesia, for example (Bastonus, 1999). As a result, Indonesia has introduced a program aimed at self-sufficiency using local breeds and feed resources where possible (Hatmono, 1999). The focus of this paper is on scavenging chickens, although in village poultry production there are at least three distinct systems (Bagust, 1994).

Indigenous chickens are found in almost every country in Asia (Aini, 1990) and contribute significantly to food security. They provide income, represent household savings and investment but are used for many other purposes, e.g. cock fighting, and crowing ability. In Bangladesh, and in many African countries, family poultry represent more than 90% of all poultry (Tadelle and Delre, 1997). The purpose of this paper is to introduce the basic changes that will lead to improved production of their birds, even though cost may be negligible.

Nevertheless village poultry often fill an important role in the village farming system. There are several reasons why egg production and growth rate of scavenging chickens are poor. Under improved conditions of nutrition, management, breeding and health, scavenging chickens have been shown to improve their meat and egg production (Roberts, 1992). A detailed description and an excellent review of the scavenging chicken was given by Tadelle and Delre (1997). The purpose of this paper is to suggest ways by which meat and eggs can be increased in scavenging chickens by examining the key elements of the system. These are shown in Figure 1.
Nutrition is critical in increasing egg and meat production in scavenging chickens. There is ample evidence to show that if indigenous chickens are given sufficient feed, production increases substantially (Roberts, 1992; Guèye, 1998). Roberts (1992) suggested that the chicken population and yield are determined by the scavenging feed resource base (SFRB). This in turn is related to the number of families in the village since the major part of SFRB is household food waste. The more variable component of the SFRB is the biomass of grass shoots and seed, insects, worms, snails and fallen feed grain. Some of these are seasonal. Often a feed supplement such as broken rice and other cereal grains and rice bran is given. Roberts (1992) reported the annual dry SFRB of a village household in Sri Lanka was 203kg. Similar calculations from data of other workers elsewhere varied from 203kg to 475kg. The crude protein content of the SFRB was 112g/kg with an apparent metabolisable energy (AME) value of about 12.5MJ/kg. It is then possible, using suitable prediction equations, to calculate the egg production and meat production that the SFRB will support. The SFRB in a village is limited and as the number of birds increases, or their level of production rises, the fewer the families that will benefit.

Analyses of the crop and gizzard contents of scavenging birds are crucial in the estimation of the value of the SFRB. Huque (1999) reported detailed analyses of these in laying hens in five locations in Bangladesh. Composition varied with season and location. Huque (1999) concluded that the feeds scavenged were deficient in phosphorus and crude protein, whose average value was about 80 g/kg. Seasonal variation in SFRB can be used to manage the flock by culling or selling birds when the SFRB will start to decline and by hatching and rearing when it is high. Scavenging chickens are not only required to forage for their feed but also to find water. In tropical environments, often characterised by a wet and a dry season, availability of clean drinking water may be a constraint to production since intake of feed and consumption of water are closely related. A constant supply of clean drinking water is essential.

The great dilemma is, where do the very poor find the additional feed to improve productivity of the scavenging chicken and do they have the will to do so? This is very much a social issue and there is often a perception that scavenging chickens provide something for nothing. This may explain why attempts to improve productivity have usually ended in failure. Ravindran and Blair (1991; 1992; 1993) have detailed a very wide range of feed sources, byproducts and waste products suitable for feeding poultry. For many of these feeds, their chemical analyses are given. This information is important because it is then possible to ‘balance’ the SFRB especially as its composition changes with season. Production of protein through the farming of earth worms and insect larvae can be undertaken at little cost once a suitable system has been established. Earthworms are intermediate hosts for Cestodes, like Davinea or Rallienta; these can harm poultry unless the worms are first dried (Branckaert, 1997). Since those who keep scavenging chickens are often the poorest of the poor, they cannot afford to purchase supplementary feed. But there are often edible seeds available such as those from kapok trees, rubber trees and from some leguminous trees; cereal byproducts such as rice and maize bran may be available at little cost, or rice bran.
Table 1: Food intake, live weight gain and food conversion ratio of chickens at 21 days of age and the apparent metabolisable energy (AME) of the five diets (MJ/kg DM) with different levels of sweet potato vine (SPV) meal replacing lucerne meal (Farrell et al, 2000)

<table>
<thead>
<tr>
<th>Diet (g/kg)</th>
<th>Food intake (g)</th>
<th>Food conversion ratio (g/g)</th>
<th>AME</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 SPV</td>
<td>867</td>
<td>601</td>
<td>1.447</td>
</tr>
<tr>
<td>40 SPV</td>
<td>883</td>
<td>610</td>
<td>1.449</td>
</tr>
<tr>
<td>80 SPV</td>
<td>870</td>
<td>614</td>
<td>1.444</td>
</tr>
<tr>
<td>120 SPV</td>
<td>857</td>
<td>584</td>
<td>1.469</td>
</tr>
<tr>
<td>160 SPV</td>
<td>831</td>
<td>579</td>
<td>1.461</td>
</tr>
<tr>
<td>SEM</td>
<td>26.6</td>
<td>21.6</td>
<td>0.021</td>
</tr>
</tbody>
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POULTRY HEALTH-IN-PRODUCTION

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The major constraint to increased productivity in poultry production systems is poultry nutrition-health inputs and their interactions with management, i.e. housing and husbandry. Cost factors will continue to be limiting in scavenging poultry production unless microcredit and access to urban markets can be facilitated.

For small-scale poultry production, the levels of usable outputs, whether edible or reproductive, will increase in close correlation with the levels of inputs of resources made. (Table 1).

Village-based scavenging poultry production represents the lowest tier of inputs for what is now referred to as Family Poultry Production (FPP, Sonaiya and Branckaert, 1998). Providing simple poultry housing using local materials, basic training and advice on good care and management procedures during the first few weeks of life and vaccination for Newcastle Disease can of themselves more than double productivity. While more inputs can further increase outputs, lack of inputs must be recognised as the critical stalling point.

Improving poultry health in low-income food deficit countries (LIFDCS), while not a particularly costly intervention in itself, has been a perennial problem. Often poor health in village chickens can be related to inadequacies in the veterinary support systems at village level in these developing countries, along with poor levels of farmer education and access to suitable vaccines, particularly for Newcastle disease virus (NDV). NDV is the major infectious poultry disease affecting production worldwide and especially in LIFDCS (Kitalyi, 1998). Major advances in NDV control have included development of the heat-stable NDV-V4 strain vaccine for village use, e.g. feed application (Spradbrow, 1992; 1999) and more recently...
Table 1: Effect of management inputs on productivity

<table>
<thead>
<tr>
<th>Management system</th>
<th>Eggs per hen per year</th>
<th>Year-old chickens produced</th>
<th>Eggs for consumption/sale</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Free range: (scavenging, no regular water or feed, little or poor night shelter)</td>
<td>20-30</td>
<td>2-3</td>
<td>0</td>
</tr>
<tr>
<td>2. Improved free range: (improved shelter, care of chickens in the first weeks, NDV vaccination)</td>
<td>40-60</td>
<td>4-8</td>
<td>10-20</td>
</tr>
<tr>
<td>3. Backyard: (as in 2 above plus feeding, watering, housing, treatment for parasites, additional vaccinations)</td>
<td>100</td>
<td>10-12</td>
<td>30-50</td>
</tr>
<tr>
<td>4. Small-scale intensive I: (Deep litter or slatted floor housing, with imported hybrids and balanced diets)</td>
<td>160-180</td>
<td>25-30</td>
<td>50-60</td>
</tr>
<tr>
<td>5. Small-scale intensive II: (as for 4 but hens in battery cages)</td>
<td>180-220</td>
<td></td>
<td>180-220</td>
</tr>
</tbody>
</table>


The NDV:12 strain with increased ability to spread within vaccinated flocks (Spradbrow, 1998, pers. comm). Thermostable NDV vaccines, their present and likely future have been overviewed by Spradbrow (1999).

Other infectious diseases however should not be underestimated as significant causes of continuing economic losses at village level (Ideris, 1998), especially when occurring in conjunction with poor nutrition. These include fowlpox virus; fowl cholera; (Pasteurella multocida); pullorum disease (Salmonella pullorum); enteric Salmonella spp; Mycoplasmosis (CRD), coccidiosis; ectoparasites and endoparasites, especially helminths and cestodes.

All of this information is widely known - so why is it then, in 2000, that we continue to recite these "scientific mantras" while little seems to change for FPP, throughout the world? As elegantly summarised in a development workshop in Denmark during March 1999 (Anon., 1999), professional experience showed there were obstacles to the implementation of improvements in scavenging poultry FPP they were identified as follows:

- participatory on-farm research with volunteer farmers needs to be undertaken first
- advice on improvements needs to be location specific
- frequent extension visits are important
- "quick cash impresses villagers", hence any practical training should be given in short segments and hopefully quickly result in increased income
- improving breeds of poultry will be a secondary priority to the reducing of mortality levels and
- improving the nutrition of the traditional chicken breeds used in the target regions credit may be a necessary component
- new development assistance paradigm in FPP is now emerging. This combines market-driven economic thinking with low cost to poor rural smallholders in LIFDCS through rural microfinance schemes. These are small loans (US$50 - 100) at very low interest to individual low-income rural smallholder households which can enable their purchase of chickens and feed, and establishing production (Bagust, 1998).
- By thinking outside the poverty square and then carefully designing pilot schemes, which include community infrastructure development and training for feed production, housing and poultry health, international development assistance and implementing agencies such as FAO (special program for food security: family poultry) and Denmark's DANIDA (Permin, 1999) are directly stimulating the uptake of FPP by rural householders to supply into urban markets. This self-assistance approach has been trialed successfully with some hundreds of thousands of smallholders in Africa and South America, and is now being refined in Vietnam.
- Positive catalytic role in FPP at the producer level can also be contributed by LIFDC Governments. They can add most value to FPP development by targeting their skills and services to :
  - establishing central hatchery services (at least early in FPP expansion)
  - strengthening of veterinary services, vaccination programs and husbandry extension to farmer groups in villages.
  - assisting the setup of local feed supplies
  - facilitating access to urban markets

MANAGEMENT TO REDUCE ATTRITION RATE IN CHICKS

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The low rate of lay characteristic of scavenging chickens is a function of both genetic factors and the fact that the scavenging hen spends a considerable amount of time broody, sitting on eggs and rearing chicks (Kingston, 1980). When the indigenous hen is housed in layer cages and provided with supplemental feed, her annual egg production often doubles (Creswell and Gunawan, 1982), but even under these circumstances production is considerably lower than
from modern layer strains under good intensive management conditions

The high hatchability often seen in scavenging village chickens (Kitalyi, 1998) is reflected in field studies where the hen is frequently observed with a large number (8-12) of very young chicks; at six weeks of age or more, the number has typically reduced to about three or four (Cumming, 1992; Kitalyi, 1998). This high mortality, ranging from 10 to 100%, but typically at least 50%, appears to be the result of a combination of factors including poor nutrition, predation and disease (Cumming, 1992). Because of the high chick mortality, typically only 8-12 of the 40-60 eggs laid each year are consumed or sold. The majority (80–90%) usually left for the hen to incubate. This is extremely wasteful.

Newcastle Disease (ND) is recognised as the disease of major importance in scavenging chicken flocks (Aini, 1990) and novel feed-applied oral vaccination systems with heat tolerant vaccine strains have been developed and validated in field trials (Spradbrow, 1992; 1999). Several other diseases are also implicated in mortalities and depressed performance in village flocks (Cumming 1992; Ideris, 1998). Although ND outbreaks can result in exceedingly high mortality in both young and old stock, the typical high mortality rates observed in young scavenging chicks occur whether ND is present or not (Cumming, 1992).

The solution to the problem involves reducing the attrition rate in the young chicks during the first six weeks of age. Fewer eggs need then be set under the hen to reproduce herself and produce the required number of males for meat production, allowing more eggs to be eaten by the farmer’s family, or sold. An alternative approach (Kingston, 1980) would be to retain the same proportion for setting, but to rear more birds for meat production; however this requires supplemental feeding of the additional birds since the scavenging feed resource base (SFRB, Roberts, 1992) is usually fully exploited.

The immediate area surrounding the farmer’s house where the chicks are usually located is often already thoroughly scavenged by older birds and other farm livestock (Cumming, 1992). Predators are also frequently present in the scavenging environment and these are a significant cause of loss in young scavenging chicks (Aini, 1990; Cumming, 1992).

The solution would appear to be to provide a secure creep area where the chicks can be given in the day-time a suitable (chick starter-type) feed and where they can escape to from predators; combined with confinement at night, which would have a profound effect on survival. There would further, be opportunity to give ND vaccine-treated grain or pellets to the young chicks. The creep feeding system allows the chicks to exploit the SFRB in the local environment and to develop scavenging and survival skills, something denied by rearing in uninterrupted confinement.

Cumming (1992) calculated that only one tenth of the 1kg of protein harvested from the environment by the hen and her chicks surviving to six weeks of age was returned as human food. This very low rate of return was due largely to high attrition rate in the chicks.

The typical scenario is of a hen laying 60 eggs per year where the SFRB provides all of her nutritional needs. About 10 of these eggs would be eaten or sold leaving 50 to incubate, producing approximately 40 offspring of which about 15 would survive to six weeks and 10 to maturity. Providing protected supplemental feeding and ND vaccination would conservatively halve mortality to maturity from 75% to 37.5%; the aim would still be to produce 10 healthy birds at maturity. This allows the number of eggs incubated to be reduced from 50 to 20, assuming an unchanged hatchability of 80%, and eggs available for consumption or sale would increase from 10 to 40, a four-fold increase! The additional costs relate to the small amount of supplemental feed, the costs of the creep protective housing, and of vaccination. These costs are likely to be considerably less than the value of the additional, available eggs.

There is a great need for research to develop simple but effective management systems aimed at reducing early chick attrition in scavenging chickens. Although there will be some common elements, effective systems will be region specific. It is thus suggested that this activity be a high priority across regions in developing countries. A role for government and non-government organisations in the research and/or the promotion of effective systems is indicated.

All improvements of this nature argue a case for cooperation and coordination at the village level for effective use of vaccine and possibly different roles for farmers in the production of chicks, eggs and meat. It would seem to be reasonable that hens are kept principally for either egg or chick production as suggested by Cumming (1992), although consumer preference for eggs of a particular type, and broodiness in the hen, would logically dictate the appropriate genotype chosen for the purpose required in the region in question.

GENETICS AND BREEDING

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The dietary needs of the world human population for animal protein over the next fifty years can be met only by greatly increased production of meat and eggs from domestic fowl and other avian species. Much of this increase will come from further extension of the 20th century revolution in poultry technology. However, at the end of this period at least 25% of the world population will still not be able to afford the products of the most advanced poultry production systems in over 100 countries with the lowest income per head of population.
It has been apparent for some time that the first priorities for improving the productivity of scavenging village chickens, as well as larger flocks in small-scale semi-intensive or intensive systems, must lie in improving the health, husbandry and nutrition of such flocks. These aspects are documented briefly by my colleagues Farrell, Bagust and Pym in the other sections of this composite paper. Genetic improvement becomes an additional option only when minimum improvement in productivity has been achieved through these other components of flock management. Otherwise the heritabilities of the relevant traits and the selection differentials possible are simply not high enough for selective breeding to be effective. Other short-cuts to genetic improvements, such an introduction of males from exotic breeds or commercial strains to upgrade village flocks, have also failed many times in the past due to the obvious deficiencies in the health, husbandry and nutritional aspects of the environment.

Options for genetic improvement of village poultry are virtually the same as those utilised in the USA and other developed economies at the beginning of the revolution in poultry technology in the 1940s and 1950s. A very wide range of genetic diversity clearly exists among the hundreds of breeds and local populations of village chickens in Asia and Africa. Differences in production performance of these populations have barely begun to be documented. The immediate need therefore is for reliable data on comparative productivity of a much wider range of these indigenous populations and, wherever possible, of their crossbred progeny. Such information will then enable the following breeding decisions to be taken with some confidence:

- whether to replace a current village flock completely by one of demonstrably higher productivity, disease resistance etc
- whether to introduce males from an appropriate alternative village flock, in order to take advantage of hybrid vigour
- whether to introduce males from exotic breeds or commercial strains, or from specific mutant strains such as Naked-neck

Development of the data bases required for such decisions will clearly require much greater initiatives and cooperation of local, national government and international (FAO etc) agencies.

The question of whether to undertake selective breeding programs to improve production performance of village chickens is a more difficult one. There is no doubt that it could be done successfully. However, it would require large scale recording of individual bird performance and, in the case of egg production, pedigree matings and use of family performance data. It would be relatively very costly. It is difficult to envisage such programs being conducted without the full collaboration of entrepreneurial individuals, village or regional co-operatives, local and national government bodies and international aid agencies. Nevertheless they should be attempted. Selective breeding program options would include conducting them within superior village populations, or within crossbred pools of two or more superior village populations, or within a crossbred pool of superior village flock(s) crossed to exotic improved genotypes. The improved genotypes from such programs would be disseminated through the available and evolving structures of the village and small-scale production industries.

The above options for genetic improvement of village poultry would all involve the replacement and loss of existing genotypes of indigenous chickens. Therefore, all such breeding programs should be accompanied by adequate programs of genetic conservation of relevant native genotypes. The widespread loss of valuable and irreplaceable genetic material which resulted from the poultry technology revolution over the past 50 years must not be repeated in this new context of improving performance of village chickens (Sheldon, 1998; 2000).

What are the genotype options for small-scale semi-intensive or intensive management systems? The products of the above programs of genetic improvement of village chickens will be largely utilised in the improved village environments. However, this development alone cannot provide all the increased production needed to meet the needs of the human population in the low-income countries. The balance can only come from larger flocks up to several hundred or a few thousand birds run as family enterprises in semi-intensive or intensive housing systems. The improvements in health, husbandry and nutrition components needed for scavenging village poultry are also a pre-requisite for these systems to be successful.

The choice of genotype(s) available to maximise profitability of such systems will range in a virtual continuum from products of the above genetic improvement programs for village chickens, to, in much rarer situations, derivatives of the “best” commercial hybrids from the international breeding companies. They will include “purebred” and crossbred genotypes, and dual purpose as well as specialised egg or meat strains. They will be increasingly supplied by diverse, localised breeding industries similar to what existed in the USA, Australia etc before the poultry technology revolution.

Decisions on which genotypes to use must depend on comparative production performance in the local environment as well as all the relevant cost and income factors. The family enterprises involved will need intensive training and assistance, not just in the agricultural technicalities and decision making on genotypes, vaccination programs etc but also in the socio-economic factors essential to the success of their enterprise. These latter factors will need to improve rapidly to meet the challenge.

If the choice of genotypes to use in a family enterprise restricts its capability to breed its own
replacement flocks or exposes it to other unacceptable pressures, a number of enterprises may well develop a cooperative breeding venture to preserve as much flexibility as possible. However it is more likely that government agencies in many countries, supported by international aid, will initially play the leading role in developing breeding programs and providing chicks at acceptable cost to family poultry production enterprises.

REFERENCES


