Dual Purpose Chickens, Exploration of Technical, Environmental and Economical Feasibility

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Summary

The production of eggs and poultry meat is specialized. There are genotypes for egg production and for meat. The males of layer breeds are in general killed as one-day-olds. Killing such young animals raises ethical questions. A dual purpose chicken, suited for both the production of eggs and meat, would prevent the killing of one-day-old males.

We examined the biological and economical consequences for different options of dual purpose chickens, varying from layers to broilers.

The amount of feed per unit of product is a determining factor for environmental burden. Based on feed utilisation and production costs, dual purpose chickens are not an alternative for specialised production. Moreover, the males of layer breeds and the cross differ in appearance, breast meat yield and taste and tenderness from regular broilers. They require different culinary traditions than the current ones in NW Europe (preference for tender breast meat and easy to cook, fast meals).

Our conclusion is, that dual purpose chickens might serve a niche market, but a total shift to dual purpose chickens, to solve the problem of killing one-day-old males, is with regard to environmental burden and economics not feasible.

Keywords: dual purpose chickens, sustainability, technical and economical feasibility

Introduction

Men keep poultry for thousands of years for eggs and meat. Only the last decades it became possible to distinguish males from females of all varieties immediately after hatch: vent or cloaca sexing was introduced on a large scale about 60 years ago (Ketelaars, 1992). Until sexing at hatch became the standard, males and females were reared as hatched until about 8 weeks of age, when males and females can be separated without special skills. The females became layers, the males were kept a few extra weeks and were slaughtered. With sexing at hatch, specialization became possible and special genotypes for meat and eggs were developed. This, combined with a number of other innovations (coccidiostats, vaccination, crossbreeding), caused an enormous expansion of poultry production world wide (Ketelaars, 1992). Currently, there are breeds specialized for egg production, with an adult weight of about 2 kg, that lay more than 300 eggs per year and breeds specialized in meat production with an adult weight of about 5-8 kg (fully fed) that lay about 160 eggs in 9 months. Their progeny, broilers, weigh about 2 kg at 5 weeks of age. The males of layer breeds attain such a weight only at 14-16 weeks of age.

Because of this specialization it is not profitable to raise males of layer breeds for meat production and consequently they are killed at one day of age. This large scale killing of very young chicks is addressed by animale welfare groups and debated in the European and the Dutch Parliament. This raises the question, if and how a dual purpose chicken breed might be

feasible. We examined if dual purpose chickens already exist, if dual purpose chickens might be produced for a market in The Netherlands (NW Europe) and what economical and ecological consequences of such a production system are.

Performance of different types of chickens for egg and meat production

Based on existing data we calculated the efficiency for egg and meat production for medium heavy brown layers, the heavier black layers, a cross between a layer and a broiler strain, dwarf broiler breeders and broilers. As starting point we used performance data from reference guides for different strains, actual data from experiments and personal communications of poultry breeding professionals ('best professional judgments') as shown in Table 1.

Table 1: Technical data for performance for egg and meat production

	Layer Brown	Layer Black	Cross LxB	Dwarf broiler	Regular broiler
Laying period (days)	420	420	390	336	294
N eggs/laying period	351	342	260	200	165
Final weight hen (g)	2000	2100	2500	2800	3500
Feed intake/hen/day	120	125	133	140	160
Feed conversion/kg egg	1.99	2.14	2.97	3.86	5.22
Mortality (%)	9	9	9	9	9
Slaughter weight male (g)	1800	1800	2000	2200	2200
Slaughter age male (days)	98	94	84	56	40
Feed conversion	3.8	3.6	2.7	1.9	1.7
Mortality (%)	2	2	3	4	4.5
Slaughter yield (%)	65	65	68	70	70
Breast meat yield griller (%)	17	17	20	24	25

Consequences for the environment of different types of chickens for egg and meat production

Feed conversion was used as indicator for the ecological footprint for egg and meat production. (Fossil) energy required for heating, lighting, transport and processing was considered equal for all production systems, just as water use and space requirements, although heavier layers need more water and space per bird and the slower growing males require per kg of product more housing space and water because of the prolonged rearing period.

Based on feed conversion, a dual purpose chicken requires per egg 50% more feed than a layer type hen and a hen of a broiler strain up to 260%. Because of their prolonged rearing period, males of layer strains require per kg of live weight more than twice the amount of feed than broiler type birds. For a dual purpose chicken this is more than 1.5 that amount.

The extra feed per egg or amount of live weight reflect differences in amount of feed ingredients (footprint) required per egg or amount of live weight, but is also an indicator for amount of minerals excreted (ammonia, phosphates) and consequently for the environmental burden per unit of product.

Economic consequences for the production of eggs and meat by different types of chickens

From the basic data we calculated the production costs per kg egg and per kg of live weight (farm gate, Table 2).

Table 2: Calculated production costs per kg egg or live weight for different types of chickens.

	Layer Brown	Layer Black	Cross LxB	Dwarf broiler	Regular broiler
Production costs (€)/kg egg	0.90	0.93	1.38	1.84	2.23
Production costs(€)/kg LW	1.50	1.43	1.17	0.92	0.82

Table 2 gives the differences in production costs of live weight. On top of that, slaughter yields and amount of breast meat of layer type birds are lower than that of broiler type (Table 1). In Europe, breast meat is more in demand than for other poultry parts. A layer type bird has about 110 g of breast meat/kg live weight; a broiler type bird 175 g. We expect that breast meat of layer type males will be more than twice as expensive as that of broiler type birds.

For the different types of hens, we calculated the extra costs for the production of 1 billion eggs and rearing all brothers of the required laying hens for meat production (Table 3). In Europe, with a consumption of 280 egg per person per year 1 billion eggs is equivalent to the consumption of 3.6 million people.

Table 3: Number of hens required for 1 billion eggs/year, extra costs of producing these eggs by different types of hens and extra costs of rearing brothers of these hens for meat production.

	Layer Brown	Layer Black	Cross LxB	Dwarf broiler	Regular broiler
N hens (million)	3.26	3.35	4.09	4.58	4.86
Extra costs eggs (million €)	0	2	30.1	58.5	83.3
Extra costs males (million €)	3.0	2.7	2.2	1.0	0
Total extra costs (million €)	3.0	4.7	32.3	59.5	83.3

The extra costs are determined by the extra hens required from the heavier types to produce the eggs and their higher feed intake per egg. The average European eats about 280 eggs/year and over 20 kg of poultry meat. This is about one hen per person per year and 10 broilers. This implies that, if all egg production is replaced by dual purpose chickens, still specialised poultry meat production is required if consumption patterns do not change, as for each hen there is only one male and the spent hen itself.

When all brothers of layers are reared for meat production, they replace a number of broilers. Thus, less broiler breeders are required. One broiler breeder produces about 130 chicks. A broiler breeders eats about 70kg of feed during her whole live. These 130 broiler chicks require about 450 kg less feed than 130 layer males. The data were not corrected for the differences in numbers of broiler breeders required. The extra costs of meat production are thus slightly overestimated.

With dual purpose chickens of whatever type the production costs are higher than with specialized production and discarding the males as one day olds. The extra costs are more pronounced for eggs than for meat, as for each laying hen only one male has to be raised.

Is there a market for dual purpose chickens?

When eggs are produced by a broiler x layer cross or by broiler breeders shell colour is more variable than with current laying hens. Whether this is an advantage or a disadvantage on the consumer market is not clear.

Dual purpose males are older and differ in taste, texture and appearance from current broilers (Rizzi et al, 2007). In Mediterranean countries and in many parts of Africa and Asia there is a market for these birds, that have more chicken flavor than standard broilers. Up to the seventies of 20th century Italy imported one-day-old males of layer breeds for the production of 'giovanni galli'. Currently, about only 50% of the one-day-old males hatched in Italy are used (16.5 million birds in 2008), and the numbers are decreasing (Unione Nazionale Avicoltura, 2009).

In Switzerland, Kagfreiland experimented with raising layer type males for meat production in an organic system and market them at 14 weeks of age at a slaughtered weight of 1 kg. These males are sold for €14.50/kg, while they sell standard organic broilers for €13/kg.

Koenig et al (2008) experimented with the layer males to weights of 600g for poussin production (a substitute for quail), but concluded the product was too expensive because of high feed costs.

In many countries world wide layer males are reared in small numbers in back yard farming systems. In these systems feed costs are low as the feed consists of kitchen waste and what the chickens gather themselves.

In The Netherlands and other North European countries the market for organic poultry and other varieties than conventional broilers is rather small (10% of total consumption). In The Netherlands 40 million layers are hatched and consequently 40 million males can be raised for meat production. This is about 10% of the current broiler production. They should be compared in market potential with organic and other special varieties. It is questionable if the market can take this extra amount. In a well designed and strongly developed niche market chain there might be a chance for marketing eggs and poultry meat from dual purpose chickens.

Conclusion

Based on performance, ecological footprint, production costs and developments in cooking and eating style we do not expect that a dual purpose chicken of whatever type will replace current specialized production. The eggs have an ethical bonus, with similar sensory quality properties as conventional eggs. The males have to compensate their in general less valued sensory properties with this ethical bonus. In the current consumer market only a limited number of consumers is willing to pay for ethical aspects, when given the choice between a higher priced more ethical product and a lower priced less ethical product.

There might be possibilities to develop a niche market for such a chicken, but only if a competent market party takes initiatives. Although a dual purpose chicken meets a lot of sympathy on first sight, pushing such chickens to the market will not lead to successful production of meat and eggs by dual purpose chickens.

References

Hendrix Genetics, Paul van der Ven, personal communication

Ketelaars, E.H. (1992) Historie van de Nederlandse Pluimveehouderij, Barneveld.

Koenig, M., Hahn, G. Damme, K. and Schmutz, M. (2009) Utilization of laying-type cockerels as poussins; growth performance and carcass quality. *Proceedings 17th European Symposium on Poultry Meat and Eggs*, Turku, Finland

Rizzi, C., Marangon, A. and Chiericato, G.M. (2007) Effect of genotype on slaughtering performance and meat physical and sensory characteristics of organic laying hens. *Poultry Science* **86**: 128-135.

Schaublin, H., Wiedmer, H. and Zweifel, R. (2005) Vergleich der Mastleistungen und Fleischqualität von Hähnen ausgewählter Legelinien mit einem extensiven Masthybriden. *Aviforum*, Zollikofen, Zwitserland

Van Middelkoop, J.H. personal communication

Unione Nazionale Avicoltura (2009) www.unionenazionaleavicoltura.nl