



# Suitability of side flows as ingredients for poultry feed

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## Background

Chicken egg and chicken meat production in the Netherlands is an efficiency-based animal production system which meets the demand for chicken products domestically and for export. The international market is focused on production costs, and this has resulted in a system with high grow/laying rates and an efficient feed conversion within the currently used poultry breeds. Within a circular bioeconomy, animal production plays an important role, and major questions converge on the scale, sourcing of resources, environmental impact, welfare issues and socio-economic aspects to close the loop within the agri-food system

## Objective

The **aim** of the project is to create building blocks for method development to evaluate the suitability of side flows for animal feed from a circular agrologistics perspective. The project's **scope** focuses on the use of side flows for Dutch poultry feed, from a circular agrologistics perspective.

## Introduction

To realise circular feed concepts for poultry, the applicability of locally sourced agri-food side flows as raw materials for feed needs to be evaluated, providing insights on how to organise effective agrologistics. The research created an overview of available side flows, the feed requirements of different poultry production systems, agrologistic opportunities and the building blocks to evaluate suitability of side flows for feed. The study is primarily based on literature review and expert workshop findings.



The physiology of the chicken's digestive system makes it a suitable animal to feed a diverse, omnivorous diet.

## Availability of side flows

Available agri-industrial side flows consist of agricultural residues, including field (stems, stalks, leaves, seed pods) and processing residues (husks, seeds, roots, bagasse, molasses) and industrial residues such as peels and oil cakes of various crops (potatoes, orange, cassava, ground nuts, coconut, soybeans). Also, processing industries generate large amounts of organic residues and related effluents from juices, chips, meat, confectionary, vegetables and fruits each year. There is both a high expected potential as well as a lack of specific data to fully explore the use of side flows for poultry feed. The European potential for additional use of side flows from currently not allowed sources is approx. 7 Mton, almost 10% of the current food loss and waste levels, set at 88 Mton for the EU annually (Bowman & Luyckx, 2019).

## Feed requirements

The nutritional requirements of poultry consist of energy, protein, and vitamins. Other, non-nutritive feed substances are water and grit (used in the chicken gizzard to grind food). Energy is supplied through carbohydrates, crude fiber and fat. Protein consists of various amino acids. A lack of essential amino-acids may cause health issues so should be compensated through other sources.

The feeding value of ingredients for poultry depends on various factors, such as nutrient composition, nutrient digestibility, toxins (some ingredients should be heated to treat toxins), palatability and nutrient balance. The use of side flows in poultry production systems is limited by the fact that poultry is usually fed with dry meal or pellets only, whilst pigs are better digesters of wet feed and therefore there is a higher potential to include side flows in pig feed than in poultry feed. Poultry can consume wet feed, and certainly broilers do appreciate wet feed, but due to the higher moisture content in the feed, they do not always eat enough dry feed and growth is often slower than with dry feed.

## Agrologistic opportunities and building blocks

The project findings could be translated into seven building blocks to guide a poultry farmer towards a circular feeding concept, by determining

- 1. Availability of side flows as feed** based on volume, composition, sources, continuity of supply, competition with other uses, local sources and transport distance
- 2. Direct or indirect routes for use of side flows** considering processing or conversion steps to safeguard safety. Indirect routes include processing, soil fertilization or intermediary steps such as insects.
- 3. Suitability of side flows** based on dietary profiles, stages and duration of the production cycle, production systems, composition of daily menu, acceptable conversion rates and animal welfare requirements
- 4. Legal requirements** including current limits imposed by the animal by-product directive (EU)
- 5. Positive business case**, including cost-benefit efficiency, pricing of inputs, available technology of production systems and economy of scale
- 6. Environmental impact** including GHG emissions, water or land use, air quality and biodiversity
- 7. Social acceptance by consumers and other food system stakeholders**, including branding, information provision, certified processes and cross-sectoral collaborations.

Applying the method creates unique circularity by design options for unique chicken farms utilizing unique side flows, considering context-related opportunities and requirements. Although the description is focused on poultry feed, it provides the building blocks to evaluate any side flows for any production process and on any farm.



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