ADVISORY COMMITTEE ON ANIMAL FEEDINGSTUFFS

62nd Meeting of ACAF on 9 October 2013

Presentation Paper: Insect Protein as a future feed material within the EU legal framework

Elaine Fitches and
Adrian Charlton
FERA
September 2013

Elaine Fitches
Adrian Charlton

Insect Protein as a future feed material within the EU legal framework

9th October 2013

Insects as a source of Protein

- Premise
- Global R & D
- Safety considerations

Animal Feed: The Protein deficit

April 2011 EU initiative highlighted the need for the EU to find alternative and sustainable protein sources (currently only 30% self-sufficient)

- Land-use issue i.e. food crops vs feed crops
- Global feed markets volatile - impact on consumer
- EU reliance on imports (US, Argentina, Brazil)
- Animal farming sustainability threatened
- Global consumption of meat (pig and poultry) rising
- Availability of suitable replacement crop for soya?

Critical requirement to develop methods to enable exploitation of alternative sources of protein

Why Insects ?

- Insects highly efficient in the rapid conversion of waste into biomass

  e.g. housefly larvae can complete development in 7-10 days at room temperature with 60 % reduction in substrate mass

- Protein digestibility (86-89%) higher than many vegetable based proteins

  Variety of insects have been shown equivalent or superior to soyabean as high protein source for chick growth (1970's – 1980's)

Protein content (30-80 % d.m.)
Fat content (5-60 % d.m.)
Fibre content (4-60 % d.m.)

UK Maggot farming State of the Art


Blowfly: *Calliphora* spp.

- Several sites produce ca. 20 tonnes of maggots weekly (ca. 5 tonnes dry weight)
- substrate abbattoir waste
- Achieved in small areas (<0.2 ha.)
- Non-optimised, inefficient procedures
  - offset by high returns on angling maggots
- With optimal procedures a significant increase in productivity per unit area feasible

Productivity/Land Use
Crop vs Insect Biomass

2013 values

Soya £400- £510 (non-GM) / tonne:

Production 2.47 tonnes/ha. = £1250

90% dry wt & 40 % crude protein = 0.788 tonnes protein

Insect Production: based on current non-optimised procedures = 25 tonnes/ha. every 8-10 days

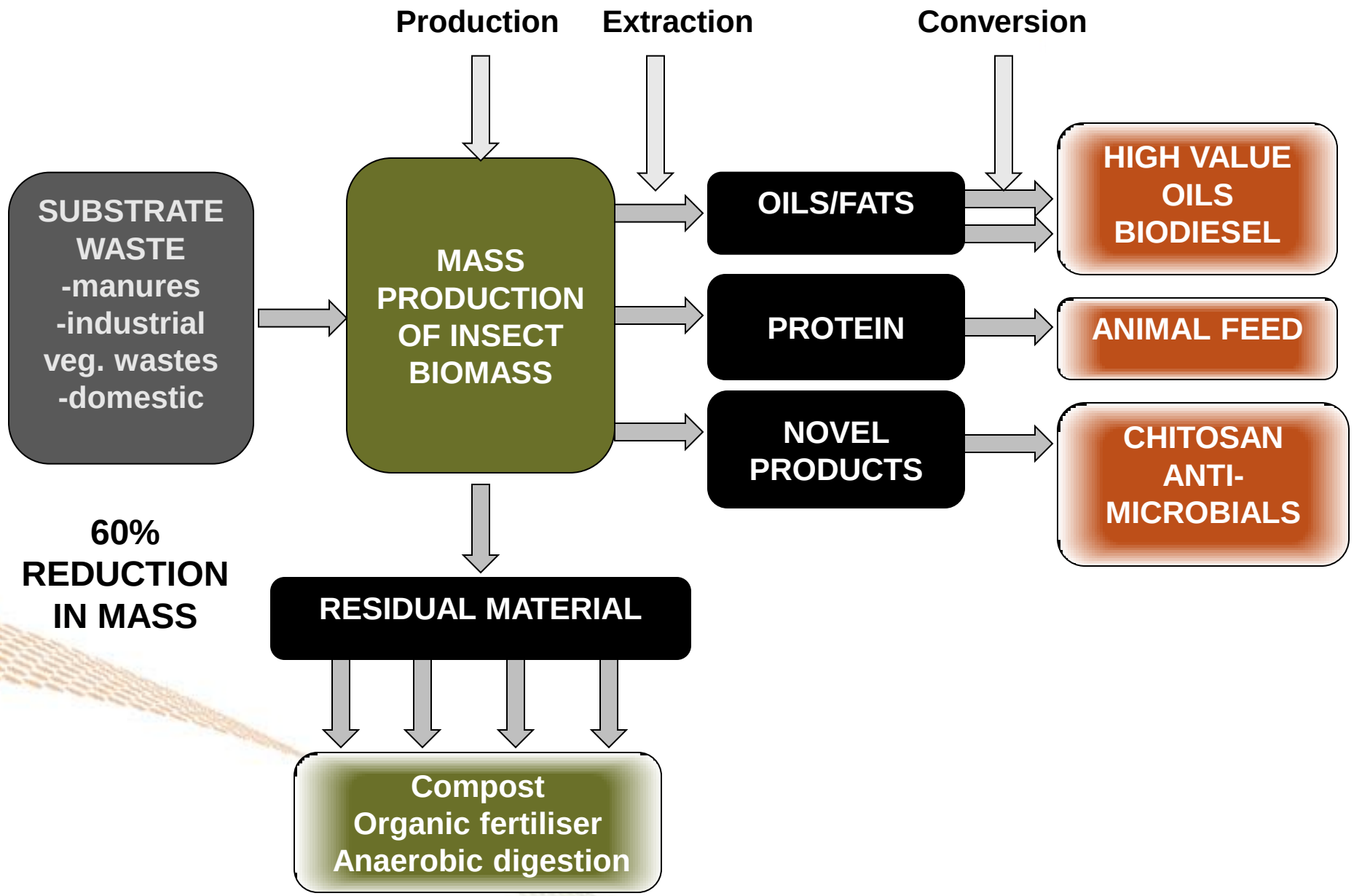
= 1000 tonnes/year/ha.

25% dry wt & 60 % protein = 150 tonnes protein

Production potential per unit area 200 x soya

Value of product ???

Cost of production ???


Production
Extraction
Conversion
SUBSTRATE WASTE
-manures
-industrial veg. wastes
-domestic
MASS PRODUCTION OF INSECT BIOMASS
OILS/FATS
PROTEIN
NOVEL PRODUCTS
HIGH VALUE OILS BIODIESEL
ANIMAL FEED
CHITOSAN ANTI-MICROBIALS
60% REDUCTION IN MASS
RESIDUAL MATERIAL
Compost
Organic fertiliser
Anaerobic digestion

Global research

Primary focus on fly species able to develop on a range of waste substrates

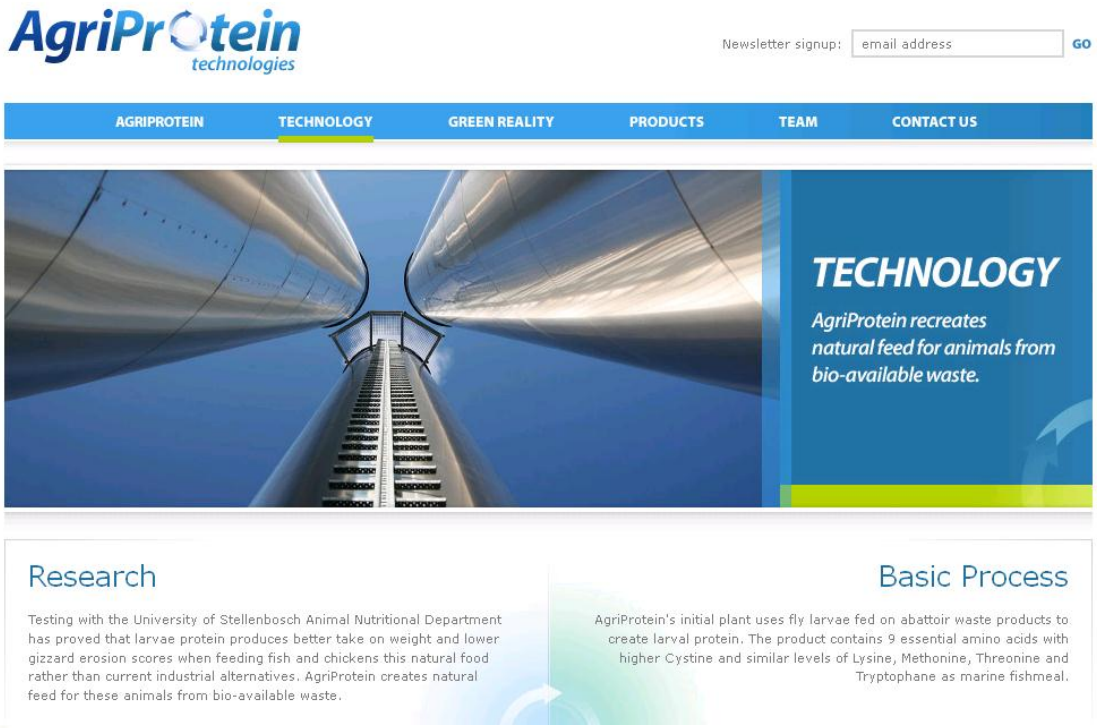
Black soldier fly *Hermetia illuscens*

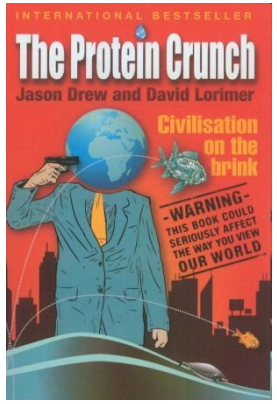
- food, swine, human & poultry waste
- min. 14 days: egg to mature larvae
- require > 30 ° C for development
- mean wt 0.2 g/ larvae

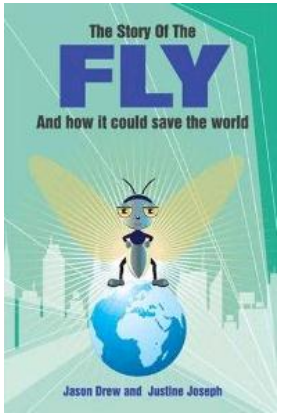
House fly: *Musca domestica*

- food, swine & poultry waste
- 4-13 days: egg to mature larvae
- require > 17 ° C for development
- mean wt 0.02 g/larvae

South Africa







- AgriProtein established 2009
- Already producing several tonnes per week
- Uses abattoir blood/wheat germ as diet for *Musca*
- Producing protein based-feed for monogastrics
- Awarded Innovation Prize for Africa 2013

U.S. Texas

ESR INTERNATIONAL™
Making Waste Our Greatest Resource

- R & D company with focus on elimination of landfill

- Parent Company of ProtaCulture inventor of BioPod™ system that uses Black soldier fly larvae to eliminate household waste

Spain

Universidad de Alicante

- Industrial pilot scale plant - Benidorm
- Black soldier fly -processes 1 tonne waste/ day
- Focus on waste reduction
- Also interested in use of larvae/pupae for biodiesel, pharmaceutical and animal feed applications

Ecodiptera Life

Flysoil SL

Food and Agriculture Organization of the United Nations

fera

Edible insects
Future prospects for food and feed security

Launched during the International Conference on Forests for Food Security and Nutrition, May 2013, FAO Rome

Netherlands – September 2013

INSECT CENTRE

International cooperative, International InsectCentre (IIC) established by more than 15 companies and government agencies interested in promoting the application of insects and insect larvae as a protein rich source for feed, food and the pharmaceutical industry.

WAGENINGEN UR
For quality of life

has university of applied sciences

UK

Technology Strategy Board
Driving Innovation

Alternative protein production technology for animal feed (April 2012)

SEVENTH FRAMEWORK PROGRAMME

PROteINSECT
INSECTS AS A SUSTAINABLE SOURCE OF PROTEIN
www.proteinsect.eu

Enabling the Exploitation of Insects as a Sustainable Source of Protein for Animal Feed and Human Nutrition (Feb 2013)

Quality and Safety of Insect Protein at Fera

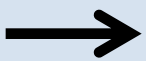
- Little published data is available in relation to the risks of using insects in feed and how these can be managed.
- Robust nutritional data also sporadic. There is a need to bring this together and fill in any gaps.
- Performance traits of animals fed on insects also need to be established.
- Downstream analysis of meat from insect reared animals also needs to be undertaken in relation to safety and quality (e.g. taints).
- Potential for by-products such as fats and oils is also being considered.

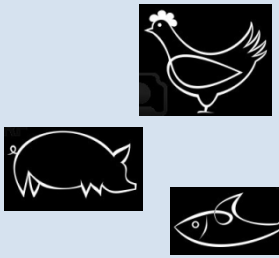
Animal Feed

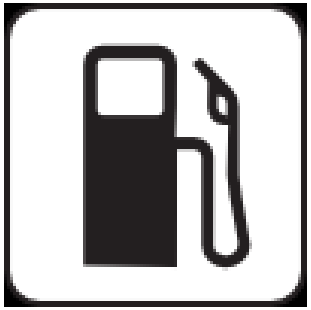
Refined protein

By-products

Nutrition & Quality







Oils & Fuels

Cosmetics & pigments

Bioactives

Input amount of chemical

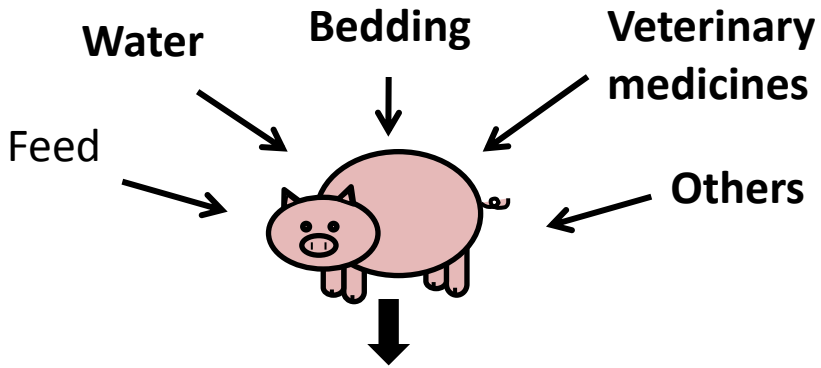
Mass balance of chemical (amount in manure)

Feed conversion rate (amount in fly larvae)

Effect of processing on chemical (amount in insect protein preparation)

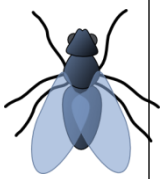
Maximum possible amount

Regulatory limits



Manure

Animal/human pathogens	Environmental contaminants	Pesticides	Medicines



- **Bioaccumulation** of toxic substances in the larvae
- **Pathogen** survival
- Natural components – **allergens**, anti-nutritional substances

Production of insect protein

Risk mitigation	Risk persistence
Inactivation of pathogens by heat/pressure/chemical processing	Insufficient inactivation of pathogens
Removal of toxic substances by extraction methods	Concentration of toxic substances in comparison to regulatory limits for feed

Chemical Safety

- Risks will be dependant on processes used in WP1&2
- Different feedstocks and insect combinations = different risks

Examples might include:

- Bioaccumulation of metals and environmental contaminants.
- Concentration of natural contaminants such as mycotoxins.
- Transfer of toxic residues e.g. pesticides

Microbiological Safety

- Again, feedstock and insect dependant, but can potentially be managed through processing e.g. heat, pressure.

- Anticipated risks may include; *Salmonella spp, Campylobacter, Lysteria spp, Cryptosporidum parvum*, and viruses such as rotavirus and Hepatitus E.

Allergens

- Very little information available about insect allergens.

Two approaches to be taken:

- Wide screen for known allergens using LC-MS/MS and ELISA.
- Bioinformatics search for allergen orthologues where insect genomes are available.

Nutrition & Quality

- Nutritional profiles of insects for designing feeding trials.
- Product quality parameters may include e.g. taints in meat from animals reared on insect based diets.

Potential and known issues

- Botulism in manures
- Veterinary medicines e.g. Nicarbazin
- Heavy metal accumulation

Legislative challenges

- Manure and urine currently banned as animal feed and insects are animals.
- Insects cannot be feed to animals including wildlife (but excluding pets!).
- Insects meal classified as PAP so BSE regulations apply.

Added Value

- Investigate potential use of waste and by-products.
- Current insect products include chitin/chitosan and shellac
- Insect oils may have value as fuel
- Insect manures as fertilisers?