Feeding trials with green protein in laying hens: effect on production and digestibility

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Objective

The specific objectives were:

- To study the effect of clover grass protein concentrate on production performance (egg %, egg weight, egg mass, feed intake, FCR) of organic hen fed 100% organic diets
- To evaluate apparent digestibility of amino acids and nitrogen retention
- Effect on egg quality

Materials and methods

- Chemical analysis of all raw ingredients used
- Feed formulation and production of 4 experimental diets including increasing level of CGPC
- Feeding 4 diets to laying hens and data collection on performance and welfare
- Digestibility trial
- Egg quality analysis

Experimental design, Housing and diets

- Experimental set-up
- Arrival of hens (17th week of age)
- 12 weeks (17-29 wk)
- Standard organic layer diet

- 12 weeks (30-42 wk)
- 4 diets (A, B, C, D)
- Data collection
- Digestibility trial (3 days)

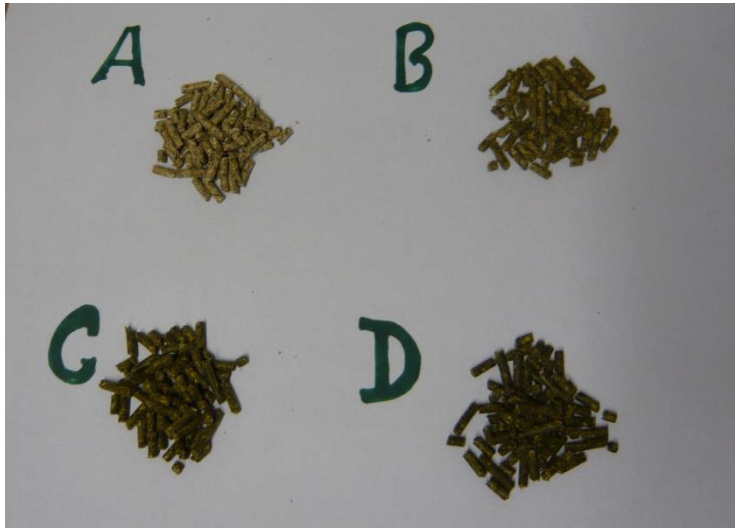
4 experimental diets

Diet A: Diet including 0% CGPC (Control)

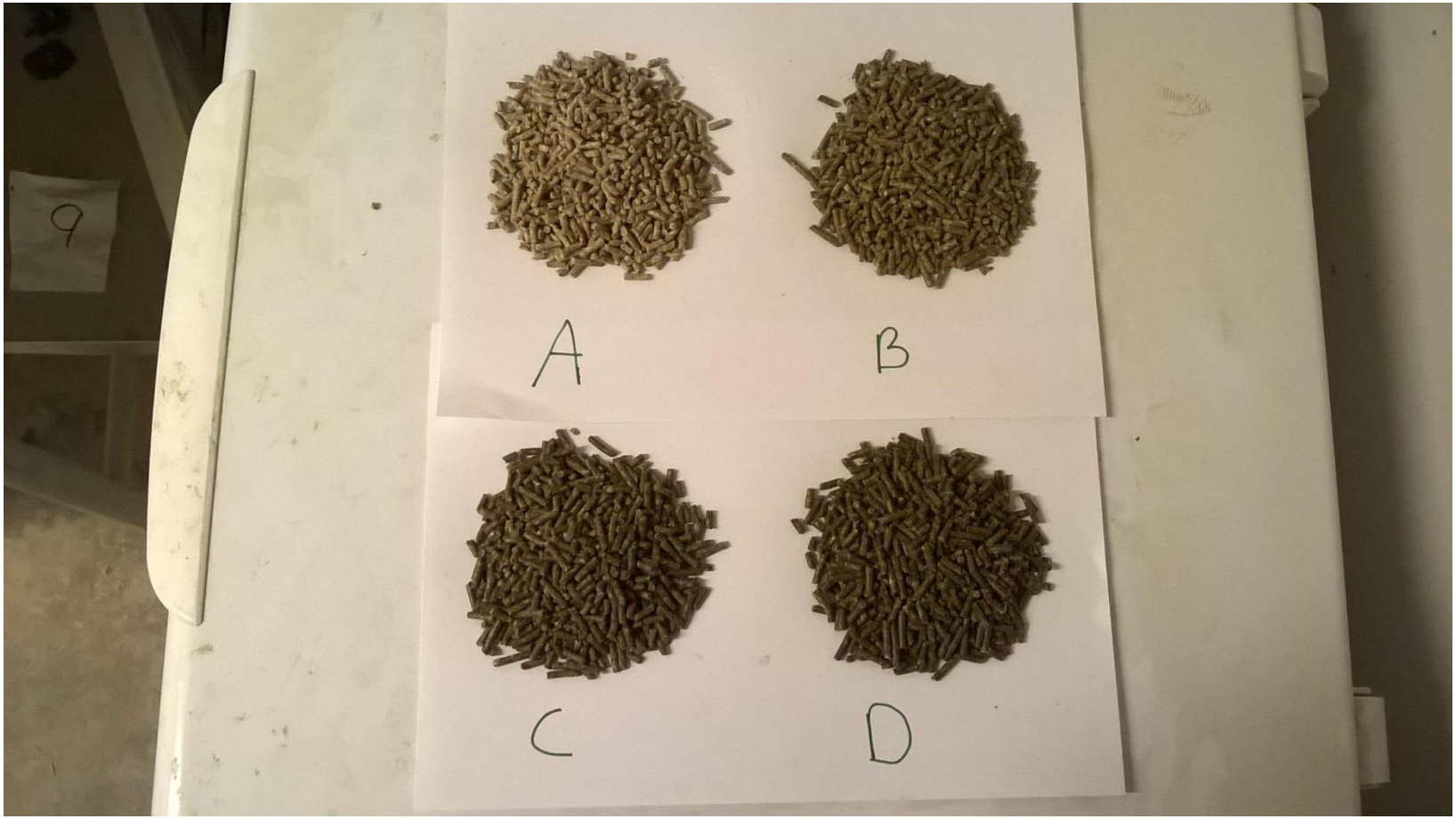
Diet B: Diet including 4% CGPC

Diet C: Diet including 8% CGPC

Diet D: Diet including 12% CGPC



Diets with 0, 4, 8 and 12 % CGPC



Diet composition (%)

Raw materials	A	B	C	D
Wheat	43.74	40.00	40.00	40.00
Oat	8.00	8.00	8.00	8.23
Triticale	4.00	5.88	4.99	4.00
Sunflower cake	8,00	8,00	8,00	8,00
Soybeans	9.00	7.00	4.83	**0**
Soybean cake	8.00	6.31	4.89	5.95
Clover grass PC	**0**	4.00	8.00	12.00
Rapeseed cake	6,52	8,00	8,00	8,00
Fish meal	3.00	2.84	3.00	3.00
Rapeseed oil	0.20	0.50	0.90	1.48
Calciumcarb.	4.00	4.36	4.30	4.25
Oyster shells	4,43	4,00	4,00	4,00
Monocalcium phos.	0,30	0,30	0,30	0,30
Salt	0,18	0,16	0,12	0,09
Sodium carbonate	0,18	0,20	0,22	0,25
Vitamin/minerals/enz	0,45	0,45	0,45	0,45

Calculated content of nutrients

- Protein: 18.7 %
- Fat: 6 %
- Starch: 31 %
- Sugars: 2,2 %

- AME: 10.5 MJ/kg (EU formula)

- Met: 3.3g/kg, Met+Cys: 6.5g/kg, Lys: 9.2g/kg, Thr: 6.8

- Calcium: 3.5 %
- Phosphorous: 0.54 %

Result

Effect of diets on production performance

Parameter	Diet A	Diet B	Diet C	Diet D	P-value
Feed intake, g/h/d	119.34	120.40	119.84	124.04	0.647
Egg production, %	87.37	90.08	91.46	89.01	0.606
Egg weight, g	62.81	61.92	61.38	62.72	0.111
Egg mass, g/h/d	54.15	55.74	56.44	55.26	0.815
Feed : Egg	2.25	2.22	2.18	2.30	0.436

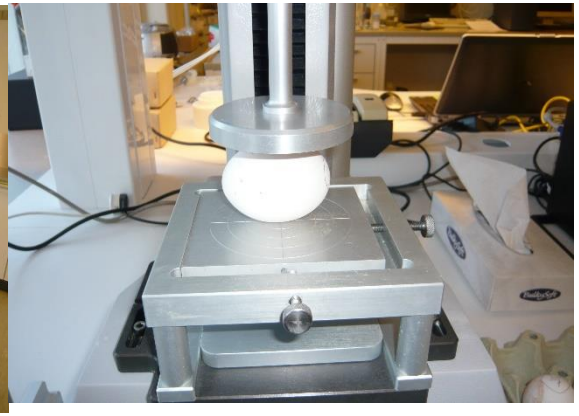
Egg quality analysis

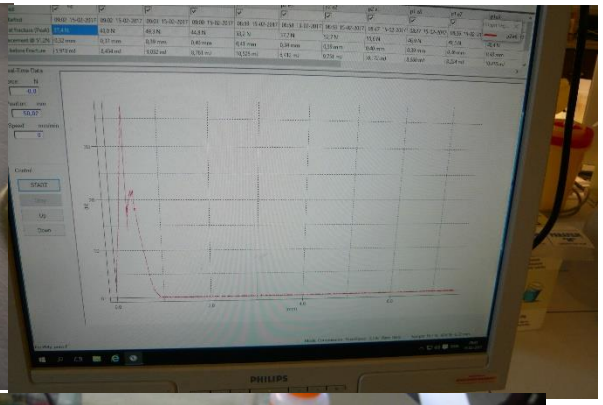
- Egg shell quality

Shell fracture force

Displacement of fracture

Slope gradient





- Egg yolk color

Lightness

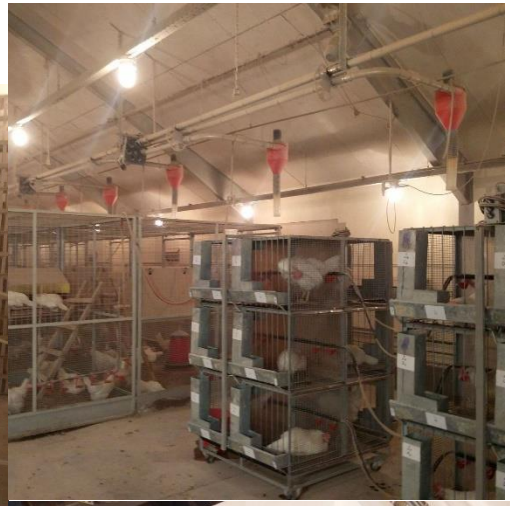
Redness

yellowness

Eggs from diets with 0, 4, 8 and 12 % CGPC

Digestibility trial

- Total tract apparent digestibility
- In battery cages (37-38 wk)
- Adaptation period= 6 d
- Experimental period= 3 d
- Diets A, B, C or D; no silage



- Excreta collection: 3 times/d
- In closed bin
- Kept at temp. of -20 ^{o}C

Apparent digestibility of amino acids and N-retention

- Nitrogen retention (% of intake)
  - On average 36.6 % with no significant difference between treatments
- Apparent digestibility of methionine, lysine and other amino acids (% of intake):
  - There were no significant effect in the daily intake (mg/h/d) of methionine and lysine from the diets
  - Apparent digestibility of methionine, lysine and other amino acids decreased significantly with increasing content of CGPC in the diets

Why does the digestibility of amino acids decrease with increasing content of CGPC?

Lower quality of the green protein compared to soya?

- too high ash content?
- too high fiber content?
- composition of the NSP ~ monosaccharide composition?

Consequence: The digestibility of amino acids in CGPC could be lower than in soybean

Conclusions

- Green protein could be a potentially alternative protein source in organic layer diets:
  - same production parameters obtained with all diets
  - positive effect on yolk color – 12% CGPC maybe too high?

Longer term effect during a whole production period? (80/90 weeks):

- high quality of the green protein important
  - higher protein content
  - lower ash content
  - optimization of the biorefinery process necessary

Green-Eggs

Greening of organic Egg-Production

Partners:

Organic Egg producer

DLG

SEGES

Aalborg University, KBH

Aarhus University, Foulum

GUDP (Green Development and Demonstrationsprogram under the Ministry of Environment and Food)

http://lfst.dk/tilskud-selvbetjening/tilskudsguide/groent-udviklings-og-demonstrationsprogram-gudp/

Green-Eggs

- 100% organic feeding
  - January 1, 2018

- Increased use of locally produced crops to cover nutrient supply
  - Introduce green protein to ensure amino acid supply
  - Use of energy willows as roughage / reduction of N leaching
  - feeding strategies
- A production that supports high health and animal welfare: increased credibility

Sustainability

AU-Foulum
Organic platform