PROJECT RESULTS
OK-NET ECOFEED

V.Ö.P
Verbund Ökologische Praxisforschung

Bioland demeter Naturland

Agenda

OK-Net EcoFeed

- Introduction to the project
- Overview of our publications
- Results of the trials
  - Nettles in cultivation and feeding
  - Testing clover varieties in the chicken run
- Information on trials in other countries

1 Introduction to the project

Introduction to the project

OK-NetEcoFeed

V.Ö.P
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- Organic Knowledge Network on Monogastric Animal Feed
- EU Horizon 2020 joint project
- Project duration 2018 - March 2021 (extension by 3 months)

Objective: To contribute to **100 % organic feeding of** monogastric animals in organic farming.

Collect, test and publish approaches to solutions in regional innovation groups.

19 partners from 11 countries

IFOAM EU GROUP
MAKING EUROPE MORE ORGANIC

FiBL

ICROFS
Internationalt Center for Forskning i Økologisk Jordbrug og Fødevaresystemer

ORGANIC RESEARCH CENTRE
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ecofeed

2 Overview of our publications

Knowledge transfer and communication

Publications overview

Topic	PDF	Video
Trials		
➢ Cultivation of nettles	German and English	German and English
➢ Nettles for feeding	German and English	
➢ Varieties of clover in poultry ranges	German and English	German and English
Elaborations		
➢ Soy feeding	German and English	
➢ Amino acids in energy feed	German and English	
➢ Waste heat utilisation	German, English and French	
➢ Free-choice feeding	German and English	


OK NET ecofeed

PRACTICE ABSTRACT

Focus on the amino acid content of energy feedstuff components

Problem

Switching poultry rations from 95 % to 100 % organic feed can lead to a reduction in the use of home-grown and regional feed. Currently, conventional maize gluten and conventional potato protein are replaced by organic oilcake (soya, sunflower, rapeseed, sesame). Oilcake has a comparatively low content of important amino acids such as methionine and so higher proportions of oilcake must be used. This can lead to further reductions in the use of regionally produced and home-grown feed components such as cereals.

Solution

Energy feedstuff components contain different amounts of amino acids such as methionine. Some grain species have a high methionine content and can grow well in most regions by the farmers themselves. The best examples are proso millet (*Panicum milleceum*) and naked oats (*Avena nuda*) followed by spelt, naked barley (*Hordeum vulgare* L. var. *nudum* Hook. f.) and buckwheat with all containing higher levels of methionine than wheat or maize.

Figures 1 and 2 show the harvest and a field visit as part of the project "Proso millet in poultry feed"

Applicability box

Theme
Layers, broilers, feeding and ration planning

Context
High percentage of self-produced or regional feed components

Application time
All-year-round use in animal feeding

Period of impact
Permanent

Equipment
Storage and mixing feed

Best in
Own cultivation and use on the farm

Figure 1: Millet harvesting. Picture: Julia Roesch

Figure 2: Millet field visit. Picture: Elisabeth Assmann

Benefits

In the present ration example, the use of oil cake can be reduced from 34.8 % (see Table 1) to 26.1 % (see Table 2). This means that the share of home-grown and regional components can be increased by more than 8 % since the oil content could also be reduced.

European platform with practical knowledge on organic farming:
https://organic-farmknowledge.org/

3 Experiments on the cultivation and feeding of nettles

Nettle cultivation and feeding

Cultivation basics

Example: Contract cultivation of stinging nettles for Agrimed , near Darmstadt

- Perennial cultivation
- Spacing: 50 cm rows and 30 cm plant = 50,000 plants per ha.
- As fine a seedbed as possible, planting from soil press pots as a young plant (pre-planting in the greenhouse).
- 2 - 3 cuts per year, cutting and loading in is done in one operation.
- After pruning the plant needs some time and rainfall
- Fertilisation: NaWaRo, digestate application with skids and drag hose, 30 m^3 before planting and
  approx. 50 kg-N after the first cut.
- Care: Hoe machine, additional 60 - 80 h hand hoe.
- Irrigation: 3 times with 20 mm each.
- Yield : 3 t DM per ha
- Leaf-stalk separation with wind sweeper/sifter, drying 50 °C

Analyses

Analysis	Nettle 1st cut wild collection	Nettle 1st cut Sowing without fertilisation	Nettle 2nd cut Fertilisation 200	Nettle Stolonen Fertilisation 100
Sampling	08.07.2019	27.04.2020	26.05.2020	10.08.2020
	TM88	TM88	TM88	TM88
Raw nutrients				
Dry matter g/kg FM	880	880	880	880
Crude ash (XA)	161	159	174	120
Crude protein (XP)	289	247	287	330
Crude fibre (XF)	83	62	64	144
Crude fat (XL)	19	30	21	21
Strength (XS)				28
Sugar (XZ)	38	100	72	13
Energy values				
Energy conversion poultry (ME)	5,61			6,48
Amino acids				
Lysine	14,34	13,58	13,64	16,09
Methionine	**4,52**	**4,08**	**4,21**	**4,49**
Threonine	11,41	10,75	11,08	11,23
Tryptophan	2,85	4,89	5,18	3,34
Lysine/Methionine	0,32	0,3	0,31	0,28

Nettle cultivation and feeding

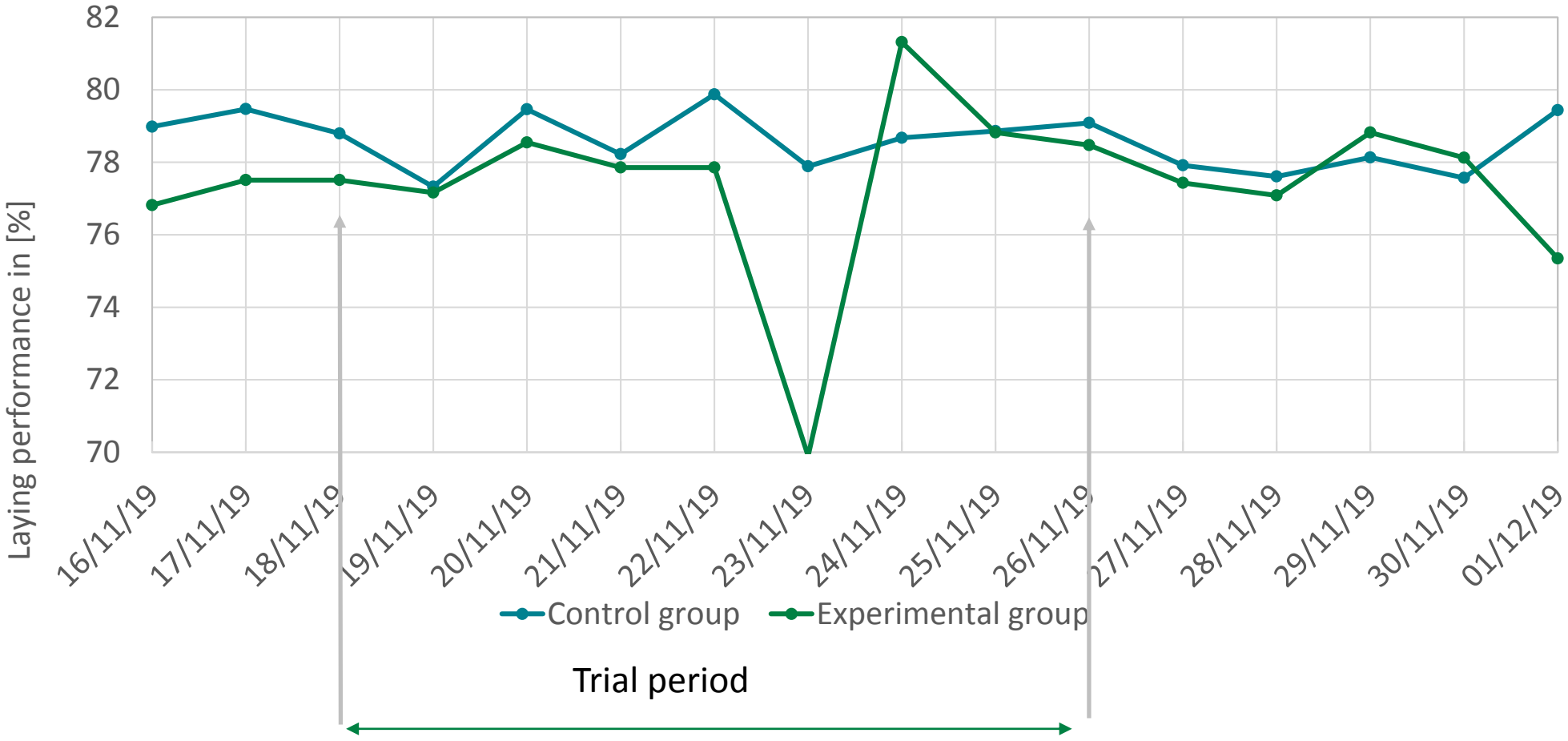
Ration feeding trial 1

Component	Share	Ingredients										
	%	Energy	Raw prot	Crude fat	Crude fibre	Lys	Met	Met+Cys	Trp	Ca	P	Na
		MJ ME	*%*	*%*	*%*	*%*	*%*	*%*	*%*	*%*	*%*	*%*
Maize	15,00	2,16	1,29	0,54	0,48	0,03	0,024	0,03	0,00	0,00	0,05	0,00
Wheat	16,25	1,51	1,76	0,42	0,50	0,05	0,029	0,08	0,02	0,01	0,05	0,00
Triticale	9,00	0,93	0,95	0,21	0,31	0,03	0,017	0,04	0,01	0,01	0,03	0,00
Oats	5,00	0,40	0,53	0,25	0,53	0,02	0,009	0,03	0,01	0,01	0,01	0,00
Lucerne meal	2,50	0,15	0,49	0,08	0,50	0,02	0,005	0,01	0,01	0,04	0,01	0,00
Peas	6,00	0,76	1,26	0,16	0,41	0,09	0,011	0,03	0,01	0,01	0,03	0,00
Field bean	2,50	0,27	0,66	0,04	0,20	0,04	0,005	0,01	0,01	0,00	0,01	0,00
Bread drink	2,00	0,00	0,00	0,00	0,00	0,00	0,000	0,00	0,00	0,00	0,00	0,00
Oyster shells	1,75	0,00	0,00	0,00	0,00	0,00	0,000	0,00	0,00	0,67	0,00	0,00
Supplement LH 35	30,00	2,40	7,95	1,95	4,05	0,35	0,180	0,32	0,00	4,50	0,35	0,15
Nettle	10,00	**0,56**	**1,85**	**0,44**	**1,29**	**0,11**	**0,035**	**0,04**	**0,03**	**0,16**	**0,03**	**0,01**
Content in compound feed	**100,00**	**9,13**	**16,73**	**4,08**	**8,26**	**0,74**	**0,315**	**0,58**	**0,10**	**5,39**	**0,56**	**0,16**
Target value laying fodder		10,50	17,00	4,00	5-7	0,78	0,32	0,6	0,16	3,70	0,53	0,18
Proportion of protein from cereals		**18%**										

Approx. 0.5% less protein and 0.01% less methionine

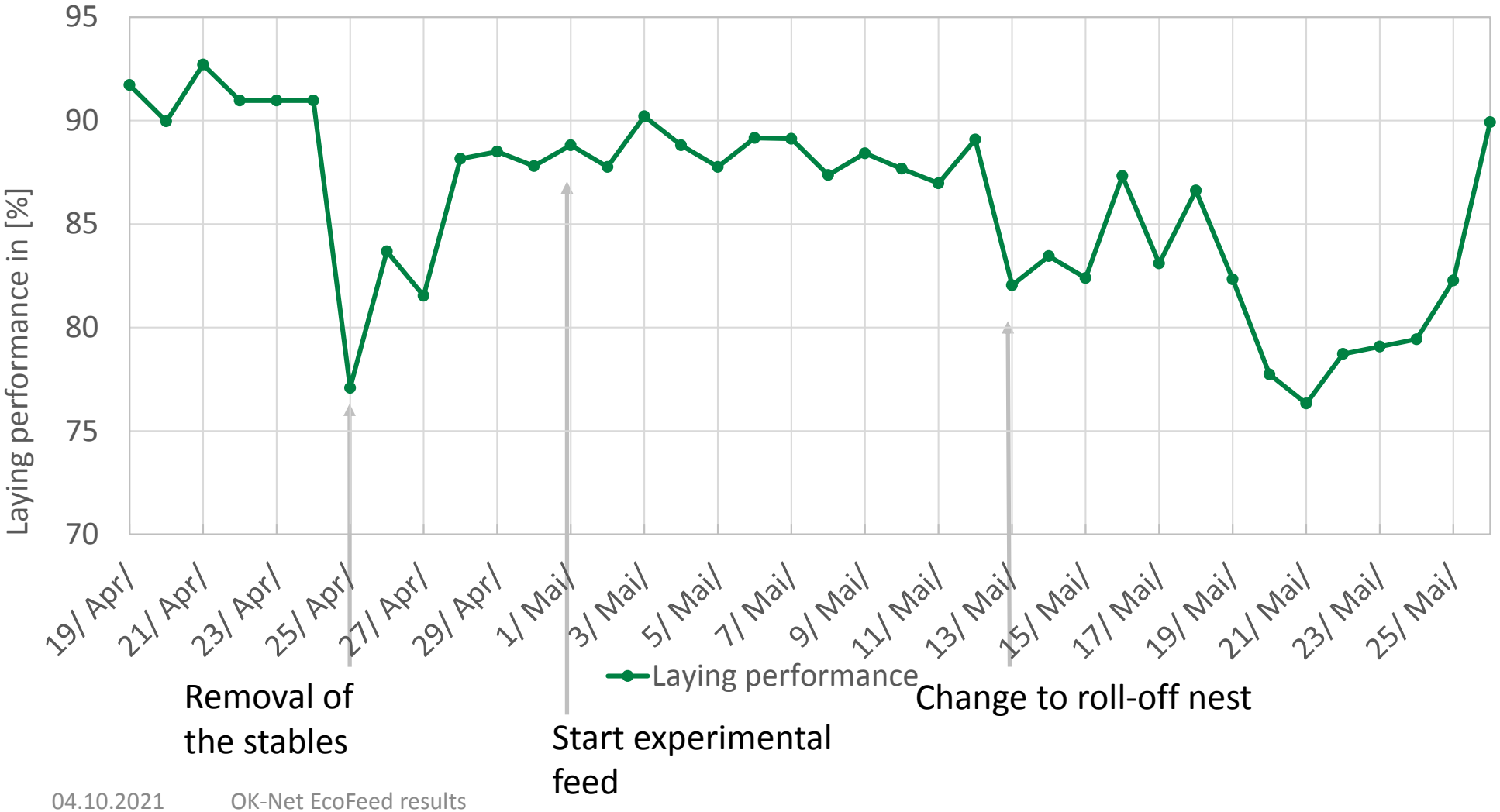
Nettle cultivation and feeding

Laying performance Feeding trial 1



Nettle cultivation and feeding

Laying performance Feeding trial 2



Nettle cultivation and feeding

Conclusion on cultivation

- Cultivation complex
  - No-till and stolons poorly emerged in 1st year
  - Propagation via stolons works better
- Analyses of pure leaf mass and of later cuts show good methionine values, ratio of lysine to methionine low (0.3..).
- Use as green meal is conceivable
  Attention: Nettles not approved as animal feed!

Nettle cultivation and feeding

Conclusion on the feeding trials

- Sensory properties of the feed: very positive
- Animal health or behaviour: no abnormalities, faeces of the animals: very firm (perception: unchanged to positively influenced - trial 1)
- Laying performance and egg quality traits (egg shell, yolk colour, protein quality): no changes discernible, not even compared to a control group (trial 1).

Nettle cultivation and feeding

Published info

- Video of the experiment (DE + EN)
- Practice Abstract on cultivation (DE + EN)
- Practice Abstract on feeding (DE + EN)

4 Experiment with clover varieties in the chicken run

Image: Corinna Nielan

Clover varieties in the chicken run

Variety selection

- Establishment of variety plots in the outlet
  - **White clover** "Hebe„
  - **Red clover** diploid: "Lucrum",
    tetraploid: "Titus"
  - **Lucerne** "Daphne"

- Observation of the growth and the feeding behaviour
  - Impression of the farmer
  - Observation with camera

Image: Corinna Nieland

Clover varieties in the chicken run

Results

- Feeding behaviour
  - No clear preference for individual plots.
  - A slight preference for white clover was observed.
- Growth (literature values)
  - Lucerne and red clover 160 dT / ha
  - White clover 85 dT / ha
- Analyses

Pictures: Corinna Nieland

Clover varieties in the chicken run

Analyses, 2nd cut, 08.06.20

	Lucerne Daphne	White clover Hebe	Red clover Lucrum	Red clover Titus
Raw nutrients				
Dry matter (DM)	880	880	880	880
Dry matter g/kg FM	880	880	880	880
Crude ash (XA)	96	106	106	112
Crude protein (XP)	238	245	250	241
Crude fibre (XF)	173	136	144	149
Crude fat (XL)	15	18	18	20
Sugar (XZ)	62	92	77	74
Energy conversion poultry (ME)	5,01	5,61	5,5	5,37
Amino acids				
Lysine	12,7	12,31	13,06	11,79
Methionine	**3,65**	**4,07**	**3,49**	**3,05**
Threonine	10,33	10,03	10,42	9,94
Tryptophan	3,71	4,27	4,44	4,47
Lysine/Methionine	0,29	0,33	0,27	0,26

Image: Corinna Nieland

Clover varieties in the chicken run

Conclusion

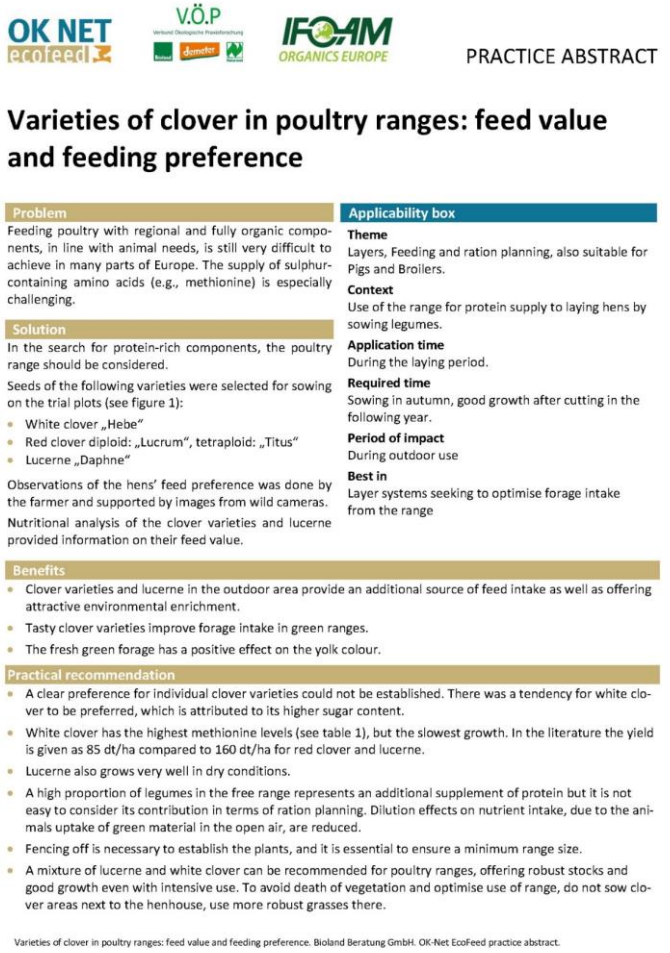
- High proportion of legumes in the run provide an additional supplement of protein and vitamins. Dilution effects of the feed through intake in the outlet are reduced. Yolk colour is positively influenced.
- Mixture of lucerne and white clover well suited for chicken runs. Thus robust stands and good growth even with intensive use. Lucerne also grows very well in dry conditions. Do not sow clover in the area close to the house.

Clover varieties in the chicken run

Published info

- Video of the experiment
(DE + EN)

- Practice Abstract for the experiment
(DE + EN)



PRACTICE ABSTRACT

Varieties of clover in poultry ranges: feed value and feeding preference

Problem

Feeding poultry with regional and fully organic components, in line with animal needs, is still very difficult to achieve in many parts of Europe. The supply of sulphur-containing amino acids (e.g., methionine) is especially challenging.

Solution

In the search for protein-rich components, the poultry range should be considered.

Seeds of the following varieties were selected for sowing on the trial plots (see figure 1):

- White clover „Hebe"
- Red clover diploid: „Lucrum", tetraploid: „Titus"
- Lucerne „Daphne"

Observations of the hens' feed preference was done by the farmer and supported by images from wild cameras.

Nutritional analysis of the clover varieties and lucerne provided information on their feed value.

Applicability box

Theme
Layers, Feeding and ration planning, also suitable for Pigs and Broilers.

Context
Use of the range for protein supply to laying hens by sowing legumes.

Application time
During the laying period.

Required time
Sowing in autumn, good growth after cutting in the following year.

Period of impact
During outdoor use

Best in
Layer systems seeking to optimise forage intake from the range

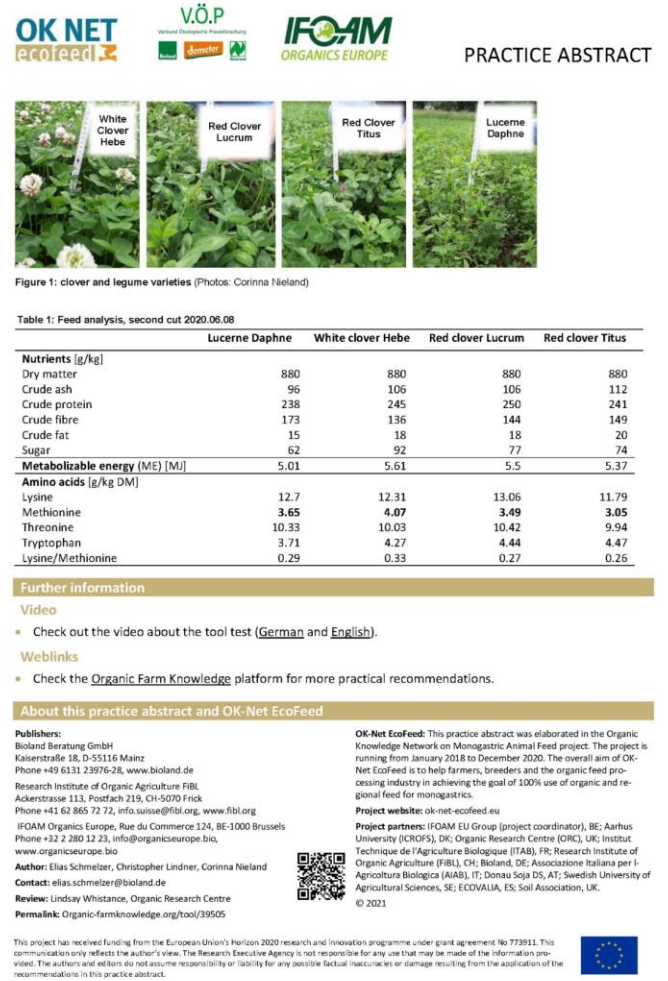
Benefits

- Clover varieties and lucerne in the outdoor area provide an additional source of feed intake as well as offering attractive environmental enrichment.
- Tasty clover varieties improve forage intake in green ranges.
- The fresh green forage has a positive effect on the yolk colour.

Practical recommendation

- A clear preference for individual clover varieties could not be established. There was a tendency for white clover to be preferred, which is attributed to its higher sugar content.
- White clover has the highest methionine levels (see table 1), but the slowest growth. In the literature the yield is given as 85 dt/ha compared to 160 dt/ha for red clover and lucerne.
- Lucerne also grows very well in dry conditions.
- A high proportion of legumes in the free range represents an additional supplement of protein but it is not easy to consider its contribution in terms of ration planning. Dilution effects on nutrient intake, due to the animals uptake of green material in the open air, are reduced.
- Fencing off is necessary to establish the plants, and it is essential to ensure a minimum range size.
- A mixture of lucerne and white clover can be recommended for poultry ranges, offering robust stocks and good growth even with intensive use. To avoid death of vegetation and optimise use of range, do not sow clover areas next to the henhouse, use more robust grasses there.

Varieties of clover in poultry ranges: feed value and feeding preference. Bioland Beratung GmbH. OK-Net EcoFeed practice abstract.



PRACTICE ABSTRACT

Figure 1: clover and legume varieties (Photos: Corinna Nieland)

Table 1: Feed analysis, second cut 2020.06.08

	Lucerne Daphne	White clover Hebe	Red clover Lucrum	Red clover Titus
Nutrients [g/kg]				
Dry matter	880	880	880	880
Crude ash	96	106	106	112
Crude protein	238	245	250	241
Crude fibre	173	136	144	149
Crude fat	15	18	18	20
Sugar	62	92	77	74
Metabolizable energy (ME) [MJ]	5.01	5.61	5.5	5.37
Amino acids [g/kg DM]				
Lysine	12.7	12.31	13.06	11.79
Methionine	**3.65**	**4.07**	**3.49**	**3.05**
Threonine	10.33	10.03	10.42	9.94
Tryptophan	3.71	4.27	**4.44**	4.47
Lysine/Methionine	0.29	0.33	0.27	0.26

Further information

Video

- Check out the video about the tool test (German and English).

Weblinks

- Check the Organic Farm Knowledge platform for more practical recommendations.

About this practice abstract and OK-Net EcoFeed

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Project website: ok-net-ecofeed.eu

Project partners: IFOAM EU Group (project coordinator), BE; Aarhus University (ICROFS), DK; Organic Research Centre (ORC), UK; Institut Technique de l'Agriculture Biologique (ITAB), FR; Research Institute of Organic Agriculture (FiBL), CH; Bioland, DE; Associazione Italiana per l'Agricoltura Biologica (AIAB), IT; Donau Soja DS, AT; Swedish University of Agricultural Sciences, SE; ECOVALIA, ES; Soil Association, UK.

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3 Particularly relevant trials in other countries

Trials in France

- 100 % organic feed
- Replacing soy in feed with regional feeds
- Protein-rich plants for fattening pigs

Trials in France

Trial: 100 % organic feed

- Question: What can 100 % organic feeding look like?
- To the experiment
  - 2 Feeding phases
  - Laying phase: 17 - 68 weeks (2019/2020)
  - 100 % organic feeding
  - 350 laying hens

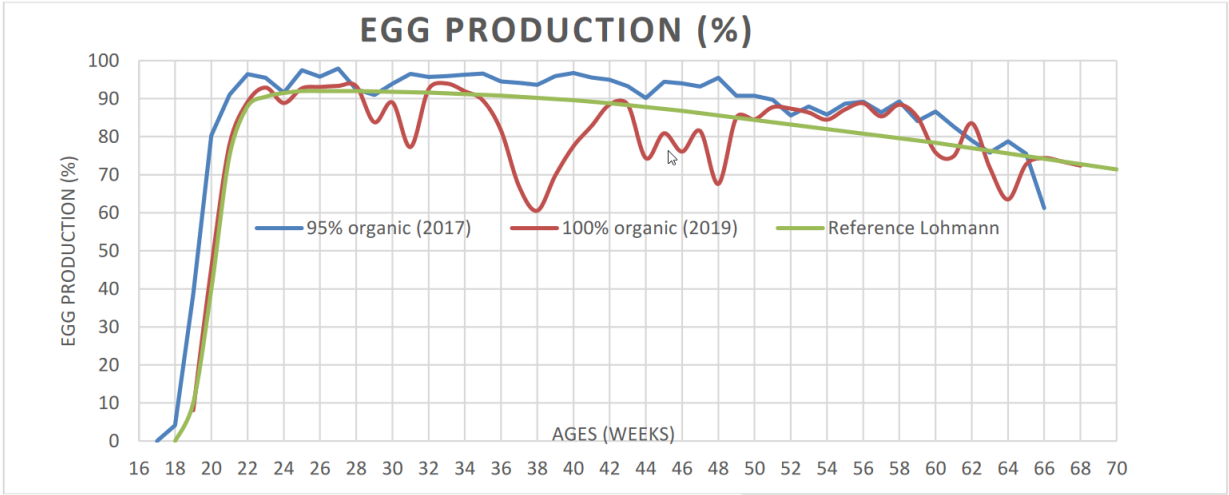


Figure 1: Egg production over time with 95 % and 100 % organic.

- Links: Video and Practice Abstract (EN): 100 % organic feedstuffs for laying hens

Trials in France

Trial: 100 % organic feed

Ration

Feed	Phase 1 Feed (%)	Phase 2 Feed (%)
Maize (C.P : 7.5)	35	35
Soybean Cake (C.P : 44)	22,5	18,7
Triticale (C.P : 11.5)	14,3	17,8
Sunflower Expeller (C.P : 24)	10	10
Bran (C.P : 9.5)	8	8
Minerals	10,2	10,5
Total	100	100
Price	610 €/t	585 €/t

Trials in France

Trial: 100 % organic feed

Nutrient composition of the 100% organic feed

Nutrient composition	Phase 1 Feed	Phase 2 Feed
Raw protein	17,7 %	16,40 %
Lysine	0,87 %	0,78 %
Methionine	0,29 %	0,28 %
Calcium	3,70 %	3,85 %
Phosphorus	0,66 %	0,60 %

Trials in France

Trial: 100 % organic feed

- Results:
  - 300 eggs/hen in the control group with 95% organic feed
  - 290 eggs/hen with 100% organic feed.
    (A heat wave resulted in a stronger drop in performance)
  - Slaughter weight of the old hens: 1.82 kg
  - Mortality: 7.1 %
  - Feed conversion: 2.56 (kg feed/ kg eggs)
  - Egg production: 81.5
- Conclusion: The lower egg production was compensated with higher egg prices. The total cost per hen was below the references.

Trials in France

Trial: Replacing soy in feed with regional feeds

- Question: What are the alternatives to soy?
- Problem: Soya cake is largely imported. Demand will increase with the implementation of the new organic regulation in 2022.
- To try:
  - In the final fattening feed, soya was replaced by camelina, rape seed and sunflower cake.
  - 350 broilers as control group and 2,350 broilers as test group

Links: Video and Practice Abstract (EN)

Image: ITAB

Trials in France

Trial: Replacing soy in feed with regional feeds

Feed	Control group (%)	Test group (%)
Triticale/peas	56,55	60,66
Wheat (10.5 % crude protein)	20	9,25
Sunflower seeds	0	3,54
Rapeseed Expeller	0	10
Sunflower Expeller	11,17	10,65
Camelina cake	2,04	3,20
Supplementary feed with soybean cake	9,35	0
Minerals	0,89	2,69
Total	100	100
Costs	449,1 €/t	447,55 €/t

Trials in France

Trial: Replacing soy in feed with regional feeds

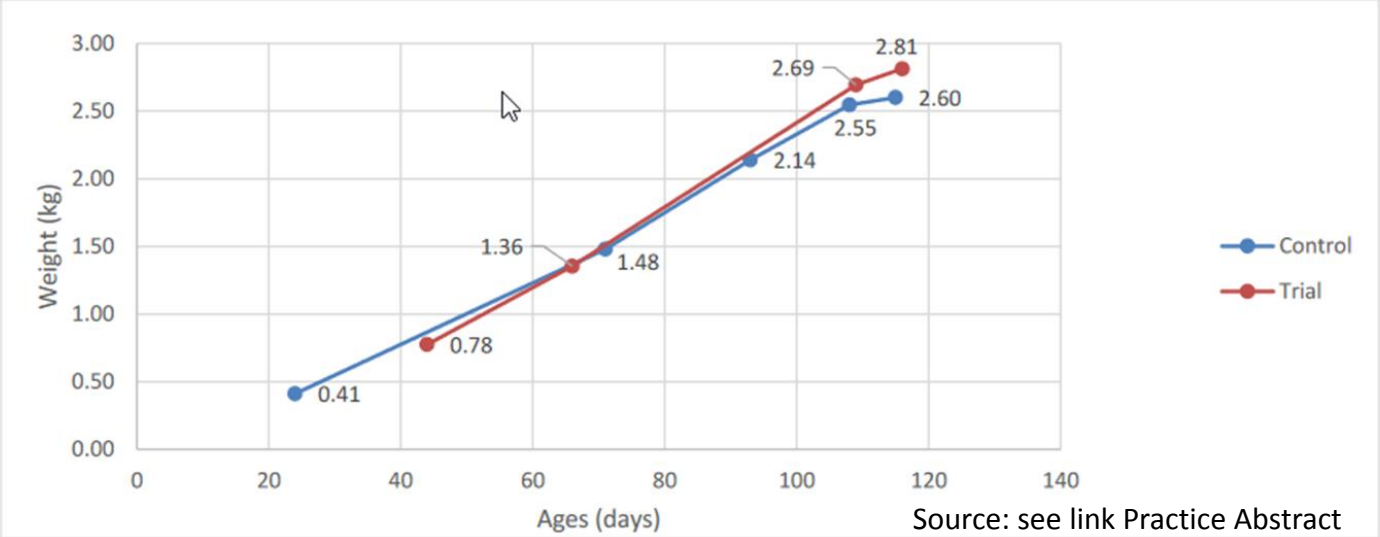
Nutrient composition	Control group	Test group
Crude protein	16 %	16 %
Metabolic energy	2700 Kcal/kg	2700 Kcal/kg
Fat	3,6 %	6,0 %
Usable lysine	0,66 %	0,65 %
Usable methionine	0,23 %	0,249 %

Trials in France

Trial: Replacing soy in feed with regional feeds

- Observations: The weight ranges show more heavy birds in the experimental group. But the weights of the chickens were similar:
  - Average weights at 1st slaughter at 108 days: control group 1.91 kg; test group 2.02 kg
  - Average weights at 2nd slaughter at 115 days: control group 2.0 kg; test group 2.01 kg

- Conclusion: The feeds contained similar nutrient compositions.
  In addition, local feeds meet the broilers' needs for the final stage, economic viability and social demand.



Source: see link Practice Abstract

Figure 1 : weight increase of broilers fed soya cake (control) or soya alternatives (trial)

Trials in France

Trial: Protein-rich plants for fattening pigs

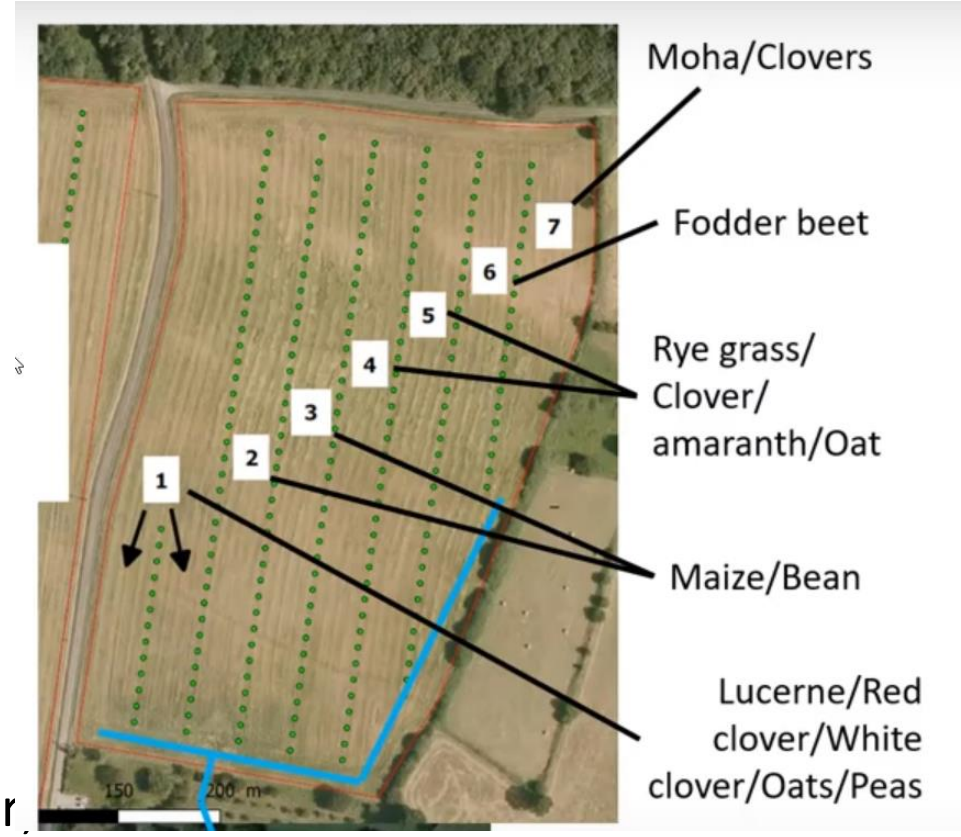
- Question: Can feed costs be reduced if final fattening takes place outdoors? Does this improve carcass quality?
- To the experiment
  - Cultivation of protein-rich plants in the run of the pigs
  - Access from the 18th LW
- Links: Video and Practice Abstract (EN)

Picture: Stanislas Lubac, ITAB.

Trials in France

Trial: Protein-rich plants for fattening pigs

- Material & Method:
  - Forage plots with 7 strips, 24 m wide; 5.7 ha
    - Moha shamrocks
    - Fodder beet
    - Rye Grass Clover Amaranth Oats
    - Maize bean
    - Alfalfa-red clover-white clover-oat peas
  - Animals:
    - Indoor control group: 12 animals
    - Test group in the run: 12 animals
  - Grazing period: Mid-July to end of August: Moha clover, then early September to mid-October maize/bean



Source: link Video, ITAB

Trials in France

Trial: Protein-rich plants for fattening pigs

- Observations - animal behaviour:
  - Access to fresh feed motivates the pigs to move, even if the paddocks are far away.
  - Pigs quickly learn to move through the corridors of shredded vegetation
  - they do not hesitate to enter the stand, even if it is high and dense
  - The pigs still use the aisles even after the grain has been eaten.
- Observations - Feed intake:
  - The green leaves of maize and beans are well eaten.
  - 100% of the maize ears are eaten
  - After 3 days of foraging, most of the vegetation was eaten up.

Trials in France

Trial: Protein-rich plants for fattening pigs

- Observations Forage plots: Moha clover paddocks
  - A clear preference for clover
  - Moha
    - Advanced growth in the early period
    - Much of the vegetation is wasted and trampled
  - Shamrocks
    - Very good consumption. Very little clover left at the end of the grazing period.
    - Some uneaten shamrocks in the middle of trampled moha clumps
  - Weed
    - Some leaves of goosefoot (Chenopodium) were eaten

Trials in France

Trial: Protein-rich plants for fattening pigs

- Observations forage plots: Maize-beans
  - Beans
    - Consumption of young leaves only
  - Maize
    - Excellent consumption of the ears
    - Eating green leaves and the tip of the stems
    - Chewed woody parts
    - Dry leaves and base of stems unchewed

Trials in France

Trial: Protein-rich plants for fattening pigs

- Results
  - Control group inside:
    - Start mid-April: 10.9 kg
    - End of July: 51.2 kg
  - Test group with outlet
    - Start mid-April: 11.1 kg
    - End July 62.4 kg
    - Final fattening weight in mid-October: 109.6 kg
    - TZ: 551 g (weaner to slaughter)
    - TZ: 630 g (final fattening phase)

Image: Carl Sheard

Trials in France

Trial: Protein-rich plants for fattening pigs

- Economic efficiency
  - Seed costs: Annual sowing expensive.
  - Additional work, including mobile fence management.
  - Feeding harvested grain to pigs kept indoors during bad weather.
- Conclusion
  - Reduction of feed costs possible under the conditions of the trial
    - Reduction by 30 % = up to 30 days longer fattening period.
    - Reduction of feed by 15 % = a 12-day extension.
  - A balance must be found between: carcass weight (and fattening time) and lean meat content.
  - The lean meat content has increased very significantly.

Trials in France

Trial: Protein-rich plants for fattening pigs

- Summary
  - Advantages:
    - Reduced use of concentrates
    - Easy to set up routine
    - A better managed soil
    - Positive customer feedback
  - Weaknesses:
    - More work
    - Seed costs
    - Weather restrictions
    - Pigs reject high and mature feeds

Trials in Italy

- Cultivation and feeding of camelina sativa

Trials in Italy

Experiment: Cultivation and feeding of camelina sativa

- Question: How can vegetable protein for monogastric animals be produced locally while increasing diversity in crop rotation and adapting to climate change? Soy should be replaced by regional alternatives.
- To the experiment
  - Feed with 3.5 % camelina sativa expeller and 1.5 % camelina sativa oil.
  - Method/animals: One run with 3,000 laying hens

Image: Cristina Micheloni, AIAB

- Links
  - Practice Abstracts: Use of organic Camelina in laying hen feed, processing, cultivation (EN)
  - Video Cultivation, processing and use of camelina for organic layers feed

Trials in Italy

Trial: Cultivation and feeding of camelina

- Feeding observations:
  - Laying performance and egg sizes unchanged
  - Increased animal welfare increased
  - Increase in omega-3 content observed.
- Observations Cultivation:
  - Camelina has a relatively short production cycle:
    Winter sowing: sow in mid-October - harvest end of May
    Summer sowing: sow in February - harvest June
  - Temperature insensitive (both high and low T.)
  - Drought-resistant
  - Nutrient availability undemanding; adaptable
  - Also suitable for slopes
  - Robust and not subject to infestation by parasites or pathogens (exception: individual plants under special conditions).

Image: Cristina Micheloni, AIAB

Trials in Italy

Experiment: Cultivation and feeding of camelina

- Problematic cultivation on waterlogged soils (soil must be well drained)
- Sowing depth of 1 cm, which requires careful preparation of the seedbed
- Inter-rows are not covered, which is why the weeds have to be worked with the harrow
- Harvesting can be done with a combine at low speed
- The seed must be cleaned before processing

- Observations Ration:
  - Due to the availability of new varieties and diversity, analysis is required
  - The farmer should start with a small amount and then gradually increase it
  - Due to antinutritional substances in the seeds, no more than 10 percent of camelina should be included in the ration.

Trials in Italy

Trial: Cultivation and feeding of camelina

- Conclusion:
  A new crop could be included in the crop rotation crop rotation,
  which contains high quality and complementary (to soy) proteins.
  camelina contains a rich source of omega-3 of omega-3 and tocopherols, which improved hen hens and improved the quality of production.

Image: Cristina Micheloni, AIAB

Trials in Denmark

- Biorefining of clover grass protein

Trials in Denmark

Trial: Biorefining clover grass protein

- Question: Can alternative protein sources, such as green protein concentrate from clover grass, increase the use of locally produced proteins in poultry diets?
- Problem: To achieve 100% organic feeding, local sources of protein for poultry are sought.
- To try:
  - Cut end of May 2020 from perennial pasture of red clover and ryegrass
- Links: Video, Practice Abstract (EN)

Trials in Denmark

Trial: Biorefining clover grass protein

- Methods:
  - The fresh biomass is pressed into press cake and juice. The protein in the green juice was heated and separated to produce a protein concentrate. This concentrate was tested for the chemical composition and shelf life of fresh protein concentrate from clover grass. Lactic acid bacteria were added to half of the samples and their effect tested over time.

Trials in Denmark

Trial: Biorefining clover grass protein

Observations:

- The influence of temperature and lactic acid bacteria was investigated on the shelf life for 6 months
  - T24 minus: without LAB, stored at 24 °C
  - T24 plus: with LAB, stored at 24 °C
  - T4 minus: stored without LAB at 4 °C
  - T4 plus: stored with LAB at 4 °C
- Protein content
  - The protein content of the green protein concentrate was 48.5 % of the dry matter
  - During storage, the protein content increased
  - T24 plus: increased by 9.5 % (in the first 1-2 months)
  - T24 minus: increased by 12.0 % (from harvest to 6 months
  - The increase in protein content during storage was less pronounced in the T4 samples, but followed the same pattern over 6 months

Trials in Denmark

Trial: Biorefining clover grass protein

- Amino acids
  - The amino acid content was high
  - For some amino acids (e.g. methionine)
  - T24: 7-8 % increase after 6 months
  - T4: 5-6 % increase after 6 months
  - for other amino acids (e.g. lysine)
  - T24 samples, the content increased after the first month and then decreased
  - T4 plus samples, the increase was about 4 %, and in t4 minus no increase until month 3.

- Lactic acid bacteria
  - the concentration of LAB increased in all samples during the first 14 days. After 14 days, the concentration increased in:
  - T24 samples decreased continuously
  - T4 samples remained stable
  - After 6 months of concentration in:
  - T4 samples were high
  - no lactic acid was measured in T24
  - T24 samples had high concentrations of butyric acid
  - Butyric acid-producing bacteria, e.g. clostridia, use lactic acid as a substrate to produce butyric acid

Trials in Denmark

Trial: Biorefining clover grass protein

- pH value and short-chain fatty acids
  - The pH value decreased during the first 14 days, especially in the T24 samples, after which the pH value slowly increased again
  - Due to the delayed microbial growth, T4 showed a slower but longer drop in pH. With T4, the pH value was more stable over the entire storage time
  - Higher concentrations of other short-chain fatty acids were found in all T24 samples, including acetic acid and propionic acid, suggesting a complex composition of the microorganisms

Trials in Denmark

Trial: Biorefining clover grass protein

- Conclusion:
  - The content of proteins and amino acids was high in the green protein concentrate and can replace soy in poultry feed
  - Dry matter, protein and amino acid content increased during storage. Caused by the growth of fermenting microorganisms, the various carbohydrate-containing soluble fibre components and starch were processed.
  - The shelf life of fresh green protein concentrate is limited. Under anaerobic conditions the product is stable at:
    - 24°C for a maximum of 2 months
    - 4°C for a maximum of 3 months
  - Temperature was the most important determinant for shelf life - lactic acid bacteria had a minimal effect
  - To avoid microbial spoilage during storage, reducing the water content of the green protein would be optimal.

Trials in Sweden

- Chicory silage for weaned piglets
- Fodder beet on pasture for sows

Trials in Sweden

Trial: Chicory silage for weaned piglets

- Question: Can silage with the addition of chicory (Chicory) reduce the diarrhoea problem of weaners?
- Problem: Diarrhoea in weaners is a big problem for many piglet producers. Also in organic pig production with a weaning age of 6-7 weeks.
- To try:
  - Silage with a high content of chicory, whose lactic acid bacteria can help to promote stomach health.
  - Animals: Pigs at the time around weaning.
- Advantages of silage with chicory: It serves as environmental enrichment and is also very tasty for the pigs to eat.
- Video of the experiment (EN) and Practice Abstract (EN)

Trials in Sweden

Trial: Chicory silage for weaned piglets

- Observations: The finer components of the silage are eaten more, while the stubble is sorted out from the field.
- Recommendation:
  - Feeding the silage with chicory silage throughout the piglet period until final fattening.
  - A combination of an early harvested chicory silage with e.g. white clover seems to be optimal for the piglets.
  - After grazing by the pigs, chicory can be sown to improve nitrogen uptake from the soil.
  - It is also interesting to include chicory in the crop rotation.

Trials in Sweden

Trial: Chicory silage for weaned piglets

- Conclusion:
  A clear statement was not made as to whether chicory has a positive influence on diarrhoea in piglets. However, the project recommends the use of this meadow herb.

Picture: Magdalena Presto Åkerfeldt/HIR Skåne

Image: Emma Ivarsson

Trials in Sweden

Trial: Silage feeding with straw bedding

- Question: Does frequent automatic distribution of small amounts of silage as feed enable better utilisation by the pigs?
- Problem: The silage is to be made available at several points in time together with the straw via a straw spreader.
- To try:
  - Silage together with straw
  - Straw spreader with two spreader discs that distributed the material in the pens
  - Animals: 400 fattening pigs
- Link: Video, Practice Abstract (EN)

Trials in Sweden

Trial: Silage feeding with straw bedding

- Advantages: There was a lot of activity among the pigs when the silage-straw mixture was distributed in the pen, although there was no crowding, fighting or aggression between the pigs.
- Observations: 30 minutes after spreading the silage-straw mixture, the activity of the pigs dropped again, with several pigs lying down and some still running.
- Recommendation: The spreading of silage can be automated via a straw spreader. The proportion of silage in the material spread in the barn was 20-25 %. For each bale of straw (250 kg), an additional 65-70 kg of silage was loaded.
- Conclusion: The pigs consumed all the silage, were active and busy.

Image: Ingela Löfquist

Image: Ingela Löfquist

Trials in Sweden

Trial: Fodder beet on pasture for sows

- Question: Are fodder beet suitable as supplementary feed and environmental enrichment for pregnant sows?
- Problem: A natural occupation material is sought that exploits foraging. At the same time, the use of the area should be reduced (less digging).
- To try:
  - Fodder beet in the run
  - Animals: 14 pregnant sows on pasture with established forage beet, 6 sows -100% commercial feed for pregnant sows (control group), 8 sows - 60% commercial feed for pregnant sows (treatment group).
- Link: Video and Practice Abstract (EN)

Trials in Sweden

Trial: Fodder beet on pasture for sows

- Method: Strip grazing was used, but ad libitum feed intake from pasture was not restricted
- Data collected:
  - Sow weight and body condition at the beginning, 6 weeks later and at weaning
  - Total number of piglets born (born alive and dead) and weaned piglets
  - Analysed energy content of the fodder beet
  - Amount of beet established in the field (kg dry matter/m^2) (counted in test fields before and after sow grazing)
  - Drone images of the field at the end of the period from the air

Trials in Sweden

Trial: Fodder beet on pasture for sows

- Observations:
  - Fodder beet is difficult to establish - many weeds (e.g. stonecrop, chenopodium)
  - Fodder beet consumption: approx. 1.1 kg dry matter per sow and day
  - All fodder beet including leaves and stems, as well as the weeds were eaten
  - Feed intake was equivalent to 11.2 MJ NE/sow and day
- Average total weight loss:
  - Treatment group: 61.3 kg
  - Control: 20.8 kg

Image: Ingela Löfquist and Magdalena Presto Åkerfeldt

Trials in Sweden

Trial: Fodder beet on pasture for sows

- Average total number of piglets born/sow:
  - 13.5/sow in the treatment group and 13.7/sow in the control group
  - More stillborn piglets in the sows of the test group
  - Few weaned piglets/sow in both groups
  - Average piglet mortality: 36.9 % in the treatment group and 34.5 % in the control group
- Pregnant sows are hungry even with 100 % commercial feed rations
- Poor establishment of fodder beet led to:
  - Too little feed for the sows in the test group
  - own body reserves were used up and they lost body condition and weight
- A fire in a nearby facility caused stress among the sows and unusually high piglet mortality occurred

Trials in Sweden

Trial: Fodder beet on pasture for sows

- Conclusion:
  - Theoretically, a lower feed ration can be replaced by fodder beet in the pasture but there must be enough beet in the field.
  - Fodder beet can serve as environmental enrichment for restrictively fed sows
  - The establishment of beets is one possible way to reduce land use.
  - The yield of fodder beet must be high - 1.1 tonnes dry matter dry matter/hectare is too little
  - To increase the yield, the fodder beet can be sown in combination with white clover

Trials in the project

Overview

IG	Topic	Try	Challenge	youtube link
Soil Association (UK)	Laying hens	Sprouted vetch and wheat seeds for green fodder	Processing, nutritional value	https://youtu.be/GPC66lDYFlY
	Broilers	Feed potential of clean-out cereals	Nutritional value	https://youtu.be/vzWM0VVDuCw
	Pigs	Heat treatment of field beans on the farm	Processing, nutritional value	https://youtu.be/0QxxjbimLG8
Bioland (DE)	Laying hens	Nettle cultivation and feeding	Cultivation, processing	https://youtu.be/-a2-HCyLXys
	Laying hens	Fine-grained legumes in the chicken run	Cultivation, feeding, nutritional value	https://youtu.be/xeyPFPUJgJc
Ecovalia (ES)	Pigs	Brewer's yeast silage	Processing, feeding	https://www.youtube.com/watch?v=e7tRD3cTyp4
ITAB (FR)	Laying hens	100% organic feed	Feeding, ration planning	https://www.youtube.com/watch?v=_cEkTy-OgjQ
	Broilers	Substitution of soy in feed with regional feedstuffs	Feeding, ration planning	https://www.youtube.com/watch?v=un0epC6c7rw
	Pigs	Protein-rich plants for fattening pigs	Cultivation, feeding	https://www.youtube.com/watch?v=hAhMjzJoXx8

Green writing = Inscribed in the front part

Trials in the project

Overview

AIAB (IT)	Laying hens	growing and feeding camelina	Cultivation, feeding	https://www.youtube.com/watch?v=cFjbWN8hJvc&t=10s
AU/ICROFS (DK)	Laying hens	Biorefining of clover grass protein	Processing, feeding, nutritional value	https://youtu.be/d3VWZbCo83c
	Broilers	Effect of lactic acid bacteria on intestinal health	Feeding, animal health	https://youtu.be/qvqBQSUHrWE
Scania/SLU	Pigs	Chicory silage for weaned piglets	Feeding, animal health	https://www.youtube.com/watch?v=zNCyNYp2MxU&feature=youtu.be
	Pigs	Silage feeding with straw bedding	Feeding, animal health	https://youtu.be/Zl2UR5xNHqQ
	Pigs	Silage feeding with liquid feed	Feeding, animal health	https://youtu.be/m1XU-mm9kZ4
	Pigs	Fodder beet for sows	Cultivation, feeding, animal health	https://youtu.be/G6EZLYXUO-0
Danube Soy	Pigs, poultry	Infrared nutritional analysis of processed soybeans	Processing	https://youtu.be/VWC79HqlAXs


VOLLER EINSATZ FÜR DAS BESTE!
Thank you to everyone who accompanied us during the project!