molecules in the essential oil such as α-thujone (0–84%), β-thujone (0–96%), chrysanthenone (10–83%), lyratol (23–55%) and umbellulone (6–36%). This high variability, especially the composition of the essential oil, is a valuable basis for a breeding program. Important knowledge was also gained for breeding and cultivation of common tansy (floral biology, harvesting stage, pests, yields, location). **References:** [1] Waller P.J., Bernes G., Thamsborg S.M., Sukura A., Richter S.H., Ingebrigsten K., Höglund J., 2001. Plants as de-worming agents of livestock in the nordic countries: historicol perspective, popular beliefs and prospects for the future. Acta Vet. Scand., 42, 31–44. [2] Valchev G., Popova-Ralcheva S., Bonovska M., Zaprianova I., Gudev D., 2009. Effect of dietary supplements of herb extracts on performance in growing pigs. Biotechnology in Animal Husbandry, 25(5/6), 859–870.

PL4 The oregano cultivar CARVA, a security for the supply of natural carvacrol

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The last two decades have seen a substantial increase in the use of aromatics herbs and essential oils for animal health and nutrition (Franz et al., 2010). In relation to public awareness of the potential health risks and environmental problems caused by in-feed antibiotics, growth hormones and some synthetic pharmaceuticals, as well as in relation with trends towards more natural approaches of food production, numerous research programs were established focusing on cultivation and extraction of plants and the use of their health related compounds for feeding animals. Oregano (*Origanum vulgare* L.) and especially its essential oil rich in carvacrol is a very promising plant with a high potential for animal health and nutrition. The production of carvacrol through the cultivation of oregano offers a high value natural product with a high supply security, a high quality and a good traceability. The oregano cultivar CARVA, developped by the Swiss Reseach Station Agroscope, answers perfectly to the demand of the molecule carvacrol and assure high and stable yields with a low variability of quality during the year and over the years. The contents of essential oil (6–7%) and carvacrol (75%) are very high as shown by several tests conducted in different regions of middle Europe. With a potential production within two years of 400 l/ha of essential oil with a carvacrol content of 75%, oregano cultivation with the cultivar CARVA can be considered as a valuable source of natural carvacrol for the industry. **References:** [1] Franz C., Baser K.H.C., Windisch W., 2010. Essential oils and aromatic plants in animal feeding-a European perspective. A review. Flavour Fragr. J., 25, 327–340.

PL6 Effects of herbal products *in vitro* and *in vivo*

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In the framework of a project for the Dutch Government on "Quality and safety of herbal products for production animals" the antimicrobial action of 23 products was investigated both by microbroth dilution and agar diffusion tests. Bacteria tested were *Salmonella typhimurium, Staphylococcus aureus Hoechst, Pseudomonas aeruginosa, Bacillus cereus, Escherichia coli* ATCC 11303, *Escherichia coli* "Bay" and *Enterococcus faecalis*. The products were tested with and without buffer, because products with a low pH may give growth inhibition which is not related to the herbs. In some products there was a marked difference between the microbroth dilution test and the agar test and also in many products there were differences between the results with and without buffer. Some products showed very good antimicrobial action whereas others did not show any activity. To examine the effects *in vivo* five of these products (both active and non-active, table 1) were fed to broiler chicken which were fed a nutritional sufficient diet containing a high amount of wheat which may impair digestion and gut health.

Tab. 1: Main ingredients herbal products

Product	Mean Ingredients
Negative control	none
Biostrong 510	Thyme oil and star anise oil, bitter substances, pungent substances and saponins
Bronch Arom	Anise oil, thyme oil, eucalyptus oil
Allimax	Garlic
Duo Kruidenelixer	120 herbs: a.o. sage, rosemary, thyme, devils claw
PrimeFulvic	Fulvic acid

The products were compared to a control group and the trial was designed as a randomized complete block consisting of six repetitions per treatment. Data on growth, feed conversion and weight gain were collected and the jejunum was sampled for histological investigation. Villus crypt ratio was determined as an indication for gut health. Three of five herbal products showed significant differences as compared to the control group, two products with superior weight gain and one product with reduced weight gain (table 2). The two products which showed the best results in the broilers were products that showed almost no antimicrobial action *in vitro*. We concluded that in this experiment effects on gut health in broilers was not related to antimicrobial action.

Tab. 2: Body weight gain (BWG; g), feed intake (FI; g), and feed conversion ratio (FCR; g/g) from D0–35, as affected treatment.

Treatment	BWG		FI	FRC	
Negative control	2547	ab	3771	1.481	a
Biostrong 510	2528	ab	3767	1.491	ab
Bronch Arom	2467	a	3734	1.514	b
Allimax	2546	ab	3758	1.476	a
Duo Kruidenelixer	2615	b	3860	1.477	a
PrimeFulvic	2578	b	3844	1.49	ab

PL7 Potential of alternative forage plants (herbs and legumes) in terms of secondary plant metabolites and capability of protein precipitation

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High contents of rapidly rumen degradable protein in forage plants are associated with metabolic and hepatic stress, disorder of proliferation and poor N utilization. Phytogenic agents, particularly tannins, may favorably modify rumen protein degradation and improve animal health and productivity (Mueller-Harvey 2006). To identify home-grown forage plants of such properties, freeze-dried and grounded material of six herbs and nine legumes (table 1) harvested in 2010, was analyzed in terms of condensed tannins (CT), total phenolics (TP) and the ability to precipitate the model protein bovine serum albumin (BSA). In addition, crude protein was fractionated according to the Cornell Net Carbohydrate and Protein System. It was assumed that plants with decent CT concentrations are able to form complexes with proteins, which consequently is reflected in protein quality. As expected, CT and TP concentrations as well as protein precipitation capacities were highest in *Onobrychis viciifolia* Scop. (Ov) and *Lotus corniculatus* L. (Lc) (table 1). *Sanguisorba minor* Scop. (Sm) with negligible CT but highest TP concentration showed above-average protein precipitation capacities (table1).

Tab. 1: CT, TP and capability to precipitate BSA of all evaluated species

Species	Common name	CT2 (% DM)		TP (% DM)		BSA precipitation (mg/g plantDM^{-1})	
Carum carvi L.	Carraway	0.04	-	4.44		1.05	-
Lolium perenne L.	Perennial ryegrass	0.04	-	1.58	-	0.03	-
Galega orientalis L.	Goats rue	0.05	-	3.98	-	1.09	-
Melilotus officinalis L.	Yellow sweet clover	0.06	-	1 59	-	2.15	-
Melilotus alba Medik.	White sweet clover	0.06	-	1.67	-	0.98	-
Taraxacum officinale Wiggers	Dandelion	0.07	-	3.54	-	2.81	-
Achillea millefolium L.	Yarrow	0.07	-	9.45		0.99	-
Medicago sativa L.	Alfalfa	0.08	-	1.37	-	0.41	-
Medicago lupulina L	Black medic	0.09	-	1.62	-	0.57	-
Cichorium intybusL.	Chicory	0.09	-	6.14		0.96	-
Trifolium repens L	White clover	0.11	-	1.80	-	0.31	-
Trifolium pratense L.	Red clover	0.11	-	3.14		0.64	-
Trifolium hybridum L	Alsike clover	0.12	-	2.75	-	2.72	-
Sanguisorba minor Scop.	Salad burnet	0.17	-	18.56	+	28.15	+
Plantago lanceolata L.	Narrowleaf plantain	0.30	-	6.61	+	2.01	-
Lotus corniculatus L.	Birdsfoot trefoil	1.93	+	4.80		18.62	+
Onobrychis viciifolia Scop.	Sainfoin	8.39	+	10.33	+	125.44	+
Total average of all species		0.69		4.90		11.11	

+/-= statistical deviations from total average ($p < 0.001$)

As hypothesized, Ov contained statistically significant ($p \leq 0.01$) below-average amounts of rapidly rumen degradable fractions (A and B1) and high amounts of not degradable fraction C. As to fraction A and B1, Sm showed equal characteristics. Sm contained significant ($p \leq 0.001$) highest amounts of rumen-undegradable but intestinal available fraction B3. No anticipated distribution of protein fractions could be observed in Lc. Results demonstrate that CT concentration seems to be an insufficient criterion to identify forage plants that potentially effect ruminant's protein metabolism. However, transferability of findings to the animal in-vivo situation has to be examined. **References:** [1] Mueller-Harvey, I. 2006. J.Sci.Food Agric.86:2010–2037.

PL8 Administration of Silver fir (*Abies alba* Mill.) to goats and its potential to control gastro-intestinal parasites

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Gastrointestinal nematodes (GIN) substantially impact on goat health. Because of the widespread development of GIN, resistant to allopathic drugs, further research into alternative parasite control methods is required. Silver fir, *Abies alba* Mill (SF), is traditionally used by Swiss farmers in order to control GIN infections of goats and to improve animal welfare. A survey among goat farmers revealed that they use SF in winter during a period of approximately five months. The estimated daily dose of SF per animal and day vary between 8 g to 600 g dry matter (DM). As there is scientific evidence neither for an anthelmintic potential of SF, nor on its influence on feed intake and milk performance of goats, we conducted a study with 30 animals. A 20 day feeding experiment was performed with 15 goats (group A), which were daily fed with SF in addition to their basic feed. The remaining 15 goats (group B) were fed with the basic ration only. Individual faecal egg counts (FEC) were conducted for all goats. Furthermore, the effects of SF on the intake of the basic feed, and on yield and composition of milk were analyzed. For 12 representative samples of SF we determined the content in total phenols (TP), and the composition of the essential oil (EO). SF contained 0.4–1.2% TP (0.9% TP on average) in fresh matter. Limonene, bornyl acetate and beta caryophyllene were identified as characteristic constituents of the EO. Administration of SF did not reduce GIN FEC significantly. The daily intake of SF per animal was 261 ± 0.22 g DM. Although SF reduced the basic feed intake significantly, SF significantly increased the total DM intake (A: 1948 ± 93 g DM; B: 1797 ± 93 g DM). SF had no effect on yield and composition of milk. Although farmers are convinced of the anthelmintic potential of SF, our short term study could not point to such an effect. Possibly a prolonged period of SF administration is necessary for such effects to become apparent.

PL9 Antimicrobial activity and stability of *Fraxinus rhynchophylla* Hance extract

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Clostridium perfringens is a gram-positive, spore-forming and anaerobic bacterium which is widely found in the food and intestinal tract of human and animal. *C. perfringens* can cause diarrhea and abdominal pain in human and necrotic enteritis, enterotoxemia and hamorrhagic gastroenteritis in animal due to several exotoxins of *C. perfringens*. e.g. A type α-toxin, B type α, β, ε and C type α, β. In this study, antimicrobial activity of *Fraxinus rhynchophylla* Hance extract against *C. perfringens* isolated from intestinal tract of broiler chickens and stability agaist heat and pH were investigated. Ethanol extract of *F. rhynchophylla* suppressed growth of *C. perfringens* at a concentration of 0.1 mg/mL (Fig. 1), whereas the growth of lactic acid bacteria, *Bifidobacterim bifidum*, was not affected by the extract. Moreover, growth of *B. bifidum* was stimulated about 5~16% compared with control after treated with the extract for 24~72 hours (Fig. 2). Antimicrobial activity of *F. rhynchophylla* extract was not altered after heated at 100 °C for 60 minutes and sustained in wide range of pH (3~11). These results suggested that *F. rhynchophylla* extract could be used as natural source for the development of antibiotics alternative.

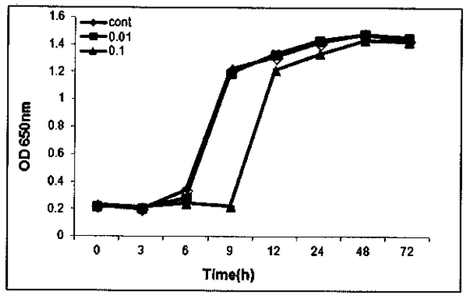

Fig. 1: Inhibitory effect of *F. rhynchophylla* extract on the growth of *C. perfringens*. *C. perfringens* was incubated at 37 °C for 0~72 hours under anaerobic condition, and the absorbance of broth was measured at 650 nm. cont: cultured without *F. rhynchophylla* extract, 0.01: treated with *F. rhynchophylla* extract at a concentration of 0.01 mg/mL, 0.1: treated with *F. rhynchophylla* extract at a concentration of 0.1 mg/mL

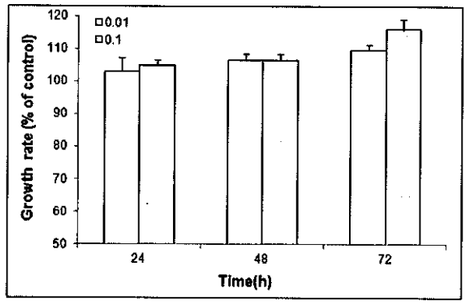

Fig. 2: Stimulatory effect of *F. rhynchophylla* extract on the growth of *B. bifidum*. *B. bifidum* was incubated at 37 °C for 24~72 hours under anaerobic condition, and the stimulatory activity of *F. rhynchophylla* extract was analyzed comparing with absorbance of non-treated broth medium (control). 0.01: treated with *F. rhynchophylla* extract at a concentration of 0.01 mg/mL, 0.1: treated with *F. rhynchophylla* extract at a concentration of 0.1 mg/mL. Means and standard errors are based on data from three replicates.

PL10 Antimicrobial activity of some phytochemical compounds against antibiotics resistant bacteria

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Plant secondary metabolites are important naturally occurring substances from renewable sources, which can be used for disinfections of animal farms. This research focuses on antimicrobial activities of plant compounds (phenols, flavonoids, essential oils) isolated and identified from species of *Lamium album* L., *Rosmarinus officinalis* L., *Monarda*