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USING ORGANIC ACIDS IN FEEDING OF PIGLETS**

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Abstract: Providing organic acids as a feed additive enhances the health status of piglets, particularly in the suckling period and in the problematical time after weaning.

Depending on type and the area of application for the acids, the dosage is between 0.1 and 4 % of the total feed. For example, formic, fumaric or sorbic acids are used alone or in mixtures. Positive effects were verified in the feed, in the digestive tract and in the metabolism of piglets. A lot of studies show a stabilisation in performance relating to weight, growth and health.

127 piglets were separated into a treated and control group and observed for the effectiveness of the organic acids. The live weights on day 5, 28, 42 and 76 were recorded. Both groups had comparable growth in the suckling period. The comparison identified an advantage for piglets receiving organic acid. On average this group of animals had a higher weight and a lower variability of live weights at day 76 (table 1).

Other positive tendencies for the treated group were lower losses and a higher rate of piglets attaining at least a weight of 25 kg at 76 days of age. The piglets receiving organic acids also had a better development at the end of the trial which they achieved during the problematic period after weaning.

Key Words: piglet, feeding, organic acids, effects on weight and growth

Introduction

It is possible to influence the vitality of piglets with specific feed additives. Ergotropika, which effect an increase in performance and better health, currently have an enormous significance in piglet feeding. Organic acids such as fumaric-, propionic-, citric-, formic-, tartaric-, apple-, und sorbic acid form one part. But also, some salts of formic acid, such as

sodium or calcium-formate, and coated acids have positive traits (*Kirchengessner,* 2004*, Jackishc et al.,* 2001).

The use of organic acids and their salts for animal feed is regulated in Germany by the „Futtermittelverordnung“ (Animal Feed Order (Law)). In this Order they are listed as „antidegradants“. All acids are certificated for all animal species, have no regulations for limiting age, minimum or maximum content and withdrawal periods (*BMELV* [2006], *BVL* [2006]).

One speciality is potassium diformate. As a salt of formic acid, „Formi/LHS®“ was granted the first certification from the European Union as a growth promoter in November 2005 (*Sommer/Bunge,* 2004, *European Commission,* 2006*)*.

The amount of organic acids in feeding stuff depends on the special acid and its use for piglets, weaners, finishing pigs or sows (*Koch,* 2005). The normal rate is approximately 1 – 4 % (*Sommer/Bunge,* 2004*)*.

Table 1. Mean value and standard deviation for weight (kg) at 4 stages of piglet life, year 2006.

	age (days) 5	age (days) 28	age (days) 42	age (days) 76
treated group*	2.57± 0.31	8.16± 1.39	9.18± 1.36	27.13± 3.38
control group	2.31± 0.27	8.18± 0.98	8.62± 1.43	25.91± 4.08

* treated group receiving organic acid Source: own calculations

The following advantages from a diverse experimental series are given in the literature:

- A higher daily gain
  (*Jorgensen et al.,* 2004*, Maribo,* 2001, 2003*, Lückstädt et al.,* 2003, *Meyer t al.,* 2006*, Lindermeyer et al,* 2003, 2005 *and Stalljohann et al.,* 2003)
- A lower feed conversion
  (*Maribo,* 2001, 2003, *Lückstädt et al.,* 2003, *Meyer et al.,* 2006*, Lindermeyer et al,* 2003, 2005 *and Stalljohann et al.,* 2003)
- A lower mortality
  (*Lückstädt et al.,* 2003*)*.

In far greater detail *Burgstaller et al.* (1999)*, Eidelsburger,* (2006) *and Kirchgessner* (2004) describe the effects of organic acids. In Table 2 are shown their place of effect and mode of action.

Table 2. Place of effect and mode of action from organic acids in piglet feed

Place of effect	Mode of action
„animal feed“	palatability of the food
	lowering the pH-value
„digestive tract“	lowering the pH-value
	antimicrobial action
	generates increased output of bile fluid
	better digestion of protein
	lowering of ammonification
„efficacy of anions“	increased ileal digestion, effecting higher growth rate
	anions act as a sequestrant and cause a higher range of bulk and trace elements in the intermediate metabolism
	regulative effect on the flora of the small intestine
„metabolism“	provide energy for the metabolism, as a natural metabolite

Source: *Burgstaller et al.* (1999)*, Eidelsburger,* (2006) *and Kirchgessner* (2004)

Materials and Methods

In a field study, the use of organic acids in piglet feed was tested. The condition of 127 piglets from 12 sows was checked. They originated from a criss-cross bred female based on „German Landrace” and „German Large White“ breeds sired by a „Pietrain“ boar to produce these slaughter generation pigs. These piglets were divided into two groups (treated and control group).

For this trial, piglets from 6 sows received starter feed with the additives formic, fumaric and sorbic acid. The investigation involved testing for and answering the question as to whether it is possible to influence piglet growth using organic acids in the ration.

The treated trial feed and the control feed were the sole solid feed from the beginning of the 7th day until the 38th day of life. After this and during this changeover period until the 46th day of age, the piglets of both groups received their specified feed plus a second stage rearer II feedstuff. This is specially adapted for older weaners and was the same for both the treated and control groups. Beginning with the 47th day of life, all piglets from both groups received only this second stage rearer II feed. Thus organic acids could no longer influence the conditioning of the piglets in this period.

Recordings of the weight and animal deaths were carried out on the 5th, 28th, 42nd and 76th day of life. Findings were analysed with Microsoft Excel and Microsoft SPSS.

Results and discussion

Following a considerable number of trials with organic acids in piglet feed, the piglets in this trial should have higher weights, daily gain and a lower mortality (compare with "Literature" point). Also, lower feed intakes were reported in the literature. As this parameter was not analysed in this trail, there is no information provided.

The addition of acids did not result in higher weights for piglets in the treated group in the suckling period (5^{th} – 28^{th} day of life). Piglets of both groups had comparable weights gains from the 5^{th} to 28^{th} day of age. Specifically, there was a minimal advantage for animals from the control group.

The piglets in the control group were on average 0.26 kg lighter than the animals in the treated group 5 days after birth. Despite this it was possible for them to achieve the same weight on average as the treated group at 28 days of age. Also, the weights on average for the control group are more evenly spread than from the treated group (Δs=0.41 kg) during this phase.

But, there could be an influence from organic acids on piglet mortality. For both groups, dead piglets were recorded only during the suckling period. With 1.6% compared with 7.7%, the treated group had a lower mortality rate in comparison to the control group.

The influence of the organic acids on piglet weight could be shown for the first time in the period after weaning. The weights of piglets from the treated group were on average higher than the control group piglets. On the 42^{nd} and 76^{th} day of age they had an advantage of 0.56 kg and 1.22 kg respectively. The development of daily gain in this period is analogous. On average, piglets from the treated group had 19.58 g/d more gain.

In addition to that, the treated group had more piglets with a 25 kg minimum weight. On average 75.41% piglets from the treated and 66.67% from the control group attained this norm.

Daily gain should be reflected upon separately in the period from the 28^{th} to the 42^{nd} day of life. This time period after weaning the piglets is particularly crucial. Their stomachs have to adapt to dry feed only, without any sow's milk (*Kirchengessner,* 2004).

This influence is discernible for the parameters mean daily gain and its variability (standard deviation). The average daily gain on the 42^{nd} day of life of the treated piglet group fell by more than half to about 70 g/d of the mean in the suckling period (28^{th} day). At the same time piglets from the control group experienced a fall in weight gain to one-eighth and effectively

to about 30 g/d compared to their mean at the end of the suckling period.

Table 3. Comparison of average weight and standard deviation of piglets from the treated and control groups, depending on the age of the piglets, year 2006.

		treated group	control group
piglets, input	n	62	65
piglets, output	n	61	60
weight, 5th day (age)	kg	2.57 ±0.31	2.31 ±0.98
weight, 28th day (age)	kg	8.16 ±1.39	8.19 ±0.98
weight, 42nd day (age)	kg	9.18 ±1.36	8.62 ±1.43
weight, 76th day (age)	kg	27.13 ±3.38	25.91 ±4.08

Source: own calculations

Comparison of individual weight gains allows piglets to be pinpointed that have lost weight in both groups. The highest weight loss from a piglet treated with organic acid was –121.43 grams per day. At the same time one piglet in the control (untreated) group lost –135.71 grams per day.

All in all, piglets receiving organic acid had a better development from day 28 to 42 of life. There were weight losses located, but the number of piglets and the level of losses were at a lower rate in the treated group.

Table 4. Comparison of average daily gain and standard deviation of piglets from the treated and control group, depending on the age of the piglets, year 2006.

		treated group	control group
piglets, input	n	62	65
piglets, output	n	61	60
daily gain, 5.– 28. d(a)	g/d	242.69 ±59.54	256.52 ±40.90
daily gain, 28. – 42. d(a)	g/d	72.83 ±73.19	30.48 ±79.58
daily gain, 42. – 76. d(a)	g/d	528.06 ±75.92	508.48 ±89.90

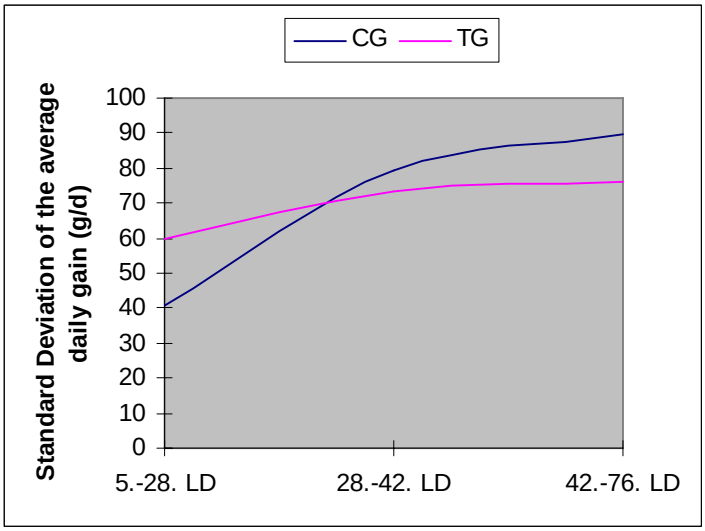
Source: own calculations

The addition of organic acids to the feed during this phase is of benefit to the weaners, because they activate the production of hydrochloric acid in the stomach. With a high rate of this acid, the pH-value drops down. An increase of in particular of coliform bacteria and other microorganisms is prevented (*Roth et al.,* 2005).

Higher weights have been previously demonstrated for organic acids. But, viewing the standard deviation shown in Graph 1 illustrates a further advantage The standard deviation of mean weights from day 5 to 76 of age are shown.

From the 28th to the 42nd day of life the piglets from the treated group had a more balanced even development than piglets from the control group. Thus it is possible that piglets receiving organic acids can overcome this stressful period better than the untreated control piglets. This advantage is maintained through until the end of the trial.

Graph 1. Standard deviation of the average daily gain dependent on organic acids given in the feed and the age of the piglets, year 2006.



Source: own calculations

KORIŠĆENJE ORGANSKIH KISELINA U ISHRANI PRASADI

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Rezime

Analiza ovog ogleda pokazuje da su organske kiseline imale pozitivan uticaj na telesnu kodnciju prasadi što je u saglasnosti sa literarturnim podacima.

Prasad iz ogledne grupe su imale manji mortalitet u periodu sisanja i veći

prirast u uzrastu od 28 do 76 dana, kao iI telesne mase prasadi iz ogledne grupe su bile ujednačenije u poređenju sa onima iz kontrolne grupe.

Merenje dnevne konzumacije hrane bi bilo poželjno u budućnosti, kao što je važno analizirati ovaj parametar kao i dnevni prirast. Pitanje produktivnosti se razmatra uz određenu kontradiktorne podatke u literautri, jer nije uvek bilo moguće pokriti troškove organskih ksielina iz ostvarenog prirasta mase (*Meyer et al*., 2006).

References

BMELV „Bundesministerium für Ernährung, Landwirtschaft und Verbraucherschutz“
(2006 online): Futtermittelzusatzstoffe.
http://www.bmelv.de/cln_045/nn_753016/DE/07-SchutzderTiere/Futtermittelsicherheit/Futtermittelzusatzstoffe.html__nnn=true, Stand 11.09.2006

BUNGE, J. und SOMMER, W. (2004 online): Alternativen für antibiotische Leistungsförderer in der Ferkelfütterung.
http://www.landwirtschaftskammer.de/fachangebot/tierproduktion/schweinehaltung/fuetterung/futterzusatz-ferkelfutter.htm, Stand 24.11.2005

BURGSTALLER, G.; BIEDERMANN, G.; HUBER, M.; PAHMEYER, L. und RATSCHOW, J. (1999):
Handbuch Schweineerzeugung. Verlagsunion Agrar; Frankfurt am Main; 4. Auflage

BVL „Bundesamt für Verbraucherschutz und Lebensmittelsicherheit“ (2006 online): Liste der für Futtermittel zugelassene Zusatzstoffe
http://www.bvl.bund.de/DE/02__Futtermittel/04__Zusatzstoffe/01__ListeZugelZusatzst/listeZugelZusatzst__node.html, Stand 11.09.2006

EIDELSBURGER, U. (2006 online): Organische Säuren in der Schweinefütterung
http://www.vilomix.com/downl/thema_1.pdf, Stand 10.06.2006

EUROPEAN COMMISSION (2006 online): Community Register of Feed Additives
http://ec.europa.eu/food/food/animalnutrition/feedadditives/comm_register_feed_additives_1831-03.pdf, Stand 25.09.2006

JACKISCH, T. UND CLAR, U. (2001): Ein bisschen sauer hält gesund – Erfahrungen beim Einsatz gekapselter saurer Salze und gekapselter Säuren in der Sauenfütterung. In SUS 3/2001, Seite 34

JØRGENSEN, L. UND BOES, J. . (2004 online): Benzoic acid and lactic acid +

formic acid for weaners.
http://www.danishpigproduction.dk/Research/Research_report/Nutrition_Weaners/Report_677.html, Stand 09.10.2006
KIRCHGEßNER, M. (2004): Tierernährung. DLG-Verlags-GmbH; Frankfurt am Main; 11. Auflage, Seite 196 ff und 235 ff
KOCH, F. (2005 online): Organische Säuren in der Tierernährung.
http://www.ava1.de/pdf/artikel/schweine/2005_03_koch.pdf, Stand 10.06.2006
LINDERMAYER, H. und PROBSTMEIER, G (2003): Säure im Ferkelfutter bringt es.
In: SUS 3/2004, Seite 40/41
LINDERMAYER, H. und PROBSTMEIER, G (2005): Alternative Leistungsförderer bei Ferkeln getestet. In: SUS 6/2005, Seite 61
LÜCKSTÄDT, C. (2003): Effekte organischer Säuren in der Tierernährung.
In: Kraftfutter/Feed Magazine 11-12/2003
MARIBO, H. (2001 online): XTRACT™Pig Starter XT 6950 and formic acid for weaners.
http://www.danishpigproduction.dk/Research/Research_report/Nutrition_Weaners/index.aspx?id=23830e78-cbd3-4f1a-83f2-6de36a42e4ba, Stand 09.10.2006
MARIBO, H. (2003 online): Citric acid for weaners.
http://www.danishpigproduction.dk/Research/Research_report/Nutrition_Weaners/Report_615.html, Stand 09.10.2006
MEYER, A.; SCHÖN, A. UND BRADE, W. (2006): Sehr gute Leistung mit Formi®.
In SUS 1/2006, Seite 39
ROTH, F.X. UND ETTLE, T. (2005): ORGANISCHE SÄUREN: ALTERNATIVE ZU ANTIBIOTISCHEN LEISTUNGSFÖRDERERN.
http://www.boku.ac.at/tte-Symposium/Tagungsband/BOKU_Symposium_2005.pdf, Stand 19.11.2006
STALLJOHANN, G. und PATZELT, S. (2003): Ameisensäure ins Ferkelfutter mischen.
In: SUS 3/2003, Seite 35