

POSSIBILITIES TO INCREASE FEEDING EFFECTIVENESS IN SWINE

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Abstract

There are many ways to improve the effectiveness of animals' feeding. Among these, one is to include the granulation stage in the technological flow of mixed feed manufacturing. Granulation could remove some drawbacks connected with feed usage as flours and so contribute to optimization of farm animals' feeding. In the current paper we approached this theme in the particular situation of feeding fattening pigs. The experiment addressed 4 animal groups as biological material, each comprised 30 weaned piglets, aged 30 days. They were fed complete mixed feed with the same nutritional value but with different presentation, as follows: LM – control group – feeding with dried flour fodder; LG1 – feeding with granulated feed Φ 2mm; LG2 – feeding with granulated feed Φ 4mm; LG3 – feeding with granulated feed Φ 7mm. During the study, there were tracked several productive traits, such as: body mass, average daily weight gain, total feed intake and feed conversion rate (FCR). By the end of the research, it was observed that the best results were produced by the pigs whom were given mixed feed with diameters of 2 and 4 mm, while granules with a 7 mm diameter didn't produced beneficial effects. In the groups with the best performances (LG1 and LG2), the final body mass was 1.58-2% higher compared to the control group, and the FCR on the whole fattening period was 2.75-4.77% more efficient than the one achieved by the pigs in control group.

Key words: granulation, swine, optimization, feeding

INTRODUCTION

Granulation is a mechanical process for compaction and agglomeration of mixed feeds in particles with variable shapes and dimensions, function of animal breed and category for which were designed [1].

Granulation of mixed feeds has many nutritional and technological advantages. Swine, due to their high appetite for food, when this one is administrated as wet flour, fill their stomach in 10-20 minutes with an aqueous feed. The gastric juices are more diluted, which lead that active digestion not to start than at pylorus level. By utilisation of granules, is re-established the whole mechanism for pre-digestion and digestion itself [2].

So, technically and nutritionally speaking, granulation:

- avoids un-homogenization and selective consumption of certain components (saving with 2-3% feeds' squander);

- improves food capitalization, by increasing of digestibility of some nutrients, under the influence of granulation temperature (is realised an improvement with 3-5% of food conversion);
- determines an increase of ingested nutrients quantity rated, energetic-protein density of granules being higher than portions;
- increases feed palatability by developing of some aromatic compounds during thermal treatment and also by possibility of incorporation of some feed additives like aroma (flavour), sweeteners, taste enhances;
- increases the preservation period and stability of feed, oxidation-reduction processes being around 4 times slower than in flour type feeds;
- assures a sanitation of feeds, by destruction of contamination micro-flora, under the thermal effect at processing;
- decreases the volume by compaction of mix, resulting a reduced storage space;

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- renders feed more suitable for mechanized distribution;
- decreases the uptake time;
- facilitates transport, manipulation and prevent powder forming in rearing shelters [4], [9], [10].

As drawbacks, granulation supposes also a series of supplementary operations with consumption of energy, which increase the price per final product unit; the highest energy consumption is recorded at feeds for birds, followed by the ones for rabbits and swine.

Supplementary costs provoked by granulation process could be recovered through production gain and moreover by decreasing of consumption indexes [11].

Into a comparative study regarding gain increase and food conversion for piglets in growing and finishing periods, Chae et al. (1997) [1] demonstrate that are obtained better performances (+2.9...+13.44% for DMG and -3.9...-10.2% for consumption index), by utilization of granulated mixed feed (852 g/head/day daily mean gain and 2.31 kg feed/kg conversion index), face to utilization of dried flour feed (751 g/head/day daily mean gain and 2.55 kg feed/kg conversion index) or face to wet type, flour with water (828 g/head/day daily mean gain and 2.40 kg feed/kg conversion index).

Utilization of granulated feed face to flour feed in feeding of recently weaned piglets, with an age of 4-9 weeks, generated a weight at testing with 7.33% higher at piglets feed with granules, in conditions of decreasing of value for food conversion index with 20% [13], [14]. Older research [6] indicates a better capitalization of food with 7-15% at piglets feed with granules, in comparison with the ones which received food under flour form. More than that, the best performances were obtained by piglets which received granules with a medium diameter (5 mm). Similar results (significant improvements of weight at the end of the study and decreasing of food conversion index) were reported also in other studies which compared flour type food with the granulated type one administrated to piglets in growing period, even if it is possible that flour type food to be more beneficial for

decreasing the pathogen flora from their intestinal tract [8].

In another research, Steidinger et al. (2000) [12] demonstrate that feed granulation had a positive influence of productive parameters of weaned piglets, obtaining a weight gain with 4% higher and a food conversion index with 1.5% lower, face to piglets which were feed with dried flour type feed. Also, another study [15] show the same thing, that piglets feed in post-weaned period with granulated feed, face to the ones which received food as flour, realised better weights with 2.3% at the end of the study, based on a daily mean gain improved with 2.9%, finally obtaining a food conversion index better with 7.9%.

Into another study [5], demonstrate that the most efficient feeding method for piglets from weaning till slaughtering is liquid administration of mixed feed, in comparison with granulated feed or dried flour one. So, liquid food generated improvements of daily mean gain (+1.44% face to granulated feed and +3.9% face to dried flour), of food conversion index (+0.45%, respectively +1.6%) and for growing speed (with 4 days, in average, less till reaching the slaughtering weight (110 kg). Results regarding efficiency of granulation way on piglets' performances were obtained into another experiment conducted by Liermann et al., 2015 [7], resulting that the best productive reply was given by piglets feed with granules with a 4 mm mean diameter, in comparison with the granules with a mean diameter of 6 mm (+2.4% weight gain; -4.4% food conversion; +1.2% slaughtering efficiency and +2% meat in carcass). It seems that the size of mixed feed granules affects significantly the growing performances after consumption period of starter recipe, because just after slaughtering, the differences obtained by Edge et al. (2005) [3] were minor, between the groups of piglets feed with granulated feed with 2.5-5 mm diameters, following that at the next recipes, performances to be in favour of granules with a bigger diameter.

After studying the literature regarding the technological and productive advantages of utilisation of granulated mixed feed in farm animals' food and especially in swine

feeding, the aim of research was to organise a case study – comparative test regarding the productive results of fattened piglets feed with flour type mixed feed, respectively with granulated mixed feed (granules with three different diameters), in conditions of a farm with integrated flow.

MATERIAL AND METHOD

The experimental factor chosen for testing was the presentation way of mixed feed, respectively dried flour (as control group) and granules with different diameters: 2 mm, 4 mm and 7 mm.

For testing of productive response of piglets subjected to fattening for those three granulation types applied to mixed feed were designed three feeding recipes appropriate to starter (30-80 days), growing (80-120 days) and finishing periods (120-155 days). For each experimental graduation, in swine farm was formed a randomized group of 30 piglets of both sexes which were used as biological material (DanBred hybrids, resulted by mating of Danish Landrace-Yorkshire mothers with Duroc boars) picked just after weaning on criteria of uniformity corporal criteria:

- LM – control group – feeding with dried flour feed;
- LG1 – feeding with granulated feed Φ 2 mm;
- LG2 – feeding with granulated feed Φ 4 mm;
- LG3 – feeding with granulated feed Φ 7 mm.

Granules (fig. 1) were made using an electric granulator, with a small capacity (0.5 tons/h), which company owns in the factory

for mixed feeds for testing different textures and sizes of feed particles, having in view that from establishing till nowadays feeding was realised in according with complete mixed feed as flour form, in according with the model recommended by the genetic material supplier (DanBred, Denmark).

Mixed feeds were composed by several raw materials such as: corn, barley, wheat, soy meal, soy protein hydrolysate, DL-methionine, L-lysine, calcium carbonate, dicalcium phosphate, soy oil, salt and mineral-vitamin premix. The nutritive value of experimental mixed feeds was in according with the nutritional demands of swine (tab. 1).

In the current study there were analysed the following production mass:

- body mass – kg (measured by individual weightings at the beginning and at the end of each technological period);
- weight gain – kg/head (difference between weight at the entrance and exit in each growing period, respectively between the one from beginning and end of experiment);
- average daily gain – kg/head/day (rate between weight gain realised on period and number of days in testing period);
- total feed consumption for each mixed feed recipe and cumulated on the whole fattening period - kg/head;
- feed conversion rate – kg mixed feed/kg gain (rate between feed consumption and achieved weight gain, on technological periods and on whole fattening period).

Table 1 Nutritional value of the utilised mixed feeds

Mixed feeds	kcal ME/kg	% CP	% M+C	% L	% CF	% Ca	% P
Starter (period 30-80 days)	3250	18.59	0.65	1.20	3.38	1.05	0.76
Growing (period 80-125 days)	3087	15.77	0.53	0.80	4.00	0.95	0.61
Finishing (period 120-155 days)	3107	14.88	0.51	0.74	4.05	0.85	0.51

The collected data were statistically subjected, by calculation of arithmetic mean, standard error of mean and variation coefficient, also being made percentage comparing between performances of control group with the ones of the groups subjected

to action of experimental factors. Results were presented in tables and graphically illustrated in diagrams corresponding to each technological period and per ensemble of the whole fattening period.



Fig. 1 – Presentation way of feed

RESULTS AND DISCUSSIONS

The studied swine flock (120 heads) was evaluated on each technological period and data were processed at each stage as well as on the whole production cycle. So, at the age of 155 days, piglets had corporal masses between 97.84 and 99.98 kg. These values were reached by realisation of total cumulated gains presented in table 2.

So, the gains were inside interval 90.34 ± 0.32 kg (group LG3 – feeding with granulated feed $\Phi 7$ mm) – 92.48 ± 0.29 kg (group LG2 – feeding with granulated feed $\Phi 4$ mm). Control group had a mean

performance (90.53 ± 0.30 kg/head) with 0.21% superior to group of piglets fed with mixed granulated feed with 7 mm diameter, and group LG1 recorded a total gain increase of 92.06 ± 0.33 kg/head. Face to control group, the piglets' performance from groups LG1-LG2 were superior with 1.69-2.15%.

Having in view the mentioned gains and the testing period of 125 days, were obtained the individual daily mean gains presented in table 3. Values were inside interval 0.72 kg/head/day (LM-LG3)–0.74 kg/head/day (LG1-LG2).

Table 2 Values of weight gain recorded on whole fattening period (kg) (30-155 days) (n=30/group)

Groups	$\bar{X} \pm s_{\bar{x}}$	V%	% face to LM
LM	90.53 ± 0.30	3.03	-
LG ₁	92.06 ± 0.33	3.52	+1.69
LG ₂	92.48 ± 0.29	2.81	+2.15
LG ₃	90.34 ± 0.32	3.39	-0.21

Table 3. Daily mean gain realised by piglets during fattening period (kg/head/day) (30-155 days) (n=30/group)

Groups	$\bar{X} \pm s_{\bar{x}}$	V%	% face to LM
LM	0.72 ± 0.002	0.02	-
LG ₁	0.74 ± 0.003	0.03	+1.69
LG ₂	0.74 ± 0.002	0.02	+2.15
LG ₃	0.72 ± 0.003	0.03	-0.21

Food total consumption was 251.69 ± 1.54 kg/pork fed at control group (dried flour feed), 248.91 ± 1.42 kg/pork at group LG1 (-1.10% face to control; granulated feed with a diameter of 2 mm per particle), 244.80 ± 0.97 kg/pork at group LG2 (-2.74% face to control group at piglets feed with granules with 4 mm diameter) and 255.32 ± 1.60 kg/head at

group LG3 (+1.44% face to control, food as granules with 7 mm diameter) (tab. 4).

Between the group with the weakest performance (LG3) and the other two groups at which were administrated granulated food, the percentage deviations were even greater, 2.57% face to LG1 (2 mm granules) and 4.29% face to LG2 (4 mm granules). If we examine the standard errors of means it could

be observed that piglets from group LG2 had the best adaptability for the consumed feed, being calculated the most reduced individual variability 11.61%, in contrast to group LG3, at which variation coefficient was with around 3 times higher.

Regarding the efficiency of food conversion in weight gain, the data from table

5 are probative. So, piglets from control group realized one kg corporal mass by consuming 2.78 kg food. Opposite were placed the results obtained by piglets from group LG3, which consumed 2.83 kg mixed feed to accumulate one kg weight gain (with 1.65% conversion index less performing face to control).

Table 4 Food consumption recorded on the whole fattening period (kg/head) (30-155 days) (n=30/group)

Groups	$\bar{X} \pm s_{\bar{x}}$	V%	% face to LM
LM	251.69±1.54	28.39	-
LG ₁	248.91±1.42	24.19	-1.10
LG ₂	244.80±0.97	11.61	-2.74
LG ₃	255.32±1.60	30.11	+1.44

Table 5 Food conversion index in fattening period (kg feed/kg gain) (30-155 days) (n=30/group)

Groups	$\bar{X} \pm s_{\bar{x}}$	V%	% face to LM
LM	2.78±0.011	0.14	-
LG ₁	2.70±0.008	0.07	-2.75
LG ₂	2.65±0.006	0.05	-4.77
LG ₃	2.83±0.011	0.14	+1.65

In case of piglets from the group feed with mixed feed as granules with a 2 mm diameter (LG1), food conversion was 2.70 kg feed/kg gain (a conversion with 2.75% better face to control group) and in case of piglets from group LG2 (granulated food, with 4 mm diameter per particle), conversion index was 2.65 kg feed/kg gain (conversion with 4.77% better in comparison with the piglets feed with dried flour – control group).

CONCLUSIONS AND RECOMMENDATIONS

Granulation process applied to mixed feed led to superior productive effects face to the ones recorded by piglets from control group (piglets feed with dried flour) when granulation was made at diameters of 2 mm and 4 mm.

Production and utilization in piglets' feed of granules with 7 mm diameter didn't produced beneficial effects, productive parameters being depreciated in comparison with control group, because of digestive transit acceleration at piglets due to a bigger texture of granules and increasing of water consumption, without that nutritional

contribution to be efficiently converted in weight gain.

Live weight at the end of experiment was with 1.58-2% higher than at groups of piglets feed with granules with 2-4 mm in diameter, face to control group.

Conversion rate of food on whole fattening period was with 2.75-4.77% more efficient at groups with piglets feed with granules of 2-4 mm diameter, face to the one computed for pigs from control group.

So, production process of mixed feeds could be improved by introduction of a granulator with high flow on the technologic line of mixed feed factory, and productive results in fattening unit will be superior face to the present ones when feeding is realised with dried flour type mixed feed.

From the point of economic efficiency, must be made tests regarding energetic consumptions in comparison with the ones of production processes for flour type and granulated type mixed feeds.

We recommend to respect a level condition for guaranteeing economic efficiency, namely to dimension the energetic consumption implied in granules' producing in a certain way so the percentage difference

face to consumption implied in production of dried flour feed not to exceed the cumulated percentage deviations for live weight and for food conversion rate (4.33% in case of granulation at 2 mm and 6.77% in case of granulation at 4 mm).

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