ZOOTEHNIE ŞI BIOTEHNOLOGII

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MANAGEMENT OF CERTAIN WASTE PRODUCTS FROM A FARM THAT BREEDS AND FATTENS PIGS IN THE SOUTH OF ROMANIA

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Abstract. Creşterea porcinelor (suinelor) reprezintă sectorul zootehnic cu cea mai mare pondere, atât pe plan mondial, cât şi naţional, porcinele fiind animale puţin pretenţioase la condiţiile de climă şi dehrană, uşor adaptabile la diferite tehnologii de creştere. Animalul sănătos poate să producă la nivelul potenţialului său genetic, dacă i se asigură condiţii de viaţă corespunzătoare; printre acestea, de mare importanţă este furajarea, care se bazează pe relaţia dintre vârstă şi ritmul de creştere. Animalul tânăr posedă capacitatea de a produce preponderent carne, porcului dezvoltat sporindu-i volumul muşchilor, dar şi producţia de grăsime.

Majoritatea societăţilor comerciale româneşti se axează peîngrăşare, întrucât fluxul tehnologic este mai simplu şi presupune mai puţine complicaţii. Astfel, pentru îngrăşarea porcinelor ciclul de producţieîncepe prin cumpărarea tineretului (20-30 kg/cap) şi se încheie cu livrarea porcilor graşi (100-110 kg/cap) către abatoare.

Reziduurile fecale provenite din exploataţiile de îngrăşare a porcinelor (dar şi a altor categorii şi specii de animale) prezintă utilitate ca material fertilizant, ca atare sau compostate, efectul fiind evident în privinţa realizării unor bune randamente la culturile agricole, dar şi asupra proprietăţilor solului.

Cuvinte cheie: Mediu înconjurător, Furaj, Management, Azotul din reziduurile porcinelor.

INTRODUCTION

In comparison with other animal species pigs breeding and exploitation has many social and economic advantages: they are a source of food, raw material for biomedical products or for the light industry (fig. 1) as well as they give the possibility to determine a large range of fodder including cereals and legumes for grains, roots, tubers and squash and various species of green plants, catering and food industry wastes that are turned into economic goods as meat and fat. Consequently, for 1 kg weight gain of living mass about 3 kg of concentrated fodder are used and even less for some breeds and specialized lines for meat production (Mariana Bran, 2004).

MATERIAL AND METHODS

Young pigs for fattening are imported in Romania in the majority of cases and they are issued from the crossbreeding of certain breeds and their synthetic lines (Large white, Landras britanic, Yorkshire, Duroc, synthetic lines of Pietrain breed) with a high productive potential. This fact leads to a high percentage of carcass lean meat, about 57-59 %; efficient utilization of fodder (specific consumption of 2,4-2,6 kg of fodder to gain 1 kg weight); average gain is about 900-950 g /day and after 100 days the animal should weigh 100-120 kg.

Animals' performances reflect the interaction between their hereditary basis and environmental conditions in which they grow (I. Dinu, 1988). Among environmental conditions, feeding is decisive (fodder expenses are about 65-75 % of total production expenses), because the profitableness of pigs breeding depends on it. The choice of the most suitable fodders and methods of feeding are influenced by concrete technical and economical conditions of the business, by the determined goal in pigs breeding as well as by the economic profit.

Intensive pigs fattening assumes that the fodder should contain all the necessary elements for growing: it should taste well and give the sensation of being full. The food is administered dry or wet.

The changes in the field of pigs breeding concern the development and modernization of combined

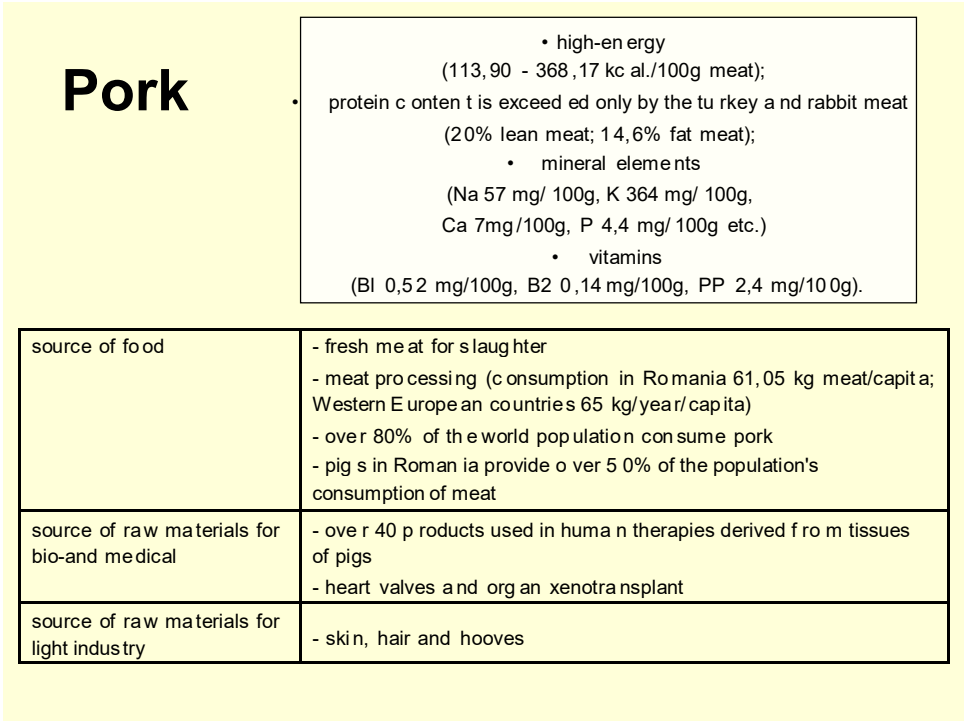

Figure 1. Economical and social importance of pigs breeding for meat

fodder industry and the improvement of fodder rations composition mainly by the use of cereals and soya depending on the breed, age, sex, natural source of protein supplemented with lysine and other artificially produced amino-acids.

There has been studied a family business of industrial type from the south of Romania where the pigs are fed with the same fodder (dry) during the whole period of fattening. The difference is in the proportion of those 5 components of the ration (table 1 and figure 1). In this situation the farm's annual production is of 3 cycles of fat pigs.

Table 1

Fodder ration for pigs breeding and fattening in the studied farm

Weight (pig), kg	Daily rations, %				
	Maize	Barley	Grist sunflower	Grist soya	Biosubstances
25-35	27.4	23.0	23.0	23.0	3.6
35-65	50.0	19.8	7.5	19.5	3.2
65-110	27.4	50.0	7.0	12.7	2.9

The technological fodder flow is the following: fodder silo – dosing – mixing – distribution.

The food contains mainly proteins. The proteic balance (A complex technology of manure use in livestockfarms to promote sustanable agriculture in Romania, Project financed by the World Bank an M.A.A. by the contract nr. 2389/2003)) used for pigs breeding and fattening process is known. The quantity of integrated protein can be found in pigs tissues and manure in the following proportions:

Protein from food 8,7 kg/pig (100%)

- 2,9 kg (33%) in pigs tissues;
- 5,8 kg (67%) in manure = 4,4 kg (51%) in urine and 1,4 kg (16%) in fecal material, out of which 3,0 kg (34 %) NH_3 emissions in the air and 2,8 kg (32 %) manure spreading on the soil.

Nitrogen is part of the structure of nucleoproteins, protoplasmic protides molecules, lipoproteins from cytomembrane, and it can be found in apoenzymes, coenzymes, vitamins B_1, B_6, B_{12}, plant hormones, photosynthetic pigments (chlorophylls and phycobilins) and in plant steroids.

Nitrogen deficiency in plants nutrition leads to leaves yellowing. The leaves stop growing. Nitrogen surplus lengthens the vegetation period, forms leaves abundance and increases the sensibility to diseases.

Figure 2. The image of fodder kitchen of the farm: fodder command screen (a,b,c) and mixer for ration making (d)

Plants may absorb nitrogen from the soil, water, atmosphere and even from other organisms (V. Simion, et al. 2005).

Nitrogen can be found in the proteic substance in the proportion of 15,5-17%. Thus, meat contains 16 % N2, milk casein 16 % N2, gelatin 18 % N2. The average percentage of nitrogen is considered to be of 16 %, which means that 1g of nitrogen can be found in 6,25g of protein. In order to obtain more exact results there are used other factors that lead to the transformation of nitrogen into protein, such as: 6,25 for maize; 5,83 for barley, oat, wheat; 5,60-5,70 for oil seeds; 6,60 for green nutrients; 6,25 for nutrients of animal origin; 6,38 for milk and diary products.

Phosphorus plays a very important role in the energetic processes of living organisms; it is a constituent cells' element and it is found in the form of organic compounds of phosphoric acid (www.anpm.ro/Files/bref07/_rearing). Being a chemical organic element, phosphorus is found in the structure of some biomolecules: nucleic acids; phosphoproteins, phospholipids. As an inorganic form it is found in the form of primary, secondary and tertiary phosphates of various metals Na, K, Ca.

In biotechnological processes phosphorus is an indispensable element of plants environment used to develop microorganisms. That is why the determination of phosphorus content during a bioprocess is necessary in the most of cases. It is considered that the quality and quantity of the yield depend on phosphorus content in the soil (http://facultate.regielive.ro/laboratoare/medicina/nutritia_minerala_a_plantelor-17402.html), as phosphorus has an important role both in transformations that happen to carbohydrates and proteic material synthesis; it increases germinative energy of the seeds and improves the bakery characteristics of wheat; it increases yield, improves yield quality and increases plants resistance to wintering. In phosphorus presence nitrogen from the used fertilizers will be better assimilated by plants. Phosphorus deficiency in the soil leads to vegetation disturbance, plants form short roots that are unbranched, plants don't grow, cereals don't fraternize and the maturity is late.

The use of fertilizers with phosphorus in the mixture with organic fertilizers greatly increases its solubility. In order to increase soluble phosphorus proportion from the pigsty waste it is recommended

waste fermentation together with tricalcium phosphate flour or other fertilizers that contains phosphorus. When pigs manure is used as fertilizer for plants, there should be known the content of nutritive elements in urine and the must from the pigsty that should be as follows: organic substance 2,8 %, nitrogen 0,43 %, phosphorus 0,7 %, potassium 0,835 %, calcium 0,01 % (http://facultate.regielive.ro/laboratoare/medicina/nutritia_minerala_a_plantelor-17402.html).

There have been analyzed fecal materials from a farm of pigs breeding and fattening. The samples have been taken from the animals of different sexes and age (table2). In laboratory there have been determined the following components in order to highlight the way of food assimilation and the possibility of manure usage as fertilizer in plants growing:

Wet;
Ash;
Ph;
Nitrogen content;
Phosphorus content.

Samples collection was done taking into consideration the material origin by age and sex groups. There have been taken 3 samples from different pigsty zones in order to establish certain average characteristics of the analyzed elements or components .

Laboratory analysis has been carried out using the following equipment: spectrophotometer Spekol, thermoadjustable oven, analytical scales Kern ABJ, electrical thermoadjustable bath for distillation.

Wet has been determined by means of analytical scales. The sample has been weighed before and after drying in the oven at 105 °C. Ash has been determined using fecal samples ignition at the flame of a gas burner. After cooling the crucible with the ignited sample there has been weighed its mass on the analytical scales. Ignition was repeated until a constant value of crucible and ash mass has been obtained. PH has been determined using Merck tests with values of 5-9. Proteic nitrogen and non-proteic nitrogen was analyzed using Kjeldahl method.

The analysis passed through the stages of mineralization, distillation and titration in which the following reactions took place:

Compounds with nitrogen + $H_2SO_4 \rightarrow (NH_4)_2SO_4$ + other compounds

$(NH_4)_2SO_4 + 2NaOH \rightarrow Na_2SO_4 + 2NH_3 + 2H_2O$

$2NH_3 + 2H_2SO_4 \rightarrow (NH_4)_2SO_4 + H_2SO_4$

H_2SO_4 (excess) + $2NaOH \rightarrow Na_2SO_4 + 2H_2O$

The sample (1-2 g) has been treated with sulfuric acid of 98 % at a high temperature (over 100 °C) in order to decompose the organic material and to transform it in sulfate of ammonium. The obtained sulfate of ammonium decomposed when boiling with the solution of NaOH of 33 % in excess till NH_3, then the product that was distillated and captured in a solution of H_2SO_4 -0,1 n. Sulfuric acid in excess has been treated with the solution of NaOH– 0,1 n in the presence of phenolphthalein. The difference between the quantity of H_2SO_4 – 0,1 n used to capture ammonia and the quantity of NaOH - 0,1 n used in titration helped to establish the quantity of H_2SO_4 combined with NH_3.

Phosphorus analysis has been carried out after the digestion of the sample at temperature with concentrated sulfuric acid and several drops of concentrated nitrogen acid (www.legestar.ro/Norma-2007-sanitar-veterina-ce-stabileste-metode-analiza-controlul-oficial-furajelor-umiditatea-bazele-azotate). Phosphorus obtained from the mineralization in the form of phosphoric acid then combined with ammonia molybdovanadate (prepared by mixing of a solution of ammonia heptamolybdate with a solution of ammonia vanadate), resulted in a form of a substance of yellow colour, soluble in the reaction with the environment. Spectrophotometer has read the solution absorbance at the wave length of 430 nm in comparison with ammonia molybdovanadate solution correspondently diluted. Calibration curve is linear for the domain 1-40 µg P/cm^3.

RESULTS AND DISCUSSIONS

The farm has two halls to breed-fatten pigs divided into paddocks that have modern equipment to distribute fodder and nourishment, watering places, ventilation installation and light. The halls floor is made of grids through which the manure is evacuated into the pit under the hall. Twice a year when

the pit is nearly full, it is emptied by an electric pump. The manure is loaded into emptying pools that have devices spreading manure in the field as a fertilizer rich in nitrogen.

Pigs for fattening excrete 11-15 kg N/capita a year, which is 0,035 kg N/capita a day (Irina Elena Petrescu, et al., 2009). Taking into account the above mentioned (forces, cycles, fattening duration), the amount of totally evacuated nitrogen from the farm is 22 t. In these conditions, if we consider that for example, maize grains have a specific consumption of 25 kg N/t, and the organic fertilizer from the farm doesn't cover the necessary quantity of nitrogen for average production of maize (7 t/ha) that grows on those annually sown 300 ha. The characteristics of the analyzed farm's pigs are presented in table 2.

Table 2

Pigs characteristics from the studied farm

Nr. sample	Age, days	Mass, kg
1	70	71.5
2	80	84
3	90	97
4	100	110

Experimental results are shown in table 3.

Table 3

Experimental determiners based on the samples of pigs' fecal material

Nr. sample	pH	Wet, %		Ash,%		Total nitrogen		Phosphorus	
		W	W average	A	A average	N	N average	P	P average
1	7	17.28	18.12	3.72	3.80	12.98	12.68	0.14	0.14
		18.34		3.82		12.24		0.12	
		18.74		3.86		12.82		0.16	
2	6.7	21.45	20.96	3.90	3.96	11.23	11.81	0.22	0.23
		19.55		4.12		12.09		0.25	
		21.88		4.08		12.11		0.22	
3	6	19.98	21.85	3.97	3.89	7.21	7.66	0.22	0.25
		21.45		4.02		8.10		0.25	
		24.12		3.68		7.67		0.28	
4	6.7	24.86	25.73	4.30	4.22	6.13	6.78	0.28	0.26
		25.72		4.27		7.07		0.25	
		26.61		4.06		7.14		0.25	

It has been stated that the taken samples have neutral or weak acid reaction and from this point of view, the organic fertilizer obtained from pigs for fattening may be used without restrictions on black soils owned by the farm owner. Wet is about 20 % and ash is about 4 %, fact that proves the observance of hygienic norms at the farm. The samples are rich in nitrogen, that means in unchanged proteins and have the acceptable content of compounds with phosphorus. Nitrogen content in the fecal material, accordingly the content of unchanged protein, diminishes with pig's growth in weight. Organic fertilizer may be used unchanged or composted in order to be spread on the soil.

The only inconvenience consists in the olfactory discomfort, but the farm's owner incorporates organic fertilizer immediately after the spreading either making the basic plowing or using a harrow of 15-18 cm in depth.

CONCLUSIONS

Pigs' breeding is an answer to the increasing demand for pork due to the economic characteristics of this species that implies rapid growth, specific fodder consumption, and increased efficiency at slaughter. Pigs manure generates in decomposing process various gases and substances that can constitute an important impact source on the environment and on the soil.

The pigsty waste is used as organic fertilizer for the arable land of the owner. Pigs manure is

used only after fermentation and is incorporated immediately in the plowed soil, the technology that minimizes the olfactory discomfort. On the basis of the accomplished studies and investigations we may assert that the farm chosen for study is not a source of pollution because of the manure that it produces and all these because of the fact that it uses adequate technology of manure collection and evacuation.

BIBLIOGRAPHY

1. Bran, Mariana, coord. *Zootehnie comparată – producţie, procesare, protecţie*, Ed. Meteor Press, Bucureşti, 2004.

2. Dinu, I., *Influenţa mediului asupra producţiei la porcine*, Ed. Ceres, Bucureşti, 1988, 150 p.

3. Petrescu, Irina Elena, Bran, Mariana. *The waste from the pig fattening farms, fertilizer or toxic waste*, Sesiunea ştiinţifică a Institutului de Economie Agrară cu tema Convergenţa economică europeană a sectorului agroalimentar şi a spaţiului rural românesc – situaţia actuală şi evaluări perspective, Bucureşti, 2009.

4. *Tehnologie complexă de valorificare a dejecţiilor în ferme zootehnice pentru promovarea agriculturii durabile în România,* Proiect finanţat de Banca Mondială şi M.A.A. prin contractul nr. 2389/2003, Bucureşti.

5. Simion, V., Tănăescu, B., Tănăsescu, V. *Nutriţia şi alimentaţia animalelor de fermă,* Lucrări aplictive, Universitatea „Spiru Haret", Facultatea de Medicină Veterinară, Bucureşti, 2005.

6. www.anpm.ro/Files/bref07/_rearing.

7. http://facultate.regielive.ro/laboratoare/medicina/nutritia_minerala_a_plantelor-17402.html.

8. www.legestar.ro/Norma-2007-sanitar-veterina-ce-stabileste-metode-analiza-controlul-oficial-furajelor-umiditatea-bazele-azotate.

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