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SWINE, A NEGLECTED SPECIES BY ANIMAL HUSBANDRY RESEARCH IN ROMANIA

Marcel PARASCHIVESCU[1], Marcel Theodor PARASCHIVESCU[2]
[1]Romanian Academy of Agriculture and Forestry Sciences, Mărăşti Blvd, no. 61,
District 1, zip code 011464, Bucharest Romania,
Phone: 0213184450, E-mail: paraschivescu_marcel@yahoo.com
[2]Reasearch and Study Centre for Agriculture and Forestry Biodiversity,
13 September Street, no. 13, District 5, zip code 050711, Bucharest Romania,
Phone: 021.318.81.06 int. 3542, Email: marceltheodor@yahoo.com

Corresponding author email: paraschivescu_marcel@yahoo.com

Abstract

In the last times pork production was discredited since it was considered concurring humans in food resources and provoking blood vessels inconvenient to consumers. With 2016 Food Day, FAO launched the call:" The climate is changing. Food production must to". The present paper argues for the opportunities pork production brings in delaying the global heating of the Earth, at least. At it is known the Earth temperature at the atmosphere level is due to the concentration of the gases having "greenhouse effect".
These gases are water vapors, carbon dioxide, methane, CFCs and nitrogen protoxide. Water vapors are at saturated concentration and can't act in global heating. CFCs are technical gases and have no relation with food production. CO_2 is produced by all live beings. CH_4 is result of anaerobic fermentation present in herbivorous animal digestion. Hogs and birds produce very small quantities of CH_4.The last mentioned gas results from manure fermentation and can be input in soil as fertilizer. On the other hand swine as genetic species is able to perform in different husbandry systems living outdoor or even in natural environment where they get their feed. The present paper suggests some themes concerning pork production that gives possibilities to reduce methane production from farm animal husbandry and fossil fuel consumption.

Key words: *greenhouse effect, pork production, pig farming systems.*

INTRODUCTION

There is no doubt Earth planet's temperature is increasing. "Climate is changing; agriculture and food must to", says FAO for the Food Day of the 2016 year.
At the same time the number of people on the planet has passed over 7.3 inhabitants. Food security is in danger. Animal farming has to react in helping life sustainability (Paraschivescu M. Th. et al. 2014).
Causes of Earth's heating aren't completely known. But one known cause is the increasing concentration of greenhouse gases in the planet atmosphere (Paraschivescu M. Th. et al. 2009). As the main greenhouse gases are considered: water vapors (H_2O), Carbon dioxide (CO_2), Methane (CH_4), Chlorofluorocarbons gases (CFC) and Nitrogen protoxide (N_2O).
Water vapors are at saturation level so their concentration can't increase. Chlorofluorcarbons are freezing industry gases involved in food storage not in food production (Sandu Mariana, 2016). Nitrogen protoxide results from animal manure by mineralization of urine. But manure, before attaining this stage of degradation can be used as valuable organic fertilizer of soil.
The remaining two gazes: carbon dioxide and methane are involved in the live beings' metabolism. CO_2 + H_2O are the mineral compounds which green plants use to synthesize organic substances in the presence of chlorophyll pigment during the day light. These way green plants are decreasing the CO_2 concentration in the atmosphere, no matter the same plants are emitting some quantities of CO2 all the day and along night. At the same time green plants aren't emitting any quantities of CH_4.
On the same land surface the green plant species have different capacity of fixing C in their bodies related to the present quantity of chlorophyll resulting from the depth of the

green layer on the land surface. For these reason forests are most efficient actor in taking CO_2 out of atmosphere. On contrary animal organisms don't fix any atmospheric CO_2 (Tufescu V., M. Tufescu,1988).

Concerning CH_4 emission animal organisms express different statuses depending of their nutrition type. Herbivorous species, since using vegetable feed only, have in their digestive tract a special fermentation compartment which is the rumen in ruminants or caecum in non-ruminant herbivorous and rodents (Paraschivescu M. Th. et al. 2014). There takes place an anaerobic fermentation producing high quantities of methane emitted by ruminants' trough eructation and by non-ruminant herbivorous through flatuses. Omnivorous species, the ones using both vegetable and animal feeds have also a caecum but it is relatively smaller and their digestion is mostly chemical. Par consequence they produce lesser quantities of methane (Paraschivescu Maria and al., 2001). The carnivorous, eating almost meat, are emitting even less methane, most of it with the expiratory air.

Another source of atmospheric CO_2 resulting out of animal production is burning fossil fuel to obtain the needed energy to conditioning the inner environment of animal housing.

We can say with regard to the impact of animal farming on the natural medium surrounding more pressure results from herbivorous species whose digestion tract has an anaerobic fermentation compartment and from poultry production requiring ventilation and heating of birds' houses. The second of the above servitudes is pretended to pigs grown in industrial technological systems, too.

Pork has been blamed, up to not long ago, for its high content of fat which was considered a danger for the blood vessels sanity of the consumers. Now it was demonstrated the cholesterol formatted from pig fat acids is needed and not a dangerous one.

Pigs were also blamed eating concentrate feed that is a costly one and might be food for humans, as well.

Since these sanogenezis arguments are dismounted pork production deserves to be considered among solutions helping to delay the actual planet global heating by reducing the methane emission from the animal production enterprises (Paraschivescu M. Th. et al. 2014). On the other hand there is one economic reason in this respect, too. In pork production one kg of body gain needs 3 kg of combined food (93% Dry Matter) to be obtained while it is necessary to feed 7 kg of DM to get 1 kg of body gain in cattle. In sheep and goats the need of feed is even more, since these animals are smaller and have a higher basal metabolism.

There are other economic reasons to develop pork production, as well. The first one is due to the fact that pigs have an everyday continue production. Before puberty they put body gain. After puberty gilts are producing piglets and continue to grow. Further prolificacy of sows is increasing in the new generation cycles and their live weight becomes greater in the next two or three years.

The second one is that pregnancy period length in swine is short (less than 4 month) and the piglets' suckling, as well (about 4 weeks). It is easy to receive twice litters, from one sow within one year (Paraschivescu Maria and al., 2001). Precocity in swine is a good one. Sexual maturity is expressed in the first year of life. It is also possible to have populations with sexual maturity before 6 month of age and the first parturition in the first year of life.

One other important trait in swine species is the modest requirements for the housing comfort along their life time. Pigs don't need special bed for their rest. They can rest on soft or on hard floor, as well. The main difficulty resumes to the request of piglets for a rather high temperature in their first week of life (up to 33^0 C in the first three days). During the rest of their life pigs can live even in rough, natural, medium.

Also it could be added the scientifically progresses in reducing the production cost of pork by better feed conversion due to less fat content of pig carcasses getting a decrease in the variable input costs. There are also hopes in reducing the fixed costs of pork production by outdoor housing of pigs and to increase the labor productivity by better management and feeding. These explain why pork covers 60% of the world consume of meat.

Such themes deserve to be discussed as targets of current research in pork production industry.

RESULTS AND DISSCUSSIONS

After privatization in order to obtain leaner meat hybridization procedure similar with the one practiced in poultry production, but using differently selected maternal and paternal lines, has been promoted. The same goal was intended with combined feed receipts having severe estimated content of essential amino acids.

The obtained results were placed and used instead of the former industrial system of pork production in continuous flow. Research units were privatized and other pork production systems have been neglected. Research units were converted in commercial units to reduce production costs and scientifically management was received from the furnishing the hybrid commercial pigs firms. The hopes for more efficient production of pork didn't confirm. Pork production decreased tremendously in Romania.

Before privatization in the pork production of Romania a pyramidal scheme of breeds' improvement was applied. In top of the pyramid there were elite farms with maternal breeds improved for fertility and paternal breeds improved for higher daily body gain, in both cases by grading up selection, in *inbreeding*. As maternal breeds Large White and Danish Landrace were used. As paternal breeds American Duroc and Hampshire were submitted to the grading up process for lean meat and higher daily gain. Later the Romanian research officer Liviu Beris succeeded in creating a synthetic breed, that he called Peris 345, a massive type of pig with very high performances of body daily gain and large muscles (Beris L., I. Petcu, 1974). He used the idea of synthetic lines promoted, those times, in the former Democratic German Republic.

Under the pyramid top multiplication farms were placed. These farms received gilts and young boars from the elite farms, bred them in closed reproduction or by crossing maternal breeds or the paternal breeds in-between sold piglets of both sexes to the commercial units where by cross breeding of fertile sows with lean meat boars produced the commercial pigs for the slaughter houses. Out of this schedule some crossbreeding schemes have resulted.

This project which we might call "Pyramidal Crossbreeding Scheme" was very efficient. The pork production of Romania for the inner market and for export was impressive (Beris L., I. Petcu, 1974). There was also a pork production for countrymen families' subsistence, including the annual traditional Christmas pig of at least 3000000 country side families.

After 1990 by liquidation of the state agriculture enterprises and of collective agriculture units as privatizing way of agriculture the former project of pork production has been abandoned. In the industrial continuous flow pork production system imported hybridcommercial pigs were brought instead. The pork production for the market vertiginously declined in Romania.

The causes of declining of the former pork production after 1990 weren't objective. There were mistakes of the successive incompetent Romanian governments and the ignorance or maladroit of advisory teams paid by EU to help our economy which acted for the outside of Romania interests.

The greatest mistake of those times in this field was the privatization of the pork production research units. Now we have no research unit for pork production. All genetic material is imported with the sanitary risk of contamination of the local livestock and only the intensive industrial pork production for the market is under the public authorities' attention. There are some research themes concerning pig feeding still in course aiming to improve receipts of feed supplements or of combined feed, only.

The difference between producing pork by *hybridization* and by *pyramidal crossbreeding schemes* refers mostly to artificial biodiversity inside the genetic species of swine. Hybridization claims for two genealogic lines one maternal of high fertility and one paternal presenting thick muscles and controlled microclimate, meanwhile the pyramidal crossbreeding scheme accepts many fertile maternal breeds and at least 2 or three paternal breeds suitable in different environment conditions (Beris L., I. Petcu, 1974). The maternal breeds all of them selected for prolificacy at the firth farrowing might differ by their body type concerning the frame, the size or by the body daily gain. The two last of these traits are related with the animals' precocity, what means earlier term of puberty, gilts getting able to be

fertilized before 6 month of age and having their first litter before 1 year of age. In the former pyramidal crossbreeding scheme the grading up selection for prolificacy associated to large size of the body started with the Large White breed for a tall frame and with the Danish Landrace breed for a long lines frame allowing more number of teats.

To have smaller size sows' selection was directed to the sexual precocity as the first selection criterion and prolificacy as the second one. The initial genetic material had to be the local Basna breed that was expressing these traits. Basna pigs were of middle size and of short body type, having a black robe with a white belt around the shoulders like in Hampshire or Saddleback breeds.

As paternal breed it was better to call and to dispose of boars from the Perish 345 breedince it had very large muscle mass and very high daily gain performances. Pietrain or Belgium Landrace boars could also be used. But it would be better to breed the paternal boars, doesn't matter the breed, in own small farms with closed reproduction, to avoid their transport on long distances and, as prophylaxis measure against contagious diseases by avoiding frequent introduction of new animals in pig herds. The Perish 345 and Belgium Landrace boars have the advantage of being free of the recessive gene of exudative myositis impelling on the maturation of the meat. There are rumours Suisse disposes of a free of this gene Pietrain population.

To this sophisticated biodiversity we have to add the still existing in Romania some rear local breeds as Mangalitsa (disposing of a thick layer of under skin fat wanted in minced meat industry and Swamp Pig able to live in natural medium

Biodiversity of artificial populations inside genetic species offers the opportunity of combining more traits in the crossing process offering a diversity of wares for the market and, what is more important, gives permission to locate pork production in peculiar environments with different resources and adequate husbandry systems.

Actual targets in pork production research might be breeding for biodiversity, implementtation of organic pork production, reduction of conventional energy and increased labor force productivity.

Breeding for Biodiversity

Let the private enterprises to continue their business. Thus it will be possible to compare breeding swine for hybrids with the pyramidal crossbreeding scheme for lean pork production scheme which must be remounted.

In this case, for the biodiversity purpose, it is necessary to preserve and select for fertility the two maternal races above mentioned Large White and Danish Landrace. Each breed has to have a clearly stabled body type able to sustain metabolism ensuring excreted net energy delivery to sustain their fertility. The project has to find out the most efficient program of multiplicative reproduction to receive the most fertile mothers for the commercial crossbred pigs. The first target of research in this field is to clarify the effect of age upon the cost of one weaned piglet due to the size of successive litters and to the number of births to have from one sow during her reproductive life.

Concerning the paternal side the Perish 345 population has to be saved and conserved in closed reproduction. It is of great interest to establish the minimal number of families in a herd and the way of eliminating feeble families and of accepting new better families. For competition the import and adoption of a Suisse Pietrain population, free of the exudative myositis gene is indicated. Projecting of a smallest farm to keeping a paternal population in sustainable inbreeding state seems to be of great importance for such schemes. Of course one or two commercial pork production units of satisfactory size have to be implemented in the research net for such schemes.

As biodiversity goal in maternal breed adding precocity to the fertility would be of interest. That means to have a maternalbreed of smaller body size, whose gilts entered puberty before 6 month of age. Virtues of such kind of size and precocity are less variable cost for sows' feeding and the possibility of a diversified and changeable reproduction plan within the year. Such scheme gives the possibility to use the farrowing boxes two times a year at fixed terms, in the spring and in the autumn, to offer hogs of about 25 kg to be further grown for the traditional Christmas pork by the interested people. Such type of units is able to integrate grading up selection in the maternal breed with the crossbreeding to parental breed boars to

dispose of different kinds of commercial animals. Such farm can sell hogs (20 kg-25 kg) to be grown further by clients or to sell finished pigs for slaughter (100 kg-110 kg). Great advantages could be received out of this peculiar technology if reproduction plan implements the so called "one birth gilt" breeding.
Resulting advantages are:
Better outputs due to the fact that to the value of the weaned piglets' the value of body gain of mothers during the pregnancy can to be added.
High selection intensity by self-performance test for prolificacy (size of the litters) is allowed.
Lower conventional energy needs in the pig houses is required since farrowing is placed outside of the cold season.
Much technical independence is offered since all the breeding schemes might be promoted in the same yard.
Surest prophylaxis against contagious diseases is guaranteed since the mentioned independence allows closed breeding.
Good start in this respect could be enjoyed since this trait is met in the gene pool of the Basna breed and is no need to induce the trait along many generations.
For biodiversity reason Mangalitza breed has to be studied, as well. Mangalitza pigs have a very thick under skin fat layer containing plenty of unsaturated fat acids. Volatile fat acids giving pleasant taste to Mangalitza pork are also present. For this reason food preparations from mixt minced meat contain in their composition Mangalitza fat. In addition Mangalitza pigs have a firm sturdiness against frost and even to sun rays being suitable for outdoor pork production.
With the same target acclimatization of any fat and prolificacy chinese breed would be tried, this way avoiding to import continuously live animals with dangerous antigens. Severe measures of quarantine must be officially promoted and supervised when importing pigs from Asia. Do not forget that located pigs in Romania have no antibodies for Asiatic diseases.
Now we know nothing about pigs grown in the country side families for their subsistence. It is of scientific interest to know if there are differences among the kind of pigs from plains, from mountains and from along the Danube or in the Danube's Delta.

Pork production husbandry systems

As it was said in the introduction of the present paper industrial pork production is one of the ways Carbon from the fossil fuel gets in atmosphere as CO_2. Much conventional energy is used to substitute labour force, to ensure a sanitary microclimate inside the pig houses, for cleaning and disinfection of pig boxes and equipment. Reducing conventional energy consumption will act not only for natural medium protection but also for less production costs of the pork.
But food security of humans is helped also if other feedstuff than concentrates feeds is used for pigs' nutrition, of the kind humans can't eat. Such circumstance is related to pork production system as well. We don't know anything about the kinds of husbandry systems practiced in small pig production enterprises in this country.
Safety food is other requirement of these days. Here is the question of food additives involved, not only of toxins or pathogenic agents. In principle the most natural is the best safety food and market offers better prices for the organic food than for products resulted from chemically treated cultured.
Let us see now what pork production systems are or were practised in Romania and which are their virtues and servitudes from the point of view of the former enlisted criteria.
The criteria are considered starting with the one of least human intervention in the running on of the system (the natural system) and going to the most artificialized one (the permanent flow industrial system).
In such order they will be:
• The natural system, met in the Danube Delta;
• The extensive system, practiced in the high hills of the Northern part of Romania;
• The familial, adopted for subsistence by mostly of families living in the country side and villages;
• The changeable flow production system, which allows changing the farrowing program of the saw herds;
• The continuous flow production system, which is the most artificialized.
• The outdoor production system, which declines using of pig houses, except farrowing boxes.

The natural system

We met such pork production system in the Danube Delta of Romania. There are three distinct zones in the Danube Delta:

a) The reservation zone where no lucrative human activity is legally permitted, but where herds of cattle or studs of horses are living like wild, stray animals, some of them being harvested by hunting;

b) The non-residential zone, without permanent inhabitants, but where some economic activities dedicated to using local resources as fishing, navigation control or periodical biomass collection is running;

c) The populated zone with small villages, some agriculture and subsistence animal husbandry.

The natural system of pork production is present in the non-residential zone of the Delta. In the neighborhood of existing facilities for fishing activity or other purposes some pens are done and let opened. At these pens pigs are coming together for rest. From them pigs live stray to any part around. They are not afraid of people as the cattle in the reservation Delta are. Colour of hair or skin of pigs is of all kinds we know: white, black, red, white, white - black spotted, red – white spotted, black with white belt around shoulders or even gray. Many new born piglets are of reddish color with whiter strips along the body like in wild species boar. All pigs, doesn't matter their color, had in common big head with strong and long jawbones. Pigs were taking all their feed out of the Delta ground and land. No chemicals were involved. No fossil fuel was wasted. It is the most possible organic feeding.

The need for research concerns natural land characteristics provable to pigs' location, the usual category structure of a swain flock in natural environment and the best unit measuring the size of herds, the minimal surface needed per flock unit, the minimal distance between pig herds, pigs protection against predators, the sanity surveillance status of animals and the mild, least disturbing method of harvesting the pork production to be used.

The extensive system

May be this kind of system is the oldest one and originates in keeping 2 – 3 sows at the sheepfold in order to eat the whey or other remainders from cheese preparation. Then, such sows and their piglets being free went grazing together with the sheep and entered in forest where they founded more fruits and roots than on pastures. Later when human communities became sedentary the ones disposing of herbivorous animals and pastures in the neighborhood of falling list forests let their pigs to go "grazing". So pigs entered forests eat acorns or beechnuts and other fruits. To the evening all animals return to their yards where, eventually, their feeding was completed. Now this system is still practiced in the hamlets from forested hill parts of the Northern Romania as subsistence pork production. There is not too much research to be done in this field except how to use the system for commercial organic pork production.

The familial system

The *familial* system is spread in less industrialized countries whose agriculture furnishes more vegetable wares. The goal of pork production is mostly to nourish the owner's family and may the occasionally engaged labor force. In Romania there is the tradition of having a pig for the Christmas fest and as source of meat preparations for the winter. The number of pigs slaughtered for the Christmas Eve must be around 3000000 heads. This pork production is completely neglected by the research.

Usually 1 or 2 pigs, preferably males, are kept by a family and fed with kitchen remainders and with own produced cereals (corn, barley, wheat, oats, sorghum or other) or residues from the vegetable oil production industry. Where and when the hogs (young pigs) are purchased God knows. Nothing is organized. It is not possible to say something about breeds. There is much to do apart research units in this field, and we have no one research of this kind. The main questions concern the seasonality of reproduction keeping two parturitions per sow per year, the controlled artificial biodiversity of Christmas pigs, efficient feeding of pigs using local resources and the needed additives to correct them, cheap solutions to housing and watering pigs, sanitary protection of livestock and so on. As it is evidently all the above requirements are questions of services which must fi answered by research units.

The controlled changeable flow system

That is a new proposed system intended to answer the above mentioned questions.

In principle it supposes to have a pavilionar housing system with, preferable, 6 houses one for different 6 families intended to preserve the genetic variability of the maternal population of the system. Best are 3 walls houses opened in front where the automat feeding facilities are fixed on a low fence, along one external alee.

Each pavilion has to be divided, let's say, into 21 rectangular boxes 1, 2 m large and 4, 0 m long in depth, from the front to the back of the house. Out of the total 21 boxes, 3 boxes are designated to 3 senior sows who are mothers of 15 their daughters housed in other 15 boxes. The remaining 2 boxes have to receive, one of them the male piglets of mother sows and the other one to receive the female offspring of the same mothers, when they are weaned. These offsprings are grown there up to puberty when daughters are moved in the before mentioned 15 boxes and the sons are selected for inbreeding or soled. The daughters are mated by crossbreeding to produce commercial kinds of pigs. When they finish suckling their first offspring the young sows (daughters) are sold or slaughtered. The piglets remain in boxes up to 20 – 25 kg live weight when they are sold to the interested country side families. Daughters are used for single parturition only, excepting the selected ones to become mothers. The hind part of the boxes is built as a ditch 20 cm deep and 60 cm vide to serve for the mechanical evacuation of the manure. Special attention must be given to the environmental temperature in the first week of live. For this reason each box, excepting the 2 designated to the offspring of mother saws, must dispose of a nest that can be wormed up to 30^0 C in the 3 days of litters' life.

The continuous flow system

This is the intensive industrial pork production for the market. The main trait of the system is to allow equal distribution of pork production along the year. Research must find out the way of keeping this trait in more complex units that have its own reproduction sector to obtain the commercial piglets by hybridization. The question of artificial insemination can't be excluded in order to stop new animals to enter the houses. Reducing the risk of infectious contamination of pig herds is a permanent task especially in units concentrating large amount of livestock.

The Intensive Outdoor Pig Production System

The system is, may be, the most sophisticated one and intends to reduce the fix costs of pork production by eliminating needs of buildings and of energy for good microclimate but keeping the strict rules of industrial programs. Detailed information in this field is given by Keith Thornton in his book "Outdoor pig production", reprinted by Farming Press in 1993.

The Intensive Outdoor Pig Production System is a novelty for the Romanian research in pig meat production. Extracting ideas from Thorton's book main tasks in this field are to find the acceptable traits of land and ground to locate such units (Thorntorn K.,1993).

The land has to be plain and the ground light. Clay presents the risk of retaining rain water and formatting mud. Facilities referring to electric energy and running water access is necessary. Most attention is paid to the breeding stock of the units. Sows and gilts are housed in distinct sectors. Each category must dispose of three kinds of boxes or pens: for mating, for in pig sows and for suckling sows. Pens of this last sector are provided with huts for farrowing acting as shelters for the sucking piglets. Weaners are collected at 3 or 4 weeks of age and moved indoor to be grown. It is not very clear why? The number of boxes (pens) in each sector is established in relation to the total surface at the unit's disposal, the number of sows, and the culling rata of sows (to count the needed number of gilts), the grouping interval of animals (shorter if number of sows is large), the ground characteristics and others. Convenient large tracks for tractors or other vehicles have to ensure good access to boxes. The best fences are the electrical ones with two strips of wire (at 20 cm and respectively 60 cm from the soil) fixed at wooden posts placed 8 – 10 m distance one to the other. Wooden hurdles are less resistant and more difficult to be moved when the place of the unit is changed.

Changing the place of the units gives the advantage of including some fertilized land in the general rotation cropping system of the farm. Thus no land is taken out from vegetable production of Agriculture. Next advantage is

reducing costs of shelters. In the outdoor intensive pig production there are needs for some cheap wire fences, genuine water troughs and small huts instead of expensive large buildings with roof and walls, windows, doors and concrete drives. Thorton says: Outdoor pigs' welfare is better than indoor (Thorntorn K.,1993).

But there are also some vices of outdoor pig production. One of them is decreased conversion of ingested energy to net energy of the biological production because of more het increment outdoor. There is considerable wastage of feed stolen by birds and vermin or gone with the wind. The last wastage can be avoided by formatting the combined feed as nuts or creep. Protection of piglets against predators has to be considered too. Difficulties are met in grouping sows of uniform size to fit the live weight of boars. Difficulties are met in depicting barren sows in the paddocks of in pig sows, what induces the need to use catch boars. Nevertheless advantages of outdoor pig production are net superior to disadvantages.

CONCLUSIONS

Menace of human food security caused by the global heating of the Earth and the climate changes might be tempered in the field of animal production by decreasing CH_4 emission through increasing pork production instead of producing beef or mouton.

Concerning pork production itself reducing conventional energy consumption for micro-climate control inside pig houses has to be considered as a positive measure, too.

New pork production systems as the natural system, the controlled changeable flow production system or the outdoor pork production allow sever reduction of energy consumption needs.

Such systems allow also to produce organic meat that benefits of better prices on the market, especially now when certainly was stabled that pig meat is a safety food.

Animals' health protection has to be improved all over the country in any husbandry system, including the intensive, industrial one.

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