PORCINE RESEARCH
International Journal of the Bioflux Society
Research article

Single area payment scheme in the integrated production of swine farms – requirements and benefits

Nicuşor Sima

Animal Husbandry Department, Faculty of Animal Sciences and Biotechnologies, University of Agricultural Sciences and Veterinary Medicine Cluj-Napoca, Cluj-Napoca, Romania. Corresponding author: N. Sima, nicusor.sima@usamvcluj.ro

Abstract. Pig farming represents one of the traditional activities of Romanian family farms in which vegetal production is efficiently used in conditions of actual evolution of the cereals national market. The adaptation of pig farming systems from family farms to the conditions imposed by the practices of a sustainable agriculture requires the knowledge of requirements related to the fodders production. The financial support measures available for Romanian farmers in vegetal production sector through National Rural Development Plan encourage the sustainable agriculture practices. Single area payment scheme (SAPS) is one of the available measures both for farms with intensive system of pig faming and for those with extensive system, with or without fodder production. Among the requirements imposed to the integrated farms for the obtaining of financial support in the frame of SAPS, a special attention must be paid both to the plants technology of culture (such as organic fertilization of fodder plants assortment) and to the liquid and solid manure management in order to protect waters against nitrates pollution from agricultural sources.
Key Words: GAECs, N and P excretions, organic fertilization, pig manure, SMRs, swine farming.

Introduction. An integrated circuit in a farm supposes the existence of both animal and vegetal systems. In this circuit a part of substances exported by plants from soil in order to obtain the net primary production can be returned in soil through solid and liquid manures provided by animals that have ingested those plants. This situation is applicable in swine farms which partially or totally produce their fodder supply. Swine feeding permits the use of a varied assortment of crops and fodder plants (annuals and perennials) as well as different ways of plant usage (seeds, fruits, roots, stems or entire plant harvested in different stages of growth or development). The technologies of culture used by farmers can be more or less in agreement with the sustainable agriculture practices. Romanian farmers are encouraged towards such practices through the possibility of using of financial support measures available on the two Pillars of Common Agricultural Policy developed through National Rural Development Plan. One of the financial support form available on Pillar I is SAPS. The beneficiaries of this payment can be both farmers with exclusive activity in vegetal or animal farming and farmers with joint activity, regardless of applied farming systems (intensive or extensive). In order to grant this payment farmers have to respect the Good Agricultural and Environmental Conditions (GAECs) and the Statutory Management Requirements (SMRs) throughout the farm and for a period of 5 years. The farmers' benefits, as a result of respecting the GAECs requirements, must be understood first of all as agronomical and environmental benefits with effect on middle and long term referring to: the reduction and avoidance of soil erosion (standard I), maintenance soil organic matter levels (standard II), maintenance of soil structure (standard III), minimum maintenance of agricultural lands including those unused for agricultural production (standard IV), protection and management of water (standard V), respectively immediate financial benefits quantified through a single area payment (annually per hectare). On the other hand respecting of the requirements imposed by SMRs reveals both in single payments on surface and

through the benefits produced on middle and long term in the fields of agricultural production, environment and plant health, respectively animals' health and welfare. The respecting of these requirements also represents a cross compliance requirement, compulsory for accessing other payments of available measures on Pillar II, such as agri-environment. Agri-environment payments encourage the traditional agricultural practices and the extensive systems of production which finally have a positive impact on biodiversity preservation. These payments represent the financial support for farmers to compensate the production losses determined by respecting of management requirements imposed by the agri-environment measures.

The aim of this research is to present the agronomical recommendations referring to the establishment of fodder plants assortment, respectively to the using of organic fertilizers in the integrated swine farms in agreement with the SAPS requirements.

The impact of SAPS requirements on plant assortment choice, technologies of culture and organic fertilization with swine manure. One of the important food sources in the swine feeding is represented by cereals, especially in the extensive system of farming. Among the reasons of cereals using on a large scale in both swine farming systems can be mentioned: small volume of labour for fattening pigs compared with other feeding sources (Durst & Wittman 2010); possibility of fully mechanized cultivation technologies, knowledge of them and possibility of one-crop system realization for the most of cereal species (Muntean et al 2008); the large variety of fodder forms – seeds, silage, fresh matter, hay (Dragomir 2005; Loustau-Vignau & Huyghe 2008); high adaptability of cereal species, varieties and hybrids at different ecological conditions, including extreme weather phenomena such as drought (Blum 2006; Hopkins 2003) and their high variety as vegetation period; high propagation through seeds capacity; minimum requirements of seeds at storage and shipping; good response of cereal species at fertilization (Schvartz et al 2005) and, thus, a better control of the quantity, quality and chemical composition of harvest (Erdelyi et al 1990). Durst & Wittman 2010 mentioned that late fertilization of cereals determined the increase of fodder protein content obtained from seeds while decrease the quality of proteins in terms of feed. The decrease of protein quality is due to the decrease of indispensable amino acids content, such as lysine and threonine, in the favor of nonessential amino acids content, such as proline.

Other important fodder crops for swine are annual legumes (soy bean, peas, broad bean, Lupine – which can be used as seeds or meal and as fresh matter mixed with annual grasses), potatoes, fodder beet and sugar beet, respectively permanent and temporary pastures (alfalfa and clover). Alfalfa, among perennial fodder crops in temporary pastures, has an important place due to its production capacity, quality of harvest and different ways of usage (Mathieu 2003), respectively due to its capacity to improve soil properties.

Organic fertilizers can be used for fertilization in the mixed farms (animal and vegetal production – swine farming), where forages are produced. This possibility has the advantage of reducing fertilizers cost but presents at the same time the risk of an inadequate management (storage problems, non-observance of restriction period of fertilization, fertilization with higher doses than those allowed by legislation).

Farmers' option for a sustainable system of fodder production in the swine farms may have a double motivation, economic and ecological, as it was previous mentioned, and supposes the respecting of GAECs and SMRs requirements in accordance with the specific of each crop technology and even more. Thus, in the frame of Romanian GAECs the compulsoriness of crops rotation with a minimum number of crops is not stipulated. In these conditions the one-crop system of cereals in the swine farms can be applied while respecting the commitments for SAPS. Nevertheless the existence of transitional national aids which are granted to the farmers for crops of national interest realized in arable land, among which those of species used in swine feeding, encourages the choice of a varied structure of crops. Such a choice provides the conditions of crops rotation with all the advantages therein such as the reduction of pesticides usage and the improvement of soil physical and chemical features (Rusu 2005). An example in this way

is the possibility of fertilizer doses reduction which is possible both due to the differentiated usage of nutritive substances by different species and to the some species capacity, such as legumes, to improve the chemical features of soil, such as nitrogen (N) and phosphorus (P) content.

Among the existing elements in pig manure important places have N and P, both important in plants growth and development and through the potential risk of environmental pollution they have. In order to prevent the problems caused by N, multiple information and rules are stipulated in the SAPS requirements, exclusively referring to the N from organic fertilizers. The amount of N obtained from the swine herd is variable (Table 1) depending both of animal category and of farming system (extensive or intensive). Based on the 2013 Action Plan data presented in table 1, depending on crop (Table 2) and corresponding surface for each crop, respectively depending on the land slope where crop is cultivated, the N fertilization dose is established. However the lack of agrochemical analyses limits N doses (active substance) allowed for different crops at 120 kg·ha^{-1} for lands with under 12% slope while for the lands with higher than 12% slope a range between 80 and 120 kg·ha^{-1}, depending on species, is allowed.

Table 1

The amount of N excretion by different animal categories and the amount available for fertilization

Animal category	*Total N in liquid and solid manure*	*Net amount of N in solid manure*	*Net amount of N in liquid manure*	*The amount of N available for fertilization*	
				Solid manure	*Liquid manure*
Pigs under 20 kg weight	2.50	2.29	2.54	1.84	2.04
Pigs between 20 - 50 kg household system	1.93	1.58	1.75	1.34	1.49
Pigs between 20 - 50 kg intensive system	1.79	1.64	1.82	1.31	1.46
Sows with piglets – household system	29.38	27.09	30.13	23.47	26.10
Sows with piglets – intensive system	26.83	27.48	30.57	22.62	25.15
Fattening pigs – household system	4.62	3.78	4.21	3.21	3.57
Fattening pigs – intensive system	4.28	3.93	4.36	3.15	3.50

The maximum N fertilization dose resulted from organic fertilizers and allowed by SAPS, based on agrochemical analyses, is 170 kg·ha^{-1}.

Table 2

N doses for obtaining a yield equivalent to national average (the last 10 years – land with slopes greater than 12%)

Crop	*N active substance·ha^{-1}*
Wheat	90
Maize	80
Other cereals	80
Sunflowers	80
Potatoes	90
Sugar beet	120
Pastures	80

In order to prevent water pollution with nitrates from agricultural sources the farmers had also the obligation to respect national (1, 2, 3, 4, 5, 6, 7) and European (8, 9, 10) legislation, measures with respect to restriction period of solid and liquid manure application, respectively with application way (National Action Plan for water protection against nitrates from agricultural sources, SMR).

Table 3

Restriction periods for application of different fertilizers type

Fertilizer type	*Usage category*		*Restriction period*
Solid organic fertilizers	Arable land and pastures		November 1 – March 15
Liquid organic fertilizers and mineral fertilizers	Arable land	Winter crops	November 1 – March 1
		Other crops	
	Pastures		October 1 – March 15

Thereby the farmers are constrained not to apply animal manure on water saturated land, flooded land, frozen or snow covered land; to provide the incorporation of organic fertilizers applied on arable land with slope greater than 12%; not to apply fertilizers, especially liquid manure when intensive rainfalls are forecast; not to store the manure in floodplains; to respect the restriction period for organic and/or mineral fertilizers application on arable land (Table 3) and to provide an uniform spreading of fertilizers on land, in accordance with the stipulations of the Action Plan.

Regarding the management of organic fertilizers and the risks of water pollution with nitrates there are many rules and information available for farmers (Farmers' guide – SMRs, Action Plan). For P, including that from swine manure, the similar information is missing.

In the swine food, generally in the animal food, P represents one of the essential macroelement. For swine feeding and the management of their resulting manure it is important to be known that from the total amount of P in fodder, at a normal food composition, 70% will be removed with fattening swine and till 90% with breeding sows (Durst & Wittman 2010). In the fodder obtained from plants the highest rate of P is contained in phytin and it can be not released in digestion through endogenous enzymes (Durst & Wittman 2010; Sutton et al 2006). It is also important to know that there are big differences within different sources of fodder with respect to P bioavailability for swine. Thus, in maize P bioavailability is about 14% while in wheat 50% (NRC, 1998 cited by Sutton et al 2006). Because of the high variability of P bioavailability for swine within different fodder sources, as well as because of its large limits of usage in swine' diet, oftentimes P is used in excess in swine feeding in order to provide the safety margins. Consequently, P in excess is excreted in manure (Gundel et al 2004; Nitrayova et al 2006; Sutton et al 2006; Guggenbuhl et al 2007) and, as a result, the use of manure in crops fertilization, in accordance with applied dose, timing of fertilizer application and its type can determine soil pollution, as with N.

Some data regarding P content in swine manure after Davidescu & Davidescu (1978) indicate the followings: 0.41% P_2O_5 in fresh solid manure and 0.07% P_2O_5 in fresh urine; 0.19% P_2O_5 in fresh manure with straw; 0.15-0.73% P_2O_5 the average variation of P in manure depending on fodder quality and age of the animal (the conversion factor in P being 0.4369).

According to SMR 4 requirements, the farmers have obligation to realize the crops fertilization plan and to keep during 5 years the farm documents for control with respect to agricultural surface, crops structure, livestock and the type and quantity of fertilizers applied on arable land. In order to realize the fertilization plan, in absence of information concerning the efficiency of N, P and K usage by plants and manure usage as a rule it was considered useful to present some information in this respect. Thus, from the good quality manure in the first year an average of 20-25% N, 30-35% P and 65% K is used. In the next years manure utilization efficiency decreases and varies depending on soil (Table 4).

Table 4

The efficiency of manure utilization (Davidescu & Davidescu 1978)

Soil type	% from harvest total average increase			
	Year I	Year II	Year III	Year IV
Coarse	40	25	20	15
Medium	50	30	15	5
Fine	60	30	10	-

Conclusions. Fodder production in the swine farm offers the possibility of organic fertilization of crops with the resulting manure. Organic fertilization determines the increase of soil organic matter content and the improvement of its chemical and physical features on long term, respectively the increase of plants and fodder protein content. Vegetal production also permits accessing of SAPS and transitional national aids which provide immediate financial benefits of 156.89 €/ha, respectively 19.81 €/ha. The respecting of GAECs and SMRs, which are SAPS requirements, imposes sustainable agriculture practices such as the correct establishment of fertilization timing and the maximum level of N doses applied in the crops used in swine feeding. The respecting of fertilization rules contributes to the obtaining of quantitative harvests, the limitation of water polluting, the reducing of greenhouse gases emissions, respectively to the biodiversity preservation.

References

Blum A., 2006 Drought adaptation in cereals. Ribaut J.-M. (ed), pp. 3-16, The Haworth Press, Inc.

Durst L., Wittman M., 2010 Nutriţia animalelor. pp 156-240, Ceres Publishing House, Bucharest, Romania.

Davidescu D., Davidescu V., 1978 Agenda agrochimică. pp. 446-455, Ceres Publishing House, Bucharest, Romania.

Dragomir N., 2005 Pastures and fodder plants – technologies of cultivation. Eurobit Publishing House, Timișoara, Romania.

Erdelyi S., Ionel A., Arvat N., Ignat A., Iacob T., Simtea N., 1990 Producerea şi conservarea furajelor. Tipo Agronomia Cluj Publishing House, Cluj-Napoca, Romania.

Gundel J., Regius-Möcsényi Á., Hermán A., Fébel H., Huszár S., Szelényi M., Szabó A. 2004 Change of the apparent digestibility of nutrients and phosphorus as a function of phosphorus source and phytase supplementation in pigs. J Anim Feed Sci 13:133-141

Guggenbuhl P., Piñón Q. A., Simões N. C., 2007 Comparative effects of three phytases on phosphorus and calcium digestibility in the growing pig. Livest Sci 109:258-260.

Nitrayova S., Patras P., Sommer A., Heger J., 2006 Effect of microbial phytase on apparent ileal amino acid digestibility of phosphorus-adequate diets in growing pigs. Arch Anim Nutr 60(2):131-140.

Hopkins W. G., 2003 Physiologie végétale. pp. 37-88, De Boek, Imprimé en Espagne.

Loustau-Vignau L., Huyghe C., 2008 Stratégies fourragères. Pâturage – Ensilage – Foin, Editions France Agricole.

Mathieu M., 2003 Luzerne - culture, récolte, conservation utilisation. Editions France Agricole.

Muntean L-S., Cernea S., Morar G., Duda M., Vârban D., Muntean S., 2008 Fitotehnie. pp. 45-60, AcademicPres Publishing House, Cluj-Napoca, Romania.

Rusu T., 2005 Agrotehnică. pp. 23-50, Risoprint Publishing House, Cluj –Napoca, Romania.

Schvartz C., Muller J-C., Decroux J., 2005 Guide de la fertilisation raisonnée. Comifer, Paris, Éditions La France Agricole, 414 pp.

Sutton A. L., Richert B. T., Joern B. C., 2006 Mitigating environmental pollution from swine production in climate change and managed ecosystems. Bhatti J. S., Lal R., Apps M. J., Price M. A. (ed), pp. 273-294, CRC Taylor & Francis.
*** (1) Codul de bune practici agricole pentru protecţia apelor împotriva poluării cu nitraţi din surse agricole, aprobat prin Ordinul MMGA/MAPDR nr. 1182/1270/2005
*** (2) Directiva 91/676/CEE privind protecţia apelor împotriva poluării cu nitraţi proveniţi din surse agricole.
*** (3) Ghidul fermierului privind ecocondiţionalitatea 2014. Versiunea 3.0.
*** (4) Ordinul MADR/MMP nr. 30/147/2010 pentru aprobarea bunelor condiţii agricole şi de mediu în România.
*** (5) Ordinul MADR/MMP/ANSVSA nr. 187/2.155/42/2011 pentru aprobarea cerinţelor legale în materie de gestionare (SMR) privind mediul şi identificarea şi înregistrarea animalelor.
*** (6) Programul de acţiune pentru zonele vulnerabile la nitraţi din surse agricole, aprobat prin Decizia nr. 221.983/GC/12.06.2013.
*** (7) Programul Naţional de Dezvoltare Rurală (PNDR) pentru perioada 2014 – 2020. Versiunea oficială 1 – 1 iulie 2014.
*** (8) Regulamentul (CE) nr. 73/2009.
*** (9) Regulamentul (CE) nr. 1122/2009.
*** (10) Regulamentul (UE) nr. 1307/2013.

Received: 09 November 2014. Accepted: 18 December 2014. Published online: 30 December 2014.
Author:
Nicuşor Sima, University of Agricultural Sciences and Veterinary Medicine Cluj-Napoca, Faculty of Animal Science and Biotechnologies, Romania, Cluj-Napoca, Calea Mănăştur, no. 3-5, 400372, e-mail: flaviusima@yahoo.com

How to cite this article:
Sima N., 2014 Single area payment scheme in the integrated production of swine farms – requirements and benefits. Porc Res 4(2):37-42.