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# Sow rearing in north Italy: II. analysis of nitrogen balance in different herds

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**RIASSUNTO** – Allevamento di scrofe nel Veneto. II. bilancio azotato di allevamenti di differente tipologia. In 17 allevamenti di scrofe (5 a ciclo chiuso, 9 a ciclo aperto convenzionali e 3 a ciclo aperto con vendita di suinetti immediatamente dopo lo svezzamento), per due anni consecutivi, si sono raccolti i dati necessari per effettuare il bilancio dell'azoto. I rilievi hanno riguardato i movimenti, numerici e ponderali di animali e di mangimi e i loro contenuti di azoto. Nelle prime due tipologie di allevamento l'escrezione di N è risultata mediamente pari a 36,0 kg/unità scrofa/anno, ma la variabilità fra allevamenti è stata notevole (C.V.=12%). Nella terza tipologia, in assenza dei suinetti in post svezzamento, l'escrezione di N è stata pari a 23 kg/unità scrofa/anno. La metodologia adottata e i risultati riportati possono essere utili per la definizione di valori di riferimento e per la valutazione di bilanci dell'azoto effettuati a livello aziendale.

**Key words:** sow, piglets, feed consumption, nitrogen balance.

**INTRODUCTION** – The evolution of the legislation concerning the environmental impact of livestock make necessary to find solution useful to evaluate and reduce the total excretion of nitrogen (N) and other possible pollutants at territorial and farm level. The methodological approach to evaluate the amount of nitrogen excreted proposed by ERM (1999) suggested that the amount of N excreted can be calculated as a difference between the amount of nitrogen consumed less the amount of N retained in the animal products. If the new national and regional legislation which is going to be approved will recognize to the farmers the possibility of making a N balance at farm level there could be benefits both for the farmers, in term of less land required for spreading manure, and the public, because this strategy can promote the use of diets with lower protein content. Reference values for nitrogen excretion are available for many countries but there is a lack of information for Italy. Then this paper was aimed to evaluate the main production indexes and the corresponding nitrogen balance of different kind of sow herds in the Veneto Region.

**MATERIAL AND METHODS** – Seventeen sow herds, placed in north-east of Italy were selected to be representative of closed herds (5 farms), open herds with post-weaning piglets (9 farms) open herds selling piglets immediately after weaning (3 farms). The herd size and composition, and all the in and out farm movements of feeds and animals, in term of numbers and weight, were recorded over a period of two years, from 2001 to 2003. Other information about these herds is given by Ceolin *et al.* (2005). The N contents of all the feeds were also recorded. The main parameters required to achieve the N balance considered were: herd consumption of various feeds, live weight of the entering gilts, of the out coming sow, and of the piglets at various ages. N balance was obtained as described by ERM (1999) as difference between N consumed and N retained in animal products. According to Poulsen and Kristensen (1998) values of N content of live weight of 25, 24, 26 g/kg, respectively for sow and gilts, weaning piglets and post weaning piglets were assumed. In order to compare herds of different size all the data were expressed taking the productive sow as unit. The productive sow

unit was defined as sow in the physiological status from the first mating to the end of the last lactation. Data were analysed with a model considering as source of variation the 3 different kinds of herds (SAS, 1990). In order to evaluate the variability of the various parameters the herds rearing piglets after weaning were classified in 3 groups according to the levels of N excretions/sow unit/year: classes low, medium and high represented, respectively, 20, 60 and 20% of herds.

**RESULTS AND CONCLUSIONS** – The average values of the main technical parameters and of the N balance for different kind of herds are given in table 1. The amount of feed consumed by the sow unit averaged 1185 kg/year its mean N content was close to 2.45%, without significantly differences due to kind of herd. The mean N content resulted from taking into account the different consumptions and N content of feeds used for pregnancy, lactation and for other purposes (i.e. feed for gilts, and creep feed) was lower to that of 2.60% taken as default by ERM (1999). The number of weaned piglets/sow unit/year ranged from 23 to 25 without significant differences due to the kind of herd. In the herds where the post weaning piglets were grown the individual final weight of the piglets ranged, in mean, from 28 to 31 kg. They received a feed containing, in average, 2.94% of N. The feed conversion rate of piglets was close to 1.68. The resulting mean values of N consumption, retention and excretion of the sow unit were 29.5, 5.1 and 24.4 kg/year, respectively. N consumption, retention and excretion of the post weaning piglets, yet expressed per sow unit, were in average 24.8, 13.4, 11.4 kg/sow unit/year, but this data regarded only the two first kinds of herds where the piglets are kept after weaning. In conclusion, for the herds rearing piglets after weaning (close or open) the average N excretion is about 36.0 kg/sow unit/year, while in those herds where the piglets are sold immediately after weaning the N excretion was only 23.0 kg/sow unit/year. These results are comparable with those reported by Dourmad *et al.* (1999), ERM (1999) and Fernandez *et al.* (1999) but are slightly lower as respect with those suggested by Poulsen and Kristensen (1998).

Table 1. Productive indexes and nitrogen balance of different kinds of sow herds.

		Closed herds	Open herds		rsd
			With post-weaning piglets	Without post-weaning piglets	
Feed consumption of sow <sup>1</sup>	kg/sow unit/year	1172	1230	1154	97
N content of sow feeds	% as fed	2.46	2.45	2.45	0.06
Number of weaned piglets	n./sow unit/year	22.7	24.0	25.0	2.6
Number of post weaning pig	"	21.8	23.3	-	2.4
LW of weaning piglets	kg	6.7	6.2	5.7	0.5
LW of post weaning piglets	"	30.6	27.8	-	2.1
Post weaning period	d	57.0	52.7	-	4.0
FCR of piglets	kg/kg	1.70	1.66	-	0.21
N content of piglets feeds	% as fed	2.98	2.91	-	0.06
Nitrogen balance					
Sow (a):					
N consumption	kg/sow unit/year	28.9	30.1	28.3	2.6
N retention	"	5.5	5.0	5.3	0.7
N excretion	"	23.3	25.1	23.0	2.3
Post weaning piglets (b):					
N consumption	kg/sow unit/year	26.4	24.3	-	4.0
N retention	"	13.8	13.3	-	1.8
N excretion	"	12.5	11.0	-	2.7
Total (a + b):					
N excretion	kg/sow unit/year	35.8 <sup>b</sup>	36.1 <sup>b</sup>	23.0 <sup>a</sup>	2.9

<sup>A, B</sup> Mean value on the same line with unlike superscript letters are significantly different, P<0.01.

<sup>1</sup> Feed consumption, live weight and nitrogen balance per "sow unit" include contribution due to the productive sow as well as that of gilts, boars, out coming sows and suckling piglets.

LW: live weight; FCR: feed conversion ratio.

The results given in table 2 show the variability in the N excretion observed among herds. About 20% of herds had an average N excretion of only 30.8 kg/sow unit/year, while another 20% showed values of N excretion in the order of 41.9 kg/sow unit/year. These differences are due to the combination of the various factors showed in Table 2. Significant differences were due to N content of feeds, to the rate of growth of post weaning piglets, to their feed consumption and feed conversion ratio. These results clearly shown as there is a high variability in the amount of N excretion among farms. There could be benefit for the public if the law will introduce the possibility for the farmer of presenting a farm N balance on the basis of which calculate the load of head /ha of land, since in this way the use of less pollutant strategies will be promoted.

Table 2. Productive performance and feed consumption of sow herds rearing post-weaning piglets (14 herds) classified in relation to the amount of N excretion/sow unit/year.

Class of farm N excretion		Low	Medium	High	rsd
N excretion	kg/sow unit/year	30.8 <sup>A</sup>	35.4 <sup>B</sup>	41.9 <sup>C</sup>	0.8
Sow:					
sow units per herd	n./herd	313	822	364	473
litters	n./sow unit/year	2.48	2.39	2.52	0.16
feed consumption	kg/sow unit/year	1122	1216	1274	108
crude protein of feeds	% as fed	14.8 <sup>A</sup>	15.4 <sup>B</sup>	15.8 <sup>B</sup>	0.5
Piglets:					
piglets weaned	n./sow unit/year	22.9	21.1	23.1	3.0
final live weight of piglets	kg/piglets	26.3	29.3	30.2	2.5
post weaning period	d	55.3	53.2	56.0	5.2
daily gain of piglets	kg/d	0.363 <sup>A</sup>	0.428 <sup>B</sup>	0.423 <sup>B</sup>	0.042
feed consumption	kg/sow unit/year	738 <sup>A</sup>	809 <sup>A</sup>	1018 <sup>B</sup>	126
crude protein of feeds	% as fed	18.3	18.3	18.4	0.52
feed conversion rate	kg/kg	1.60 <sup>A</sup>	1.65 <sup>A</sup>	1.90 <sup>B</sup>	0.15

<sup>A, B</sup> Mean value on the same line with unlike superscript letters are significantly different, P<0.01.

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