Proceedings of the

7th World Rabbit Congress

4-7 july **2000** – Valencia Spain

These proceedings were printed as a special issue of WORLD RABBIT SCIENCE, the journal of the World Rabbit Science Association, Volume 8, supplement 1

ISSN reference of this on line version is 2308-1910
(ISSN for all the on-line versions of the proceedings of the successive World Rabbit Congresses)

HEINZL E.L., LUZI F. ,BARBIERI S. , ZECCHINI M., PETRACCI M., CRIMELLA C.

EFFECT OF PROPILENE GLYCOL IN THE DRINKING WATER ON THE PERFORMANCES OF GROWING RABBITS

Volume C, pages 291-296

EFFECT OF PROPILENE GLYCOL IN THE DRINKING WATER ON THE PERFORMANCES OF GROWING RABBITS

HEINZL E.L., LUZI F., BARBIERI S., ZECCHINI M., PETRACCI M.*, CRIMELLA C.

Istituto di Zootecnica - Facoltà di Medicina Veterinaria - Università degli Studi
via G. Celoria, 10, 20133 Milano - Italy
*Istituto di Zootecnica - Facoltà di Agraria - Università degli Studi
via S. Giacomo, 9 - 40126 Bologna - Italy

ABSTRACT

Over a 49 days period (June-July 1999), the effect of a flushing method to improve the productive performance of fattening rabbits reared in plein-air system were studied. One productive cycle was investigated on 384 rabbits weaned at 35 days. Four experimental treatments were performed in drinking water: module 1 - pure water during all time (controls); module 2 - propylene glycol (PG) at 2%, as energetic source, during the first 24 days and pure water during the last period (25 days); module 3 - pure water, during the first 24 days and then PG at 2% at the last period (25 days); module 4 - PG at 2% during all time. Daily weight gain (DWG) did not show statistically significative differences amongst treatments during the whole trial, but controls had the highest DWG. Feed conversion ratio and daily feed intake (g) of the 4 treatments were: 3.60-114.58, 3.47-103.33, 3.40-103.87 and 3.28-99.45, respectively.

INTRODUCTION

Breeding animals have high-energy requirement during the fattening period. In order to balance energy intake, some Authors suggest the use of Propylene Glycol (PG) to increase it in a lot of species such as veal calves, dairy cows and sows (Formigoni *et al*., 1996; Cozzi *et al*., 1996; Sabbioni *et al*., 1999). Propylene glycol (PG) is a polyhydric alcohol ($C_3H_8O_2$). Pure PG is colourless, odourless liquid with mildly acrid and sweetish taste. It is freely soluble in water and ethanol. In rabbits, the use of this substance is quite unknown; just a few studies look at the effect of PG to improve reproductive performance on rabbit does (Luzi *et al*., 1999, 2000). Because the economic interest of this substance is very high in the other breeding animals, the objective of the present study is to evaluate the benefits of PG on the productive performance in rabbit during the fattening period.

MATERIAL AND METHODS

<u>Farm and Management</u>
The trial was carried out on an intensive rabbit farm in the North of Italy, producing lab and commercial animals (Grimaud). The rabbitry is constituted by three traditional buildings for reproductive and productive cycles. For our experiment, it was added a system including four plein-air modules for fattening rabbits. Every module is formed by forty-eight bi-cellular boxes (25x44x28cm), on two semi-superposed levels. The cage is totally insulated and it has a manual simultaneous opening system of the reversible saddle roof. This system controls the air changing, inside temperature and relative humidity. The plein-air system has an East-West exposure.
The diet, *ad libitum* administered, was a normal commercial feed (crude protein 15.7%, crude fibre 18.5%, crude fat 3%), manually distributed

<u>Animals and experimental treatments</u>

Three hundred and eighty four rabbits were studied during the summer of 1999 (June-July). The performance trial was run from weaning (35 days old) to slaughtering (84 days old), for a total 49 days. The animals were divided in four experimental groups of 96 subjects each one, according to the following plan:

Module	Treatments	
1 (W)	Water - 49 days	
2 (PG/W)	PG - 24 days	Water - 25 days
3 (W/PG)	Water - 24 days	PG - 25 days
4 (PG)	PG - 49 days	

At the end of the study, 10 animals of every experimental groups were sacrificed to evaluate the residue in meat, kidney, liver and lung, by gas chromatographic analysis (Kaijwara *et al.*, 1981).

Animal performance

The microclimatic parameters were recorded by temperature and relative humidity probes connected to a data logger with solid state memory (LSI BABUC/M). The two probes were located inside the plein-air system, under the roof, between the 1st and the 2nd modules and the other one between the 3rd and the 4th ones.

Animal weight are divided according to the cage position (East - West). Rabbits were weighed every week, from housing to slaughtering, to evaluate the daily weight gain (DWG) divided in the following periods:

DWG 7 = daily weight gain from 35 to 42 days;
DWG 14 = daily weight gain from 35 to 49 days;
DWG 21 = daily weight gain from 35 to 56 days;
DWG 28 = daily weight gain from 35 to 63 days;
DWG 35 = daily weight gain from 35 to 70 days;
DWG 42 = daily weight gain from 35 to 77 days;
DWG TOT = daily weight gain from 35 to 84 days;
DWG 0-7 = daily weight gain in the first week;
DWG 7-14 = daily weight gain in the second week;
DWG 14-21 = daily weight gain in the third week;
DWG 21-28 = daily weight gain in the fourth week;
DWG 28-35 = daily weight gain in the fifth week;
DWG 35-42 = daily weight gain in the sixth week;
DWG 42-49 = daily weight gain in the seventh week.

Every week the distributed and residual feed was recorded to evaluate the feed conversion ratio (FCR) and the *pro capite* intake; PG administered and its total consumption were also recorded.

Statistical analysis

The recording data are processed by a ANOVA, according to GLM procedure (SAS®, 1990), using the following model:

$Y_{i,j,k} = \mu + \alpha_i + \beta_j + \alpha_i\beta_j + \varepsilon_{i,j,k}$

$Y_{i,j,k}$ = dependent variable;

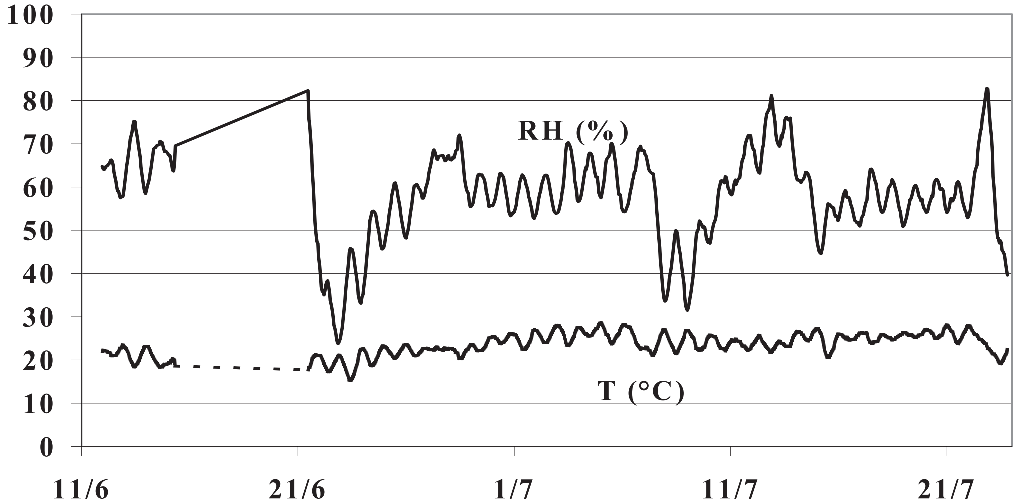
μ = overall mean;

α_i = fixed effect of treatments; (i = 1…4);
β_j = fixed effect of the position (j = 1,2);
$\alpha_i\beta_j$ = interaction between position-treatments;
$\varepsilon_{i,j,k}$ = random effect of error.

RESULTS AND DISCUSSION

During the trial, temperature and relative humidity (daily and nightly means) showed seasonal values according to the experimental period (Figure 1).

Figure 1 - Daily and nightly trend of temperature and relative humidity during the trial



The lowest data of relative humidity percentage agreed with particular climatic periods, marked by local strong winds. Concerning the daily weight gain, DWG42, DWG35-42 and DWG42-49 resulted statistically significative ($P \leq 0.01$) for both the positions (Table 1).

Table 1 - Least Square Means and Standard Error of Daily Weight Gain.

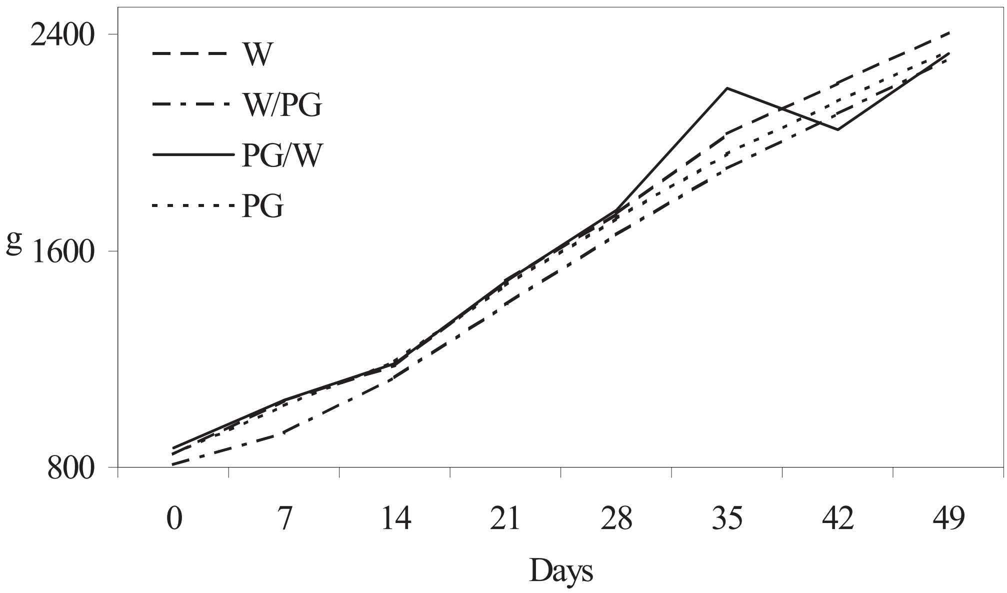
	Treatments			
N°	96	96	96	96
	Water	PG/Water	Water/PG	PG
DWG 42 (East)	33.58±1.07ab	31.13±1.07a	29.96±1.07ac	31.01±1.07a
DWG 42 (West)	31.67±1.07a	24.94±1.07d	31.73±1.07a	30.98±1.07a
DWG tot. (East)	31.86±1.12	30.06±1.12	30.08±1.12	30.34±1.12
DWG tot.(West)	31.71±1.12	29.46±1.12	31.01±1.12	30.44±1.12
DWG 35-42 (East)	29.95±6.46	24.61±6.46	28.95±6.46	30.93±6.46
DWG 35-42 (West)	23.54±6.46	-11.33±6.46a	28.66±6.346	24.51±6.46
DWG 42-49 (East)	21.52±6.92	23.62±6.92	30.79±6.92	26.29±6.92
DWG 42-49 (West)	31.92±6.92	56.60±6.92a	26.73±6.92	27.19±6.92

Means values with different small letters, in the same DWG period, showed a statistical significance of $P \leq 0.05$ and $P \leq 0.01$.

DWG35-42 of PG/W group had a reduction balanced in the following week (DWG42-49) by a compensatory growth. Daily weight gain showed lower values than the normal fattening

period (De Blas and Wiseman, 1998). Anyway, animals were weighted weekly and it caused a high stress situation.
Animal weight showed a homogeneous evolution amongst treatments. (Figure 2).

Figure 2 - Weight evolution (mean values) during the trial



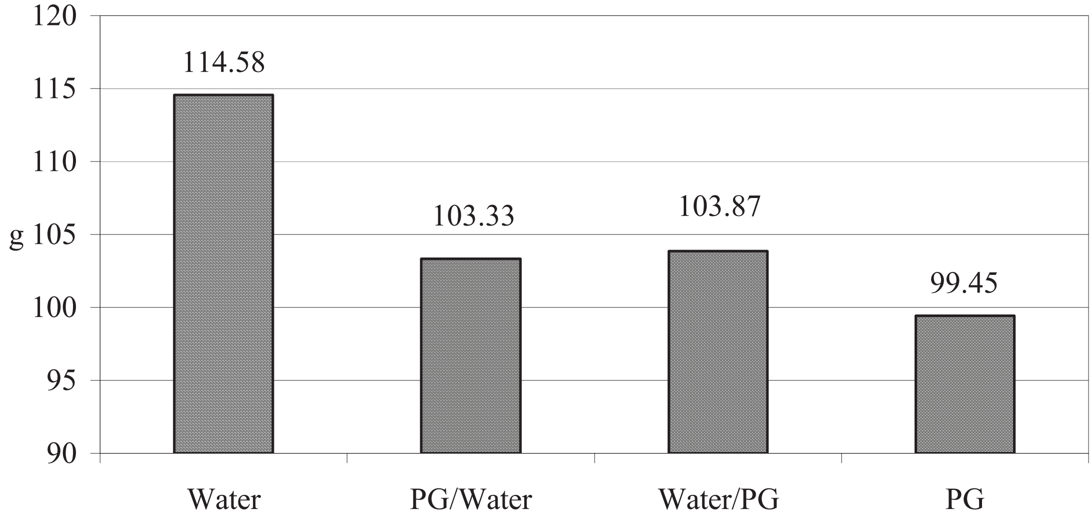
In the following plan, the mean weights at weaning and at slaughtering, according to the treatments, are reported in the table 2

Table 2 : Average weights at weaning and at slaughter time

Module	Weight at weaning (kg)	Weight at slaughtering (kg)
1 (W)	0.849	2.406
2 (PG/W)	0.871	2.329
3 (W/PG)	0.810	2.310
4 (PG)	0.849	2.336

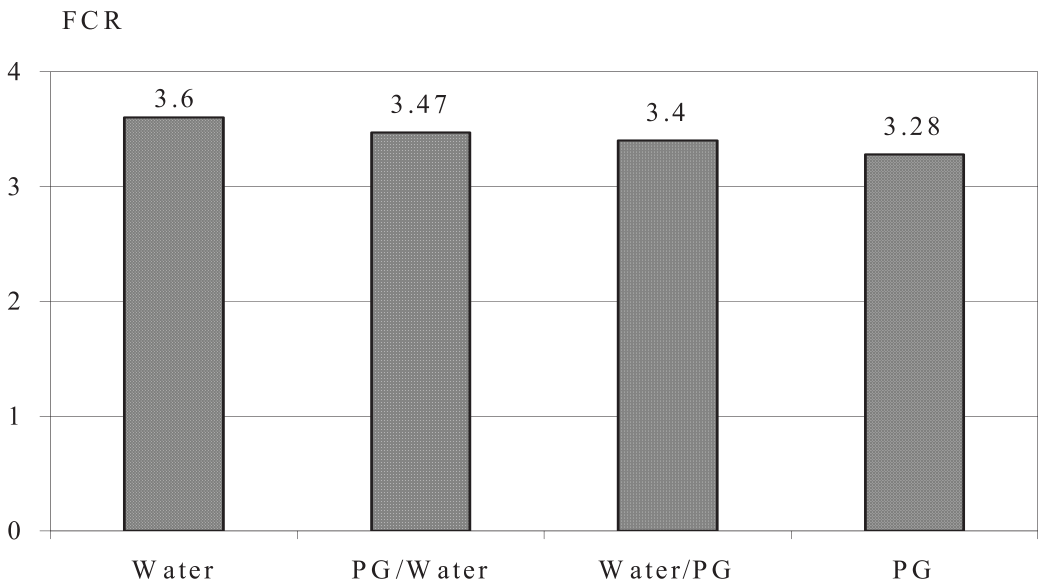
Module 2 group (PG/W) showed an increasing weight around the 28th -35th days. During the first experimental period, PG gave an energetic flushing; then it fell down and animals increased the feed intake to restore the previous energetic balance. It caused a temporary weight gain in the first week of the second experimental period. Weight gain adjusted itself on values comparable to other treatments.
Pro capite daily feed intake, during the whole period of the trial (49 days), is showed in figure 3. It did not show any statistically significative differences amongst the treatments (mean values. 114.58 g, 103.33 g, 103.87 g, 99.45 g for the modules 1, 2, 3, 4 respectively).
Data evolution showed an effect of PG on a improved energetic balance. Animals, drinking Water/PG and moreover PG, had a reduced daily feed intake, but the final weight was comparable amongst them.

Figure 3 - Feed intake (g/day) according to the treatments



Feed conversion ratio is showed in Figure 4. It did not show any statistically significative differences. The average values were 3.60, 3.47, 3.40, 3.28 for the thesis 1, 2, 3, 4 respectively. Mortality rate was very low and statistically not significant.
According to literature data, PG residues in meat, liver, kidney and lung were not present when used at 2% in drinking water (Kaijwara N. *et al.*, 1981).
The trial evidenced the flushing effect of PG, as energy source, as already shown by other

Figure 4 - Feed conversion ratio according to the treatments



Authors (Cozzi *et al*., 1996; Sabbioni *et al*., 1999). Although *pro capite* daily feed intake and the feed conversion ratio showed more favourable values in PG treated group, however a negative response on daily weight gain and final weight was obtained.
Concerning economic evaluation, *pro capite* daily feeding costs with GP were 0.035 €, pure water, Water/GP and GP/Water groups were 0.03 €.
Further trials must be planned to better quantify the convenience of these treatments, using different administration periods and doses of the PG.

Acknowledgements: The authors wish to thank Mrs Giulia Zucchi and Mr Adelio Lafranconi for the kind collaboration. This research was financed by M.U.R.S.T. ex 40% (1997-1998) et co-financed by the University of Milan.

REFERENCES

COZZI G., BERZAGHI P., GOTTARDO F., GABAI G., ANDRIGHETTO I. (1996) Effects of feeding propylene glycol to mid-lactating dairy cows. *Anim. Feed Sci. Techn., 64, 43-51.*

DE BLAS C., WISEMAN J. (1998) The Nutrition of the Rabbit. CABI Publishing.

FORMIGONI A., CORNIL M.C., PRANDI A., MORDENTI A., ROSSI A., PORTETELLE D., RENAVILLE R. 1996. Effect of PG supplementation around parturition on milk yield, reproduction performance and some hormonal and metabolic characteristics in dairy cows. *Journal of Dairy Research, 63, 11-24.*

KAIJWARA N., KAWAI H., HOSOGAI Y. 1981. Determination of propylene glycol in commercial food by gas chromatography. *Nippon Shokihin Kogyo Gakkaishi, 28, 471-475.*

LUZI F., BARBIERI S., LAZZARONI C., CAVANI C., ZECCHINI M., CRIMELLA C. 1999. "Flushing method" to improve the reproductive efficiency in rabbit does. *Abstracts of the 50th Annual Meeting of the European Association for Animal Production, Zurich, 22-26 August, 112.*

LUZI F., HEINZL E., ZECCHINI M., BARBIERI S., LEONI S., CRIMELLA C. 2000. Effect of propilene glycol in rabbit: I. Reproductive performance. 7th World Rabbit Congress, 4-7 July, Valencia, Spain. (submitted)

SABBIONI A., SUPERCHI P., BONOMI A., TAGLIETTI P., ARTONI V. 1999 - The use of propylene glycol in veal calf feeding. *Proc. Of the A.S.P.A. Congress, Piacenza (Italy), June 21-24, 351-353.*

SAS/STAT 1990. User's Guide, Version 6, 4th *Ed., SAS Institute Inc., Cary, NC, USA.*