WORLD RABBIT SCIENCE 1996, 4(2), 47-56.

EFFECT OF A SYSTEMATIC PMSG TREATMENT 48 HOURS BEFORE ARTIFICIAL INSEMINATION ON THE PRODUCTIVE PERFORMANCE OF RABBIT DOES

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ABSTRACT : A total of 148 multiparous rabbit does were distributed into two equal groups. Two days before insemination, the animals of the treated group received 25 IU of PMSG (Ciclogonine PROCHENA). The animals of the control group received no injection. At the end of the 9-month experiment, the does went on breeding according to the same protocol (artificial insemination [AI] 10-11 days after each kindling), except injections of PMSG, in order to study the possible remanent effects of the treatment. This post-experimental stage lasted for 7 months. During the experiment, PMSG improved the percentage of receptive does (72.0 *vs* 38.4 %, P = 0.001) and its efficiency was not reduced with time; the percentage of kindling through AI was however improved only for the first four inseminations (78.7 *vs* 66.2 %, P = 0.024), PMSG treatment was without significant effect for the following inseminations. Moreover, PMSG significantly improved the fertility of the lactating does at the time of insemination (+ 18.4 %) but did not improve the fertility of the non lactating does (+ 1.3 %). PMSG treatment improved the number of total born young per kindling by 7.4 % but, for a similar level of receptivity, the treatment did not improve the numerical productivity but decreased the mean weight at weaning (658.4 *vs* 674.9 g, P = 0.044). PMSG treatment made it possible to improve the global productivity of the rabbit does (number of weaned young per insemination) by + 28.4 % following the first four inseminations; there was no improvement for the following inseminations. The improvement of this criterium depended on the physiological stage of the does at the time of insemination. In lactating does indeed the increase in the number of weaned young per insemination in the treated does persisted throughout the trial (beginning: + 44.6 %, end: + 48.0 %) while the molecule had no effect on the non lactating does whatever the experimental stage. The use of PMSG in non lactating does is thus unjustified. It was also demonstrated that when treatment was over the productivity of the does which were previously treated was identical to that of the control group.

RESUME : Effet d'un traitement systematique avec P.M.S.G. 48 heures avant insemination artificielle, sur les performances de reproduction des lapines.
Cent quarante huit lapines multipares ont été également réparties en 2 lots. Deux jours avant insémination, les lapines du lot traité (lot PMSG) recevaient 25 U.I. de PMSG (Ciclogonine Prochena). Les lapines du lot témoin ne recevaient aucune injection. A l'issue de la période expérimentale de 9 mois, le troupeau a continué de produire selon le même protocole (IA 10-11 jours après chaque mise bas), à l'exclusion des injections de PMSG, afin d'étudier les éventuels arrières effets du traitement. Cette phase post expérimentale a duré 7 mois. Au cours de la période expérimentale, la PMSG a amélioré le pourcentage de lapines réceptives (72,0 vs 38,4 %, P = 0,001) sans réduction d'efficacité avec le temps ; par contre, le pourcentage de mises bas par IA a été amélioré uniquement sur l'ensemble des 4 premières inséminations (78,7 vs 66,2 %, P = 0,024), le traitement par PMSG est resté sans effet significatif ensuite. Par ailleurs, la PMSG a amélioré significativement la fertilité des lapines allaitantes au moment de l'insémination (+ 18,4 %), mais pas celle des lapines non allaitantes (+ 1,3 %). Le traitement par PMSG a amélioré de 7,4% le nombre de lapereaux nés totaux par mise bas, mais à niveau de réceptivité identique, il n'a pas amélioré la productivité numérique mais il a diminué le poids moyen au sevrage (658,4 vs 674,9 g, P = 0,044). Le traitement par PMSG a permis d'améliorer de + 28,4 % la productivité globale des lapines (nombre de lapereaux sevrés par IA) à la suite des 4 premières inséminations ; il n'y pas eu d'amélioration pour les inséminations suivantes. Cependant, l'amélioration de ce critère dépend du stade physiologique des lapines au moment de l'insémination. En effet, chez les lapines allaitantes, l'amélioration du nombre de lapereaux sevrés par insémination chez les lapines traitées est démontrée tout au long de l'expérience (début : + 44,6 %, fin : + 48,0 %) alors que chez les lapines non allaitantes, la molécule est sans effet significatif quelle que soit la phase expérimentale. L'utilisation de PMSG chez les lapines non allaitantes n'est donc pas justifiée. Il a été enfin démontré qu'après arrêt du traitement, la productivité des lapines antérieurement traitées, ne diffère pas de celle des lapines du lot témoin.

INTRODUCTION

PMSG (Pregnant Mare Serum Gonadotropin) administration in adult does stimulates the increase in the number of pre-ovulatory follicles during the two to three days following the injection (BONANNO *et al.*, 1990). This would lead to an increase in the level of oestrogens and thus to an increase in the sexual behaviour according to LEFEBVRE and CAILLOL (1978). Several scientists and breeders have tried to

take advantage of the effect of the PMSG treatment at a moderate dosis (20 to 40 IU/animal) to improve the productivity of breeding does (FACCHIN *et al.*, 1992; MIRABITO *et al.*, 1994).

For example, MAERTENS *et al.* (1983) have studied the influence of a PMSG treatment (20 IU, Folligon, INTERVET) on the behaviour and the reproductive performance in the case of natural service. Compared with a control group, PMSG administration improves the mating receptivity and the litter size but decreases the fertility and increases the mortality between birth and weaning. MIRABITO *et al.* (1994) have also shown that in does subjected to artificial insemination (AI) a PMSG injection (30 IU, Chrono-gest PMSG 600, INTERVET) two days before each artificial insemination significantly increases the percentage of does receptive to mating as well as the numerical productivity of the lactating does.

In contrast, CANALI *et al.* (1991) have shown a progressive decline in fertility which could be detected after the 4th injection in 20 does subjected to repeated PMSG treatments (40 IU of Ciclogonine PROCHENA, two days before artificial insemination). They also observed an increase in the level of anti-PMSG antibodies. This result was recently confirmed by STRADAIOLI *et al.* (1994). MAERTENS and LUZI (1995) underline the large increase in the mortality rate at birth which was observed after injection of 30 IU PMSG before artificial insemination.

BOURDILLON *et al.* (1992) have shown that the reproductive performance of does treated 48 hours before artificial insemination with 30 IU PMSG (Chrono-gest PMSG 600, INTERVET) did not significantly differ from those of the control group (which only received an injection of solvent) when they were either non lactating or, lactating and multiparous. In this trial however, PMSG treatment improved the fertility of the does in first lactation (58 *vs* 29 %) and their litter size (12.6 *vs* 9.8 born alive rabbits). As a consequence the authors suggest to limit the use of this molecule to primiparous females. It is however regrettable that the trial was not carried on over a longer period (only four series of AI) to possibly confirm the observations of CANALI *et al.* (1991). It is worth noting that the mean fertility of this does was very high (75%).

The systematic administration of PMSG to rabbit does 48 hours before AI or natural service is recommended for commercial breeding and the promoters of this technique say that it is possible to obtain a significant increase in productivity (COLIN, 1992). That is the reason why we have decided to carry out a trial over a sufficiently long period of time and on a large number of animals in order to measure the practical consequences of a systematic PMSG treatment of rabbit does. In particular we wanted to use the same products as those recommended by COLIN (1992), i.e. Ciclogonine (PMSG with hyaluronidase as a diffusion factor). We also planned to use the same breeding schedule: AI every 42 days with re-insemination of the females not fertilized 21 days after a negative AI.

The trial was conducted on multiparous does with an initial mean fertility (53 %) over a period of nine months in order to test the efficiency of Ciclogonine on the induction of the receptivity and more generally on the productivity of does. In order to determine the possible remanent effects of PMSG we followed up the reproductive performance of the does over seven months following the end of the treatment.

MATERIAL AND METHODS

The trial included 148 contemporary does of the Hyplus strain and which had been previously subjected to AI for 7 months. They were inseminated every 42 days and the non pregnant females were re-inseminated 21 days after the previous AI. Every week, inseminations were made with fresh mixed semen from several bucks. The material used was that marketed by the IMV Company (0.5 ml straw). The ovulation was induced by an i.m. injection of 0.2 ml of Réceptal (0.8 µg of Buséréline, DISTRIVET) made at the time of insemination. The does which were not fertilized after 3 consecutive negative AI were systematically culled. Throughout the trial the does were fed *ad libitum* a commercial diet including 17 % of raw proteins and 15.5 % of crude fibre cellulose. They were put under a continuous photoperiod of 16 hrs per 24 hrs.

At the beginning of the trial the present does were distributed into two equal groups according to their parity and the time spent since the last kindling. Their assignment to a group was definitive. A total of 75 does were included in the PMSG group and 73 in the control group.

Two days before each insemination, the does from the PMSG group received a sub-cutaneous injection of 25 IU PMSG in the form of Ciclogonine (PROCHENA) by using a vitamin complex as a solvent (2.5 ml of Vitatox, FATRO). The does of the control group received no injection.

Immediately before insemination, the does from both groups were systematically presented to a male to test their mating receptivity which was coded into two classes only: receptive and non receptive.

Table 1 : Effect of the treatment and the physiological stage of the does on mating receptivity and fertility. Mean performance

		Level of receptivity			Kindling rate	
		No	m (σ_m)	P	m (σ_m)	P
Group	PMSG	*473*	72.0 (2.3)	0.001	71.9 (2.3)	0.002
	Control	*497*	38.4 (2.1)		62.0 (2.1)	
Physiological stage	Lactating	*617*	57.6 (1.8)	0.127	60.4 (1.9)	0.001
	Non lactating	*353*	52.8 (2.5)		73.5 (2.5)	

For some analyses we distinguished 2 periods within the experimental period:

- the *beginning* which corresponded to the first four inseminations,
- the *end*, which corresponded to the following inseminations. The inseminations number 8, 9 and 10 were pooled in one group for some analyses (indicated as 8&+).

At the end of the 9-month experimental period the does went on breeding according to the same protocol except the injections of PMSG. The aim was to study the possible remanent effects of the treatment. This post-experimental stage lasted for 7 months.

We studied the following variables:

- receptivity rate
- birth rate or fertility (kindling/inseminations)
- number of total born (alive or dead) young per kindling
- number of weaned young per litter at the age of 29 days
- total weight of the litter at weaning
- mean weight of a young at weaning.

Data were statistically analyzed using the SAS program. Variables were studied according to a model of analysis of variance based on a fixed effect model. We studied the fixed effects of the group (2 levels: PMSG, control), of the period (beginning, end) and possibly of the physiological stage (2 levels: lactating and non-lactating) and of the receptivity as well as the various interactions linked. These analyses were made for the experimental period as a whole or by considering the two stages "beginning" and "end" separately. For the individual weight at weaning we systematically added the litter size at weaning as covariable. In these analyses the receptivity and fertilization rates were considered as variables of Bernoulli (variables 0-1 at the individual scale) and treated by an analysis of variance like the classical continuous variables.

Results are expressed as follows: the calculated probability (P) pertaining to each effect or interaction (the means are considered to be equal for the various levels of a factor) was indicated in a numerical value for the values lower than 0.200 and indicated "NS" for the higher probabilities. The effects of the controlled factors other than those of the experimental group are presented only if they are significant ($P<0.05$). Unless otherwise stated, the results of the PMSG group are presented before those of the control group. The mean values indicated for a particular factor are the adjusted means for the effects of the other controlled factors included in the analysis considered ("lsmeans" of the program GLM of SAS-STAT); they are given with the standard deviation to the mean (σm).

RESULTS

Died and discarded animals

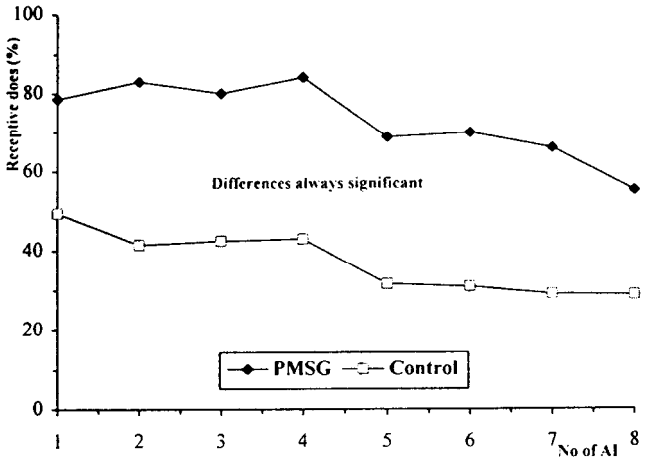
During the experimental period, 3 does from the PMSG group *vs* 2 from the control group were discarded because of reproductive failure (3 consecutive AI). The other does died or were eliminated because of disease. A total of 75 and 73 does were included at the beginning of the experiment in the PMSG group and the control group respectively, and the number of animals per group at the end of the treatment were 56 and 55, respectively. The treatment had thus no effect on the animal losses.

Efficiency of the PMSG treatment during the experimental period (9 months)

Receptivity

Table 1 shows that PMSG-treated does were significantly more receptive than those of the control group (72.0 *vs* 38.4 %) during the 9-month trial. This effect persisted throughout the experiment (Figure 1), despite the general decrease in the mean rate of receptivity observed on the does. Lactating does were more frequently receptive than non lactating (57.6 *vs* 52.8 respectively, Table 1) but the difference was not

Figure 1 : Effect of a PMSG treatment on the percentage of receptive does.
Variation with the number of inseminations



significant. The analysis of variance however showed an interaction between the group and the physiological stage (P<0.001). PMSG induced the receptivity of the lactating does more efficiently. (+ 45.0 points: 80.1 *vs* 35.1) than that of the non lactating does (+ 22.2 points: 63.9 *vs* 41.7 %).

Fertility

We checked that the fertility of the does was statistically identical during the 7-month period prior to the trial: 53.2 % and 52.9 % for the PMSG group and the control group respectively.

During the experimental period the treated does had a significantly higher birth rate than the control group: 71.9 % *vs* 62.0 % (Table 1) which represents a decrease of 5 days in the interval between two kindlings in our type of does management (50.4 *vs* 55.5 days; P<0.001). However if the beginning and the end of the experimental period are analysed separately, the fertility of the females of the PMSG group was significantly higher than that of the control group only for the first four inseminations taken as a whole: 78.7 *vs* 66.2 %, respectively (P = 0.024) for the beginning against 62.6 *vs* 56.8 (NS) for the inseminations ranked 5 to 8&+ also taken as a whole. This observation is illustrated in figure 2.

When we add the factor "receptivity" to the model of analysis of variance the treatment had no significant effect on the fertility any longer (67.1 and 66.0 % for both groups, respectively). No interaction was significant. For a similar mean receptivity, PMSG did not improve the fertility of the does.

Non lactating does were significantly more fertile than lactating ones (73.5 *vs* 60.4 %). As for the receptivity rate, there was a significant interaction between the physiological stage and the group. Thus, PMSG significantly improved the fertility of lactating does (+ 18.4 points: 69.6 *vs* 51.2 %) but not that of non lactating (+1.3 point: 74.1 *vs* 72.8 %) as shown in figures 3 and 4 (8th AI not included because of the small number of animals).

When the factor "receptivity" was integrated into the model of analysis of variance the does receptive at the time of insemination were much more fertile than the non receptive does independently from the treatment and the physiological stage. (79.7 *vs* 53.4 %, P<0.001).

Table 2: Effects of PMSG treatment on the numerical and weight productivity of the does

Criterium	GROUP				P
	No of litters	PMSG m (σ_m)	*No of litters*	Control m (σ_m)	
Litter size at birth:	*336*		*299*		
Total born/kindling		10.21 (0.18)		9.46 (0.22)	0.009
Born alive/kindling		9.37 (0.20)		8.75 (0.23)	0.043
Still-born/kindling		0.84 (0.12)		0.71 (0.11)	NS
Litter size at weaning:	*323*		*288*		
Weaned/weaning		8.50 (0.16)		8.01 (0.19)	0.045
Weight at weaning (g):	*313*		*280*		
Litter weight		5496 (67)		5323 (94)	0.131
Individual mean weight		646.3 (6.0)		684.2 (8.5)	0.0002

Table 3 : Distribution of the litter sizes (total born) within the two experimental groups

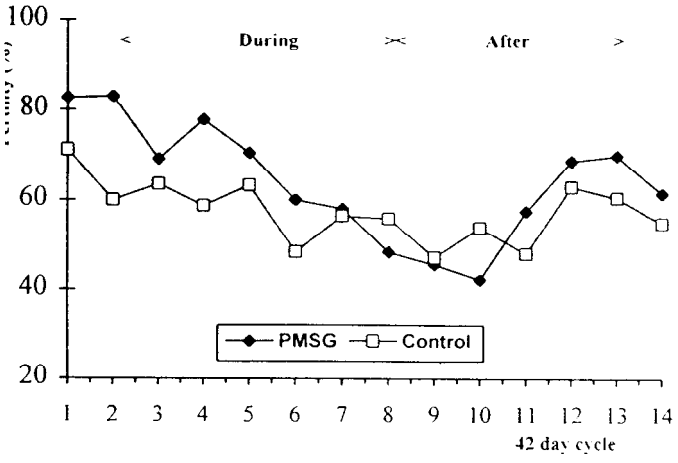
Young/litter	1 to 4	5 to 12	13 and +	P
Global period :				
PMSG group	5.95 %	71.43 %	22.62 %	0.001
Control group	14.72 %	63.88 %	21.40 %	
The first four AI (period=beginning)				
PMSG group	2.34 %	74.30 %	23.36 %	0.003
Control group	10.40 %	66.47 %	23.12 %	
AI ranked from 5 to 8 and + (period=end)				
PMSG group	12.30 %	66.39 %	21.31 %	NS
Control group	20.63 %	60.32 %	19.05 %	

Numerical productivity

The litter size at birth (total born) was significantly higher in the PMSG group than in the control group (Table 2). This effect was also observed for the number of born alive and weaned young. On the contrary the treatment had no significant effect on the death rate at birth. The increase in the litter size at birth was attributed to a smaller proportion of small-sized litters in the PMSG group (Table 3, Figure 5). The lower proportion of litters of 1 to 4 young at birth was much more significant at the beginning (PMSG group: 23 % of the control group) than at the end of the experimental period (PMSG group: 61 % of the control group).

If the receptivity and the physiological stage of the does at the time of the insemination were included in the analysis of variance, the litter size at birth and at weaning did no significantly differ any longer whether the does were treated or not 48 hrs before insemination (Table 4). The mean deviations in the litter size seen in table 2 principally originates from the change in the proportion of receptive does within the group of treated does in comparison with the control group, the receptive does at mating being more prolific.

Figure 2 : Effect of PMSG treatment on fertility



The physiological stage also affected the numerical productivity at birth: the lactating does had fewer total born than the non lactating ones at the time of insemination (9.16 *vs* 10.04). A similar trend was observed for born alive, but at weaning the differences were no longer significant.

As already indicated the receptivity had a highly significant influence on the numerical productivity at birth and this effect persisted until weaning. At this stage, the does receptive at the time of insemination produced 13.5 % more young than the non receptive does (8.60 *vs* 7.58).

We analysed the mortality over the whole experimental period. We found no significant difference between the treated group and the control group, neither for the death rate at birth as already stated, nor for the mortality between birth and weaning.

Weight productivity

At weaning, the total weight of the litter was not significantly different between the two groups. But the use of the litter size at weaning as covariable in the analysis of variance showed that the adjusted mean weight of the weaned young in the PMSG group was significantly decreased by 3 % as compared to that of the young of the control group (654.6 *vs* 674.8 g).

Table 4 : Effect of the treatment, the physiological stage and the receptivity of the does at the time of AI on their numerical productivity. Mean performance

		Total born			Born alive		Weaned		
		No of litters	m (σ_m)	P	m (σ_m)	P	*No of litters*	m (σ_m)	P
Group	PMSG	*336*	9.76 (0.25)	NS	9.15 (0.27)	NS	*323*	8.18 (0.21)	NS
	Reference	*299*	9.43 (0.20)		8.73 (0.22)		*288*	7.99 (0.18)	
Physiological stage	Lactating	*376*	9.16 (0.22)	0.006	8.63 (0.24)	0.080	*363*	7.96 (0.19)	NS
	Non lactating	*259*	10.04 (0.23)		9.24 (0.25)		*248*	8.22 (0.20)	
Receptivity	Receptive	*423*	10.48 (0.19)	0.001	9.62 (0.20)	0.001	*408*	8.60 (0.16)	0.001
	Non receptive	*212*	8.71 (0.26)		8.25 (0.28)		*203*	7.58 (0.23)	

Table 5 : Effect of the treatment, the physiological stage and the receptivity of the does at the time of AI. Mean performance

			Total litter weight (g)		Mean weight at weaning (g) (1)	
		No of litters	m (σ_m)	P	m (σ_m)	P
Group	PMSG	*313*	5399 (101)	NS	658,4 (6,3)	0,044
	Control	*280*	5313 (83)		674,9 (5,2)	
Physiological stage	Lactating	*350*	5336 (89)	NS	664,2 (5,6)	NS
	Non lactating	*243*	5377 (95)		669,0 (6,0)	
Receptivity	Receptive	*397*	5516 (75)	0,015	658,6 (4,7)	0,054
	Non receptive	*196*	5196 (107)		674,6 (6,7)	

(1) Adjusted weight for an identical litter size at weaning

Figure 3 : Variation of fertility as a function of the number of AI.

Lactating does at the time of AI

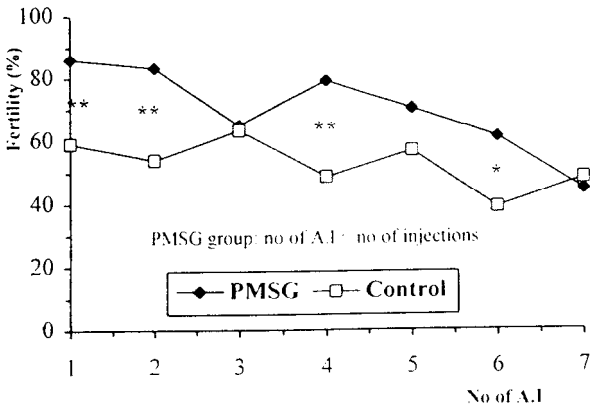


Figure 4 : Variation of fertility as a function of the number of AI

Non lactating does at the time of AI

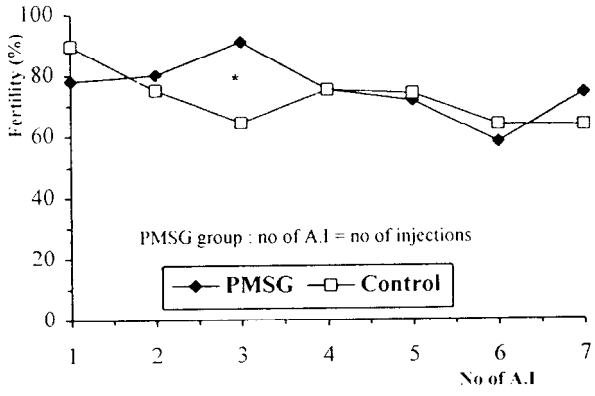


Table 6 : Effect of PMSG on the reproductive performance of the does during the period following treatment. Mean performance.

	PMSG		Control		
	No of litters	m (σ_m)	*No of litters*	m (σ_m)	P
Level of receptivity	*148*	34.4 (3.7)	*193*	26.8 (3.2)	0.129
Kindling rate	*148*	54.1 (4.0)	*193*	53.6 (3.5)	NS
Total born/kindling	*77*	8.85 (0.45)	*99*	9.42 (0.42)	NS
Born alive/kindling	*77*	8.48 (0.43)	*99*	9.02 (0.41)	NS
Weaned/kindling	*77*	7.27 (0.36)	*99*	7.92 (0.34)	0.189
Litter weight at weaning (g)	*73*	5203 (190)	*97*	5389 (177)	NS
Mean weight at weaning (g)	*73*	710.7 (12.3)	*97*	705.6 (11.5)	NS

If the receptivity and the physiological stage of the does at the time of insemination were included in the analysis of variance as in the study of litter sizes, the treatment had still no effect on the total weight of the litters at weaning (table 5). The young of the treated group were however significantly lighter at weaning (658 *vs* 675 g; -2.4 %). The analysis based on one stage of the treatment showed that the mean weight difference at weaning between the treated group and the control group was only significant at the end of the treatment: - 6 g at the beginning *vs* - 26 g at the end of the treatment.

The physiological stage of the does at the time of the AI had no effect on the weight parameters. But the receptivity at this stage had an influence on the total weight of the litters at weaning (receptive does: 5516 g; non receptive does: 5196 g) and the mean weight at weaning (658.6 g and 674.6 g respectively) but this difference was almost not significant.

Global productivity

During the whole trial, PMSG treatment made it possible to wean 36.6 young per doe versus 31.6 in the control group. The global productivity was thus improved by 15.9 %. This increase was due to a very favourable effect of PMSG at the beginning of the trial: + 28.4 % *vs* 1.6 % at the end of the trial. This effect was however extremely different according as to whether at the time of AI the animals were lactating or not. In lactating does, the PMSG treatment led to an increase in the numerical productivity for each AI by 47.3 % (5.68 *vs* 3.86 weaned young per AI) over the experimental period. On the contrary, in non lactating does, this treatment only led to a very small and non significant improvement: + 6.0 % (6.10 *vs* 5.75 weaned young per AI). These different effects of PMSG treatment were relatively stable with time (Fig. 6 and 7). Analysing the production increase in the lactating does (Table 7) shows that the increase was mainly due to an increase in the fertility for the first four inseminations. In contrast, at the end of the trial, the increase resulted both from a more moderate increase in fertility and from an increase in prolificacy and survival rate between birth and weaning at the end of the trial.

Possible consequences of the treatment on the post-experimental period

During the post-experimental period the percentage of receptive females was slightly higher in the PMSG group than in the control group (34.4 *vs* 26.8 %) but the difference was not significant. Fertility (Figure 2) and numerical productivity did not significantly vary whether the does were treated or not during the previous stage, even if the young of the group which was previously treated tended to be less numerous at weaning (7.27 *vs* 7.92).

DISCUSSION

As shown by MAERTENS *et al.* (1983) in the case of natural mating and MIRABITO *et al.* (1994) in the case of artificial insemination, PMSG improves mating receptivity at the time of insemination throughout the experimental period. The positive effect of PMSG

Figure 5 : Structure of the litters according to the treatment

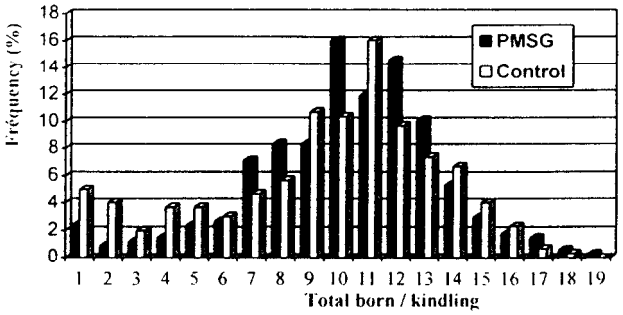


Table 7 : Distribution of the global productivity of lactating does

Experimental period		No of AI	No of kindling	Born alive /litter	No of weaning	No weaned /weaning	Weaned young per 100 AI
Beginning	PMSG	100	78.0	9.56	75.5	8.73	659
	Control	100	56.1	8.90	54.9	8.29	456
End	PMSG	100	56.4	8.44	52.4	8.08	423
	Control	100	44.2	7.45	43.3	6.60	286

which was observed by BONANNO *et al.* (1990) regarding the increase in the number of preovulatory follicles would thus result in an increase in the level of oestrogens responsible for an increase in the sexual behaviour of the does as suggested by LEFEVRE and CAILLOL (1978).

In agreement with MIRABITO *et al.* (1994) we noted that PMSG induced the receptivity of lactating does more efficiently than that of non lactating does. But unlike these authors and ALABISO *et al.* (1994) we observed a positive effect of PMSG on fertility of lactating does at the time of insemination.

BOURDILLON *et al.* (1992) obtained a positive effect of PMSG on the fertility of the primiparous lactating does (not included in our trial) but they did not obtain a positive effect on the fertility of the multiparous lactating does; it must be noted however that the mean fertility of their control group was higher (76.6 %) than that of our control group (62.0 %).

The effect of PMSG on the fertility of the lactating does was significantly expressed only during the first four inseminations and disappeared almost completely afterwards. In this respect, our results confirm those of CANALI *et al.* (1991) but they were obtained with a larger number of animals. BOITI *et al.* (1995) also noticed that the PMSG efficiency decreased with the number of injections. This decrease was associated with the presence of antibodies since the fertility (and the litter size) decreased only in the does having a high level of antibodies. It may be wondered whether, in our case, an immune process was not responsible for the loss of efficiency of the molecule on fertility at the end of the trial. This would confirm the observations of CANALI *et al.* (1994) and STRADAIOLI *et al.* (1994). Blood samples were taken at the end of our trial. In the following article (LEBAS *et al.*, 1995) the assays of anti-PMSG antibodies and their link with the performance of the does are analyzed

The loss of mean efficiency of PMSG on fertility decreased as the number of injections increased whereas its efficiency towards mating receptivity remained steady . After 4 or 5 injections of PMSG, 25 IU may continue stimulating the maturation of the follicles in its quantitative aspects: number of preovulatory follicles. These follicles might however not be completely mature but might increase the level of circulating oestrogens because of their number, so that the does have a high sexual receptivity. A very strong stimulation of the number of follicles whose size is larger than 0.6 mm seems to be induced with a single dose of 25 IU even after 4 or 5 injections , as it was observed by GOSALVEZ *et al.* (1994) after one injection of 100 IU PMSG.

Unlike the conclusions of MAERTENS and LUZI (1995) but like BOURDILLON *et al.* and MIRABITO *et al.* (1994) we obtained an improvement of the numerical productivity with the PMSG treatment in lactating does. MAERTENS and LUZI (1995) had noted a significant increase in the proportion of extreme litters (very small and very large) with the PMSG treatment but we did not notice anything like that. On the

Figure 6 : Average productivity of the does as a function of the number of AI and linear adjustment

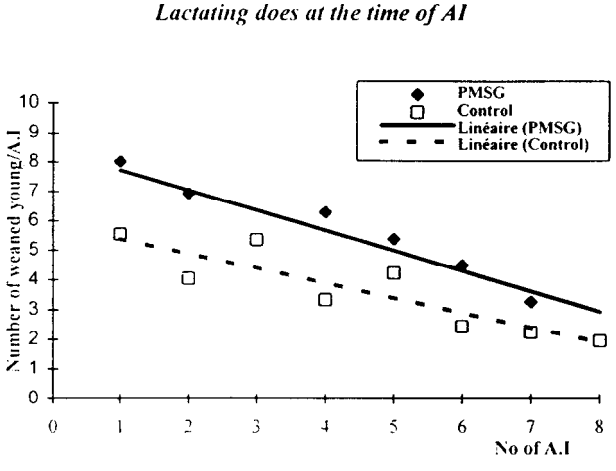
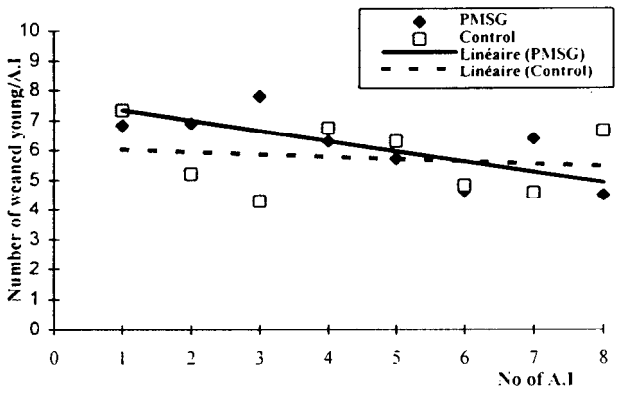


Figure 7 : Average productivity of the does as a function of the number of AI and linear adjustement

Non lactating does at the time of AI



contrary we even observed a very significant decrease in the proportion of very small litters at the beginning of the treatment, precisely when PMSG makes it possible to improve the rate of pregnancy. This effect persisted afterwards but not significantly. The hypothesis suggested by MAERTENS and LUZI (1995) in order to explain their observations, i.e. the production of poorly viable oocytes after a PMSG treatment, cannot be generalized.

It is worth noting that the higher prolificacy of the treated group was strongly associated with a higher receptivity of the does. Taking into account the receptivity in our model of analysis of variance suppressed all the direct effects of PMSG on the numerical productivity. The PMSG treatment increased the frequence of receptive does through the maturation of a greater number of follicles. BOITI *et al.* (1995) have shown that after 3 injections, 48 hours after AI, PMSG-treated does had a significantly higher number of degenerated embryos than those of the control group. The favourable effect of PMSG during the first injections could thus be partly cancelled afterwards because of fertilization failure or a bad viability of the embryos. Differences linked to the experimental conditions such as the strain, the dosis of PMSG and the interval between the injection and the AI, could then explain the differences observed by the various authors.

Like MIRABITO *et al.* (1994) we obtained no effect of the treatment on the total weight of the litter at weaning; the individual weight at weaning was however slightly but significantly reduced at the end of the treatment. This surprising result need all the more to be confirmed as it appeared at the end of the trial when the effect of PMSG on fertility for example tended to disappear.

The PMSG treatment improved the global productivity of the does (number of weaned young per AI) by + 28.4 % following the first four inseminations; there was no overall improvement for the following inseminations. The improvement of this criterium however depends on the physiological stage of the does at the time of insemination. In lactating does, the improvement in the number of weaned young per insemination in treated does was obvious throughout the experiment (beginning: + 44.6 %, end: + 48.0 %) whereas in non lactating does the molecule had no significant effect whatever the experimental stage. The use of PMSG in non lactating does is thus not justified.

HULOT (1975) and THEAU-CLEMENT and ROUSTAN (1992) had already underlined the positive link between the receptivity of the does and the various components of their reproductive performance. In our trial, insemination of a receptive doe led to a number of weaned young 79 % higher than that obtained after insemination of a non receptive doe.

The lactation stage of the doe at the time of insemination (Day 10 of lactation) decreased the fertility and the numerical productivity at birth. This result was consistent with that obtained by CHMITELIN *et al.* (1990), THEAU-CLEMENT *et al.* (1990) or ALABISO *et al.* (1994). The global productivity of the lactating does (number of weaned young per AI) represented only 84 % of that of the non lactating does.

PMSG did not alter either the induction of the receptivity, or the fertility, or the numerical and weight productivity of the does over the period following PMSG treatment. This original observation is of interest for a farmer who would like to use this molecule over a particular interval as advised a priori by CONTERA (1989) or SCHLOLAUT (1989). It has no visible adverse effect on the subsequent productive lifes of the female.

CONCLUSION

PMSG increased the receptivity of the does throughout the trial whatever the number of injections received. The consequence on fertility was however only significant in lactating does at the time of insemination and only at the beginning of the trial (first four inseminations). Assays of anti PMSG antibodies will make it possible to study the relationship that might exist in our trial between the result and a possible immune reaction.

According to our results and for prolific does (9.5 to 10.0 total born/kindling) with a moderate fertility (55-60 %), the use of a systematic PMSG treatment on lactating does two days before an AI seems to be interesting. In our experimental conditions PMSG made it possible to improve the global productivity (number of weaned young) by 47.3 % in lactating does at the time of insemination. Its interest remained stable with time despite the decrease in the efficiency of the molecule regarding fertility. On the contrary, the use of this treatment was of no interest for the non lactating does.

When treatment was over, no influence of the latter was noted on the further performance of the breeding females.

These observations were made on does having a relatively moderate initial level of success for AI (influence of the environment?, influence of the method of insemination?). These results should thus be confirmed on a does having a higher "basic level".

Remarquably the effect we studied is in fact the effect of the complex PMSG-Vitatox. Our experimental approach makes it impossible to conclude that PMSG only is efficient. We wanted to test the system as it is used in Italy.

ACKNOWLEDGEMENTS : The authors are grateful to the team of technicians of the meat rabbit production unit of the INRA experimental farm of the Magneraud headed by Jacqueline BELLEREAUD for breeding and the various handlings on animals as well as the Company PURINA France for the supply of Ciclogonine and Vitatox.

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