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EFFECT OF POST-PARTUM BREEDING AND PRE-WEANING LITTER MANAGEMENT ON THE PERFORMANCES OF HYBRID DOES

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Introduction

The ability to breed immediately after parturition makes that rabbits have theoretically an extremely high reproduction potential. However the shortfall between the biological and the realized potential is great and rises on average the actual production level

Already early research of Hammond and Marschall (1925), demonstrated some weak points of post-partum (PP) breeding: decreased fertility and increased embryo mortality. With the development of large scale commercial rabbit breeding, the interest for PP breeding increased but always some important disadvantages were observed (Prud'hon et al., 1969; Foxcroft and Hasnain, 1973; Prud'hon et Lebas, 1975). With improved feeding methods (Adams, 1967), selected strains (Surdeau et al., 1984) or a suitable reproduction method (Schlolaut et al., 1980), the results with PP breeding improved (see review Maertens et Okerman, 1987).

However, at this moment PP breeding is not yet the most applied reproduction method (Henaff et Ponsot, 1986), although in some comparative reproduction studies, encourageous results have been obtained (Partridge et al.,1984; Perrier et al.,1982). Also at our Research Institute good performances were obtained with PP breeding and have incited us to a critical judgement of the overall results of a nutrition experiment with hybrid does (Maertens and De Groote, 1988). Furthermore the influence was studied of pre-weaning management, as the standardisation of the initial litter size to 8 and the separate housing of the doe and her litter, on pup mortality and development.

Material and methods

Animals and housing

The analysis was performed on 96 Elco hybrid does. The experiment was conducted over a 9-month reproduction period and started with 80 young does. After 4 months 16 additional nullparous does were introduced. The first mating took place at approximately 16 weeks of age. All does were housed in the same compartment, on flat-deck cages (60x40 cm), and 16h/24h of light was provided. A minimum temperature of 16°C was maintained during the winter. On day 28 of gestation does received their metal nest box (30x30 cm). They were fixed outside the cages and filled up with white wood shavings.

Thirty of these does had two cages to measure daily milk production (Maertens & De Groote, 1988). One cage was used for kindling and for the pups before weaning, while in the cage next to he litter the doe was placed after parturition and initial nursing. Once a day(between 8.00 and 10.00h) these does were transferred to the pup cage for nursing. With this housing system it was further possible to measure daily feed intake of the young separately from their mother.

The males were housed in a separate, similar compartment and received only 9h/24h of light. The ratio bucks-does was maintained between 1/8 and 1/7 throughout the experiment.

Feeding

During the pre-breeding period the does were fed ad libitum a fattheners diet containing 16-16.5% CP and 9.6-9.8 MJ DE/kg. Starting at the first positive palpation, the experimental diets (Maertens and De Groote, 1988) were offered always ad libitum throughout the succesive litters.

Breeding shedule

All does were first bred at a weight of about 3.2kg, which corresponded with an age of 15 to 17 weeks. During the 9-month experimental period, does were re-bred within 24h after parturition. Palpation was performed at day 14. Not pregnant does were immediately presented to the male. Does refusing 5 times consecutively the male or which were not pregnant 3 times consequtively, were eliminated. Does with signs of diseases as mastitis, pododermatitis, abcesses and pasteurellosis were also discarded. At the end of the experimental period, does were re-bred post-partum. In this case the results of the last experimental litter were not influenced by a non-pregnancy period. A young doe was considered as doe from the first fertile mating on, till the last experimental weaning date or in case of mortality or elimination till this date.

Pre-weaning litter management

Litter size was standardised to 8 pups at parturition by cross fostering. Superfluous pups, which have been initially nursed, were kept together in a waith-nest during 48h as reserve. If not enough pups were available, litter size was completed to 8 the day after parturition. Nest box was removed when the litter was 21d old. Pups were systematically weaned at 28d of age.

Litters which were housed separately from their mother,received pellets from day 16 on. The same feeder and nipple drinker was used as in the "normal" doe cages.

Post-weaning litter recording

After weaning each litter was housed together. Mortality was noted during the first 3 weeks after weaning and related to pre-weaning management and PP pregnancy of the mother.

Analysis of the overal results

To study the effect of intensive reproduction, results were devided in "true" PP matings and rematings. Also litter records were judged taking into account if the doe was PP pregnant or not. Furthermore litter records were devided in "normal" housed and separated housed pups.

Data were statistically analysed using a two way analysis of variance. Factor A being always dietary treatment (see Maertens and De Groote, 1988) while factor B was respectively PP versus not PP or normal housed versus separate housing.

Results

Fertility

The fertility results of the total population are given in table 1. The data of the first mating and litter size are not included, because they are by no means influenced by the reproduction rythm.

The doe's mating response immediately after parturition was extremely high. Only one doe refused to mate on a total of 453 presentations. Because this doe died within 24h after presentation, we have determined a 100% acceptation of the male within 24h after parturition for healhty does.

The overall conception rate was 73%. Real PP matings had still a conception rate of 71.4% while the rematings were 6.1% more succesful. The difference in litter size between both groups was more pronounced ($p<.01$). A difference of one pup born alive/litter, in favour of the rematings, was noted (8.95 vs 10.29).

In figure 1 the frequencies of the intial litter size (alive) are given. Litters with 9 pups were most numerous (14.9%). But because of the high overal litter size, also litters with 10, 11 and 12 young were strongly represented. Because all litters born are given, also some kindlings without live pups occurred.

If we assume the highest frequency (9 pups) as the optimal litter size,and litters with 2 pups more or less as being still acceptable, within this range 57% of the litters are found. But 24.2% of the litters were too large (>11 pups) and 18.8% were too small (<7)

Mortality of young between birth and weaning is given in figure 2. Because the overall litter size amounted 9.24, we were obliged to remove 13.4% of pups born alive to standardise litter size to 8. Four litters were lost completely because of mortality of the doe at parturition or immediately after kindling. But between standardisation and weaning, the loss was limited to 5.1%. So in total 80.8% of the young born alive were weaned.

Reproductive performance

In table 2, performances of does expressed as number of young weaned is given. In total 3883 young were weaned, this means on average 40.4 per doe during the experimental period. Expressed on a common 365-day experimental period the number of young weaned was 66.0 per doe.

From the 80 initial does, 43 were still in production after 9 months and also 11 of the 16 additional does at the end of the experimental period.

Influence of PP pregnancy on pup development

Concurrent lactation and pregnancy decreased litter weaning weight with 4% (table 3). This difference was already pronounced ($p<.05$) when the young where 3 weeks old, respectively a litter weight of 3.114 and 3.019 kg was noted. Litter size nor at 3 weeks neither at weaning was significantly different. A tendency of lower pup mortality in favour of the non pregnant does was observed, but individual weaning weight was still 14g or 2% higher ($p<.05$) when the mother was not immediately pregnant after parturition.

Feed consumption was comparable before 3 weeks of age but the last week before weaning feed intake of the doe and her litter was significantly ($p<.01$) lower when the doe was PP pregnant.

Mortality of young in the first 3 weeks after weaning was comparable in both groups (respectively 10.7 and 10.8%).

Influence of separation doe-litter (table 4)

Already at 3 weeks of age, litters separated from their mother were significantly lighter ($p<.01$). However at weaning this difference was even much more pronounced, and reached more than 10% in comparison with normal housed litters. Because litter size was comparable, a mean difference in individual weaning weight of 69g was observed. Feed consumption, of the doe and her litter together, was both before and after 3 weeks significantly lower ($p<.01$) when pups were separated from the mother.

Post-weaning mortality was much higher ($p<.01$) in litters which were separated housed before weaning: 8.4% and 14.9% for "normal" and "separated" reared rabbits, respectively.

Feed intake of pups before weaning.

Data include only the results of separated housed litters. Distinction is made between litters which mother was PP pregnant or not (figure 3). Solid feed intake started in both groups on day 21 (> 1g/day). From day 24 on, a linear increase in feed intake was determined, which was much quicker when the mother was PP pregnant. The day before weaning feed intake/pup was respectively 40.4 and 25.1g.

From day 19 on, a large difference in daily milk consumption was observed between pups which mother was PP pregnant or not pregnant (fig. 3). For example when the pups were 22 days old, they still received only 20g of milk when their mother was PP pregnant versus 35g if she was not PP pregnant.

Discussion

In contrast with literature data, in our study a 100% acceptation of the male was noted PP. In a lot of other comparative studies rematings or 1st matings of young does are pooled together with true PP matings (see review Maertens & Okerman, 1987). A second explanation can be found in the time between kindling and presentation to the male, which was always lower than 24h in our experiment. In this case an optimal use is made of the PP oestrus. But in a lot of studies no matings were carried out during the week-end, so that a number of does were rebred only after 2 or 3 days.

In agreement with numerous reports PP breeding reduced conception rate and litter size. But a conception rate of 71.4% and a litter size (alive) of 8.95 is still more than acceptable. We can fully subscribe the conclusion of Surdeau et al., 1984, that PP breeding can only be of interest when using high performant strains , selected for this system and in excellent healthty condition. Based on our results (Maertens & De Groote, 1988) also an adapted feed seems to be necessary.

Standardisation of the heterogenous litter size resulted in a low mortality level of young before weaning. Succesful cross fostering depends on two basic rules (Lebas et Dorche, 1982; Roustan, 1981): it should be done as quick as possible and by preference with young of the same weight. Using this technique and taking into account if the pups have initially nursed, 80.8% of the pups born alive were weaned even when 13.4% , superfluous pups were removed. We may assume if we had allowed 8 , 9 or 10 pups, according to the litter size, at least the half of the 13.4% removed pups would have survived. In that case total mortality, over all litters born, would have been hypothetically near to 10% before weaning. In comparison with data of commercial rabbitries (Henaff et al., 1987; Van Gelder, 1987) mortality should be reduced in a significant way.

Post partum pregnancy decreased very strongly milk production starting from day 18. This explains fully the difference in litter weight at day 21 in favour of the non PP pregnant group. At weaning this difference was not increased because, in agreement with Szendro et al.,(1985), pups can compensate totally the loss of milk by an increased solid feed intake (fig.3). Stimulation of solid feed intake from day 16 on, can probably abolish the negative influence of the PP pregnancy on pup weaning weight.

Pups of PP pregnant does are already virtually weaned before day 28, because they are nearly totally switched from milk feeding to pellets. On the other hand when the mother is not PP pregnant, intake of milk is still more important than pellet intake at day 28 (fig.3). However this seems not to be an extra stress factor, because mortality after weaning was comparable after weaning.

Although a separation between the doe and her pups can reduce mortality before weaning (Castello et al., 1984), our results indicate that the doe initiate the pups to drink and to eat. An evidence is found in the strongly reduced weaning weight in the separated group. An evidence can also be found when the daily milk intake and solid feed intake are judged together (fig. 3). Before solid intake was significant (day 22), pups received during a few days only a very low quantity of milk, especially when their mother was PP pregnant. But no difference can be observed between the PP and non PP group in starting solid feed intake. This can impossibly be the case when the litter is "normal" housed because differences in litter weight, at 3 and 4 weeks, have to be then much larger than the observed 3%. For this reason solid feed intake of pups, as presented in figure 3 , have to be taken with caution. They do not reflect the normal situation and prove the importance of the initiation of the mother.

Furthermore it is of interest to note that post-weaning mortality was significantly influenced by the pre-weaning separation. The already mentionned irregular feed intake can be responsable. Diarrhoea problems because of an irregular feed intake after weaning were noted by Morisse (1986).

As a conclusion we can say that in spite of some disadvantages PP breeding leads to "top" performances (66 pups weaned/doe/year) but a number of conditions have to be fulfilled and an optimal pre-weaning litter management is necessary.

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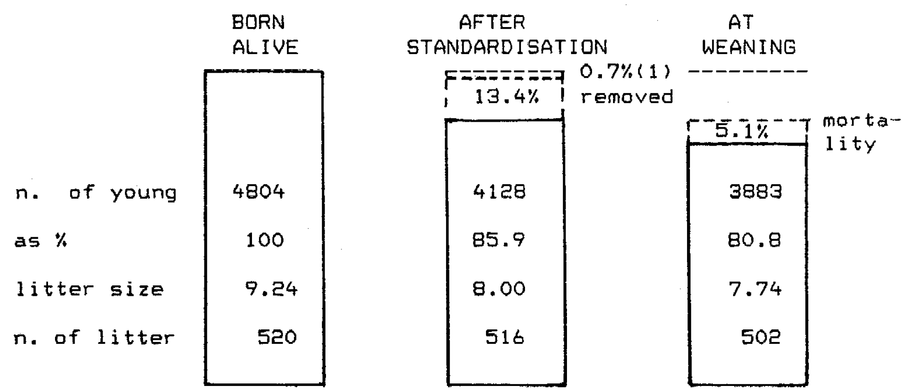
Table 1. Fertility of "real" p.p. matings versus rematings.

	All matings	"Real" p.p. mat.	Rematings
Number of matings	599	448	151
Conception rate(%)	73.0	71.4 (92)	77.5 (=100)
		+-------NS------+	
Litter size			
n. of litters	426	331	115
alive	9.31	8.95(87)	10.3(=100)
		+-------**------+	
total	9.96	9.57(87)	11.0(=100)
		+-------**------+	

Results of primiparous does are not included
**: p<.01



(1) because of doe-mortality at parturition

Figure 2. Mortality of young before weaning

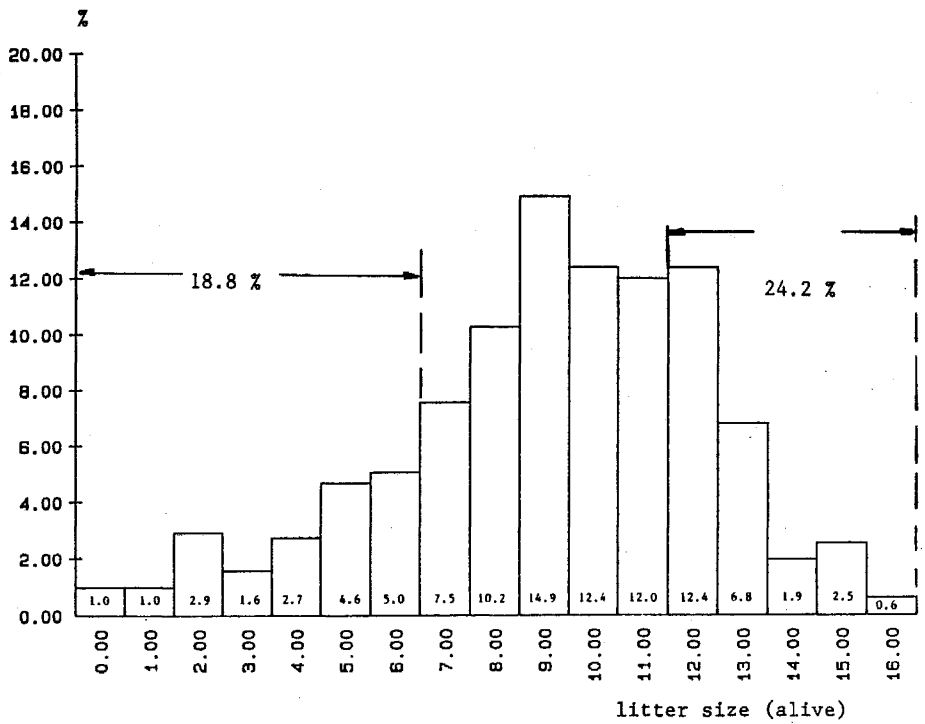


Figure 2. Frequencies of the litter size of p.p. breeding does

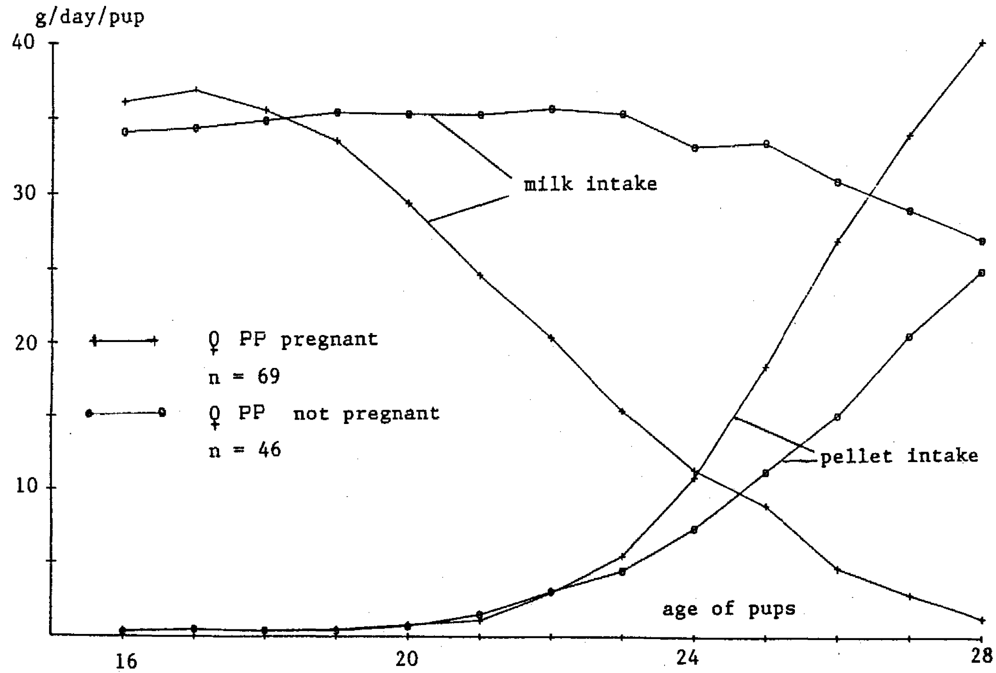


Figure 3. Mean daily feed intake, before weaning, of separated housed pups

Table 2. Overall productivity of the does.

Number of does (A)	initially 80, and +16 after 4 months
Reproduction period	March-December 1986
Considered as doe	1st fertile mating till last weaning date or mortality date or elimination date
Total"doe" days(B)	21,488
B/A	223.8 days
Young weaned	
total	3,883
per litter	7.74
per doe	40.4
per doe /year	66.0

Table 3. Influence of PP pregnancy on pup development and feed consumption.

	Mother PP pregnant	Mother PP not pregnant	Variab. coeffic.	Stat.(2) signif.
Number of litters(1)	283	123	-	-
Litter weight(g) at				
21d	3019 (97)	3114 (=100)	12.6	*
28d	4658 (96)	4857 (=100)	14.8	**
Litter size (3) at				
21d	7.77	7.86	5.9	NS
28d	7.68	7.82	7.0	NS
Weaning weight (g)	607 (98)	621 (=100)	10.9	*
Feed consumption(g)				
0-21d	8385 (101)	8301 (=100)	12.8	NS
21-28d	3668 (94)	3890 (=100)	16.0	**
Post-weaning mortality (%)	10.7	10.8	-	NS

(1) first litter not included (2) *: p<.05 **: p<.01
(3) litters initially standardised to 8

Table 4. Influence of the pre-weaning pups-doe separation on pup development, feed consumption and post-weaning mortality.

	Separated litters	Normal housed litters	Variab. coeffic.	Stat.(2) signif.
Number of litters	139	267	-	-
Litter weight(g) at				
21d	2984 (97)	3081 (=100)	12.5	*
28d	4381 (89)	4894 (=100)	14.8	**
Litter size (1) at				
21d	7.82	7.79	6.1	NS
28d	7.76	7.71	7.7	NS
Weaning weight (g)	565 (89)	634 (=100)	12.1	**
Feed consumption(g)				
0-21d	8126 (96)	8481 (=100)	11.8	**
21-28d	3610 (95)	3800 (=100)	16.6	**
Post-weaning mortality (%)	14.9	8.4	-	**

(1), (2), (3): see table 3

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Summary

A critical judgement of post-partum (PP) breeding was performed using the data of a nutrition experiment. In total 520 litter records from 96 hybrid does were analysed. Initial litter size was systematically standardised to 8 pups at parturition. Furthermore, to measure the milk production of the does, 30 of these does were housed separately from their young. Consequences on pre- and post weaning litter performances were recorded.

Even "real" PP matings had still a conception rate of 71.4% and a litter size of 8.95 pups at birth (alive). In comparison with the rematings, these traits were reduced respectively with 6.1% and 1.35 pup/litter ($p<.01$). Because the overall litter size at birth amounted to 9.24, 13.4% of the pups had to be removed in order to standardise litter size to 8 young. However, till weaning mortality was further limited till 5.1%, so that more than 80% of the pups born were weaned. On the average the reproductive performance of the does amounted to 44.4 weaned young during the experimental period or 66.0 on a yearly basis.

PP pregnancy decreased litter weight at day 21 or at weaning with 3-4%. An increased feed intake of the pups avoids a larger difference. PP pregnancy had no influence on pre- or post weaning mortality.

It was proved that the mother initiates the pups to drink and to eat. Evidence was found in the distinct difference (11%) in litter weaning weight in favour of the "normal" housed litters.Furthermore a significant ($p<.01$) higher mortality was observed post weaning, when the litter was housed separately from their mother before weaning (respectively 14.9% vs 8.4%).

Résumé

Une analyse critique du rythme de reproduction intensif a été faite en utilisant les données d'un essai alimentaire. On a utilisé les 520 nichées, obtenue dans une période de 9 mois, des 96 femelles participantes. La taille de toutes les portées a été standardisée à 8 lapereaux. Pour mesurer la production laitière, 30 des femelles etaient logées séparément de leurs jeunes.

Même pour les vraies saillie post partum (PP) on a obtenu un taux de gestation de 71,4% et une taille de la portée de 8,95 (vivant). En comparaison avec les resaillies, ces résultats étaient réduites de respectivement 6,1% et 1,35 lapereaux/portée ($p<0,01$). Puisque la taille de la portée était en moyenne de 9,24 laperaux nés-vivants, 13,4% des lapereaux ont été écartés pour obtenir une taille de portée standardisée de 8 jeunes. Mais avant le sevrage, les pertes étaient limitées à 5,1% et même ainsi plus de 80% des lapereaux nés vivants ont atteint l'âge du sevrage. La productivité globale s'élève à 44,4 lapereaux par femelle durant l'essai ou 66,0 sur base annuelle.

Le poids de la nichée après 21 jours et au sevrage était inferieur de 3-4% quand la mère était gestante PP. Une augmentation forte de la consommation alimentaire des jeunes évite que la différence est plus prononcée. La mortalité avant ou après le sevrage n'était pas influencée par une gestation PP de la mère.

Les résultats prouvent que la femelle initie les jeunes pour boir et manger. Une preuve a été trouvé dans la différence prononcée (11%) du poids de la nichée au sevrage en faveur des nichées logées avec leur mère. Après le sevrage, la mortalité était beaucoup plus élevée ($p<0.01$) dans les nichées élevées séparément de leur mère (respectivement 14,9% vs 8,4%).

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