WORLD RABBIT SCIENCE 1997, VOL. 5 (4), 155-159

EFFICACY OF PROSTAGLANDIN $F_{2\alpha}$ AND ITS ANALOGS IN ENHANCING REPRODUCTIVE EFFICIENCY OF DOE RABBITS

MCNITT J.I.[1], MELLAD K.E.[1], SIMON G.[1], NEGATU Z.[1], LUKEFAHR S.D.[2]

[1] Box 11170, Southern University and A&M College, BATON ROUGE, Louisiana 70813, USA
[2] Department of Animal and Wildlife Science, Texas A&M University-KINGSVILLE, 78363, USA

ABSTRACT: The efficacy of prostaglandin $F_{2\alpha}$ ($PGF_{2\alpha}$) and two analogs for inducing parturition in does to increase long-term rabbitry efficiency was studied. For the two-year trial, 40 single doe cages were used as experimental units. There were four treatments - does injected on day 29 of gestation with 5 mg $PGF_{2\alpha}$ 35 µg fenprostalene, 35 µg cloprostenol, or 1 ml saline as a control. Attempts to remate does began at 7 days *post partum* and were continued daily until the doe accepted service. All does housed in a particular cage during the trial received the same treatment. The model included the fixed main effects of treatment, year, and season, with doe within treatment and residual error as random effects. The linear effect of parity was included as a covariate for those traits where it was significant (number of kits weaned and nest score). Doe repeatability accounted for significant variation in litter birth weight (16.9±5.1%), total kits born per litter (22.5±5.1%), kits born live per litter (19.5±5.0%), nest score (24.4±5.2%), and kits weaned per litter (14.6±4.8%). The 31.9±0.1 d gestation seen in the Jul-Sep season was greater (P<0.05) than the other seasons (31.2±0.1 to 31.6±0.1 d). Litter birth weight was greater (P<0.05) in Jan-Mar (338±19 g) than in Jul-Sep. (279±19 g) and followed a pattern similar to the number of kits born. At 63.5 d, the kindling interval in the Oct.-Dec. period was longer than the other seasons (P<0.01). During the same period, the conception rate was lower (P<0.01) as indicated by the higher number of services per litter (2.3±0.1 vs. 1.7±0.1, 1.6±0.1 and 1.6±0.1 for Jan.-Mar., Apr.-Jun. and Jul.-Sep., respectively.) Gestation length for saline treated does was 31.9±0.2 d vs. 31.4±0.4, 31.1±0.3 and 31.3±0.2 for the fenprostalene, cloprostenol and $PGF_{2\alpha}$ treated does, respectively (P<0.01). Fenprostalene and cloprostenol treated does kindled 7.3±0.5 and 7.2±0.5 kits per litter while $PGF_{2\alpha}$ treated does had only 5.8±0.5 kits per litter (P<0.01). Fenprostalene treated does had larger (P<0.05) litters born live (6.0±0.5) than $PGF_{2\alpha}$ treated does (4.8±0.5). At 330±21 g, the litter birth weight of saline treated does was greater than $PGF_{2\alpha}$ treated does (285±20) (P<0.05). Treatment had no effect on the quality of the nest constructed and little effect on subsequent reproductive performance, although the fenprostalene treated does showed the least degree of lordosis (P<0.05). Treatment with $PGF_{2\alpha}$ and the two analogs did not significantly shorten the kindling interval nor affect the number of services required for each litter. There were no differences among long-term responses to $PGF_{2\alpha}$ and its synthetic analogs nor any effect on conception rate. However, the differences in litter size born and born alive indicate some differences may exist. Using our procedures, and breeding by natural service, routine use of prostaglandins or prostaglandin analogs did not improve reproductive efficiency in meat rabbits.

RESUME : Efficacité de la Prostaglandine $F_{2\alpha}$ et de ses analogues pour augmenter la productivité de la lapine reproductrice.
Les auteurs ont étudié l'efficacité de la prostaglandine $F_{2\alpha}$ ($PGF_{2\alpha}$) et de deux analogues sur l'induction de la gestation chez la lapine afin d'augmenter la productivité à long terme d'un élevage. Pour cet essai d'une durée de 2 ans, 40 cages individuelles pour lapines ont été utilisées. Quatre lots de femelles ont reçu au 29ème jour de leur gestation soit une injection de 5mg $PGF_{2\alpha}$ soit 35µg de fenprostalène, soit 35µg de cloprostenol soit 1ml de sérum physiologique pour le lot témoin. Les lapines ont été présentées au mâle à partir du 7ème jour post partum puis éventuellement tous les jours jusqu'à accouplement effectif. Les différentes lapines qui se sont succédées dans une même cage durant l'essai ont reçu le même traitement. Les principaux effets fixes du traitement, de l'année, de la saison et de la lapine intra traitement et l'erreur résiduelle comme effet aléatoire, ont été inclus dans le modèle. L'effet linéaire de la parité a été inclus comme covariable pour les caractéristiques où il est significatif (nombre de lapereaux sevrés et note de qualité du nid). Des variations significatives de la répétabilité des mesures intra lapine ont été montrées pour le poids de portée à la naissance (16,9 ± 5,1%), le nombre total de lapereaux nés par portée (22,5 ± 5,1%), le nombre de lapereaux nés vivants par portée (19,5 ± 5,0%), la note de qualité du nid (24,4 ± 5,2%) et le nombre de lapereaux sevrés par portée (14,6 ± 4,8%). Pendant la période Juillet-Septembre la durée de gestation a été plus longue (31,9 ± 0,1 jour) que pendant les autres périodes de l'année (31,2 ± 0,1j à 31,6 ± 0,1j). Le poids de la portée à la naissance est plus élevé (P<0,05) en Janvier-Mars (338 ± 19g) qu'en Juillet-Septembre (279 ± 19g) en accord avec le nombre plus élevé de lapereaux nés. Pendant la période Octobre-Décembre, l'intervalle moyen entre mises bas est plus important (63,5 jours) que pour les 3 autres saisons (51,5 à 56,1j ; P<0,01). Pendant la même période, le taux de fécondation est plus bas (P<0,01) comme le montre le nombre plus élevé de saillie nécessaire par mise bas (2,3 ± 0,1 vs 1,7 ± 0.1 - 1,6 ± 0,1 et 1,6 ± 0,1 pour Janvier-Mars, Avril-Juin et Juillet-Septembre respectivement). La durée de la gestation des lapines traitées avec du sérum physiologique est de 31,9 ± 0,2 j vs 31,4 ± 0,4 ; 31,1 ± 0,3 et 31,2 ± 0,2 pour les lapines traitées par le fenprostalène, le cloprostenol et $PGF_{2\alpha}$ respectivement (P<0,01). Les lapines traitées par le fenprostalène ou le cloprostenol ont mis bas 7,3 ± 0,5 ou 7,2 ± 0,5 lapereaux par portée, tandis que les lapines traitées par $PGF_{2\alpha}$ n'ont eu que 5,8 ± 0,5 lapereaux par portée (P<0,01). et les lapines témoin 6,7 ± 0,5 lapereaux. Les lapines traitées par le fenprostalène ont eu plus de lapereaux nés vivants par portée (6,0 ± 0,5; P<0,05) que celles traitées par $PG_{2\alpha}$ (4,8 ± 0,5). Le poids de la portée à la naissance est plus élevé (330 ± 21g) chez les lapines traitées par le sérum physiologique que chez celle traitées par $PGF_{2\alpha}$ (285 ± 25g ; P<0,05). Les différents traitements n'ont pas affecté la qualité du nid et n'ont eu que peu d'effet sur les performances de reproduction ultérieures, bien que les lapines traitées par le fenprostalène aient montré un moindre degré de lordose (P<0,05). Le traitement par $PGF_{2\alpha}$ ou ses deux analogues n'a pas raccourci significativement l'intervalle entre les mises bas, ni diminué le nombre de saillies nécessaires par portée. Il n'y a pas de différences dans les conséquences à long terme de $PGF_{2\alpha}$ et de ses deux analogues synthétiques, ni aucun effet sur le taux de fécondité. Cependant, les différences entre la taille des portées nées et nées vivantes pouraient indiquer l'existence d'une éventuelle influence. On peut conclure de cette expérimentation que l'utilisation routinière de la prostaglandine ou de ses analogues, selon la méthode d'élevage employée par les auteurs avec saillie naturelle, n'améliore pas la reproduction chez le lapin de chair.

INTRODUCTION

As described in a review by MCNITT (1992), prostaglandin $F_{2\alpha}$ ($PGF_{2\alpha}$) has been shown to be luteolytic in rabbits. Work in Europe has shown that intramuscular injection of $PGF_{2\alpha}$ or synthetic prostaglandin analogs on day 29 of gestation will induce parturition within 24-60 hours (REBOLLAR *et al.*, 1989; UBILLA *et al.*, 1989; UBILLA and RODRIGUEZ, 1989a, b; PIMENTA *et al.*, 1996). MCNITT *et al.* (1994) reported that fenprostalene, a synthetic $PGF_{2\alpha}$ analog administered by subcutaneous injection, was also effective in inducing parturition. This treatment has been shown to increase the conception rate at the next breeding (REBOLLAR *et al.*, 1989; UBILLA and RODRIGUEZ, 1989a) and proportion of kits born alive (UBILLA and RODRIGUEZ, 1989a). Increasing the proportion of kits born alive, the

number of litters produced in a year and the number of kits in the litters would obviously increase the efficiency of rabbit production. Furthermore, no studies comparing the efficacy of $PGF_{2\alpha}$ and its synthetic analogs have been published.

This work was carried out to compare the efficacy of $PGF_{2\alpha}$ and two synthetic $PGF_{2\alpha}$ analogs for inducing parturition in does and to evaluate their potential for increasing long-term rabbitry efficiency as measured by gestation length, total litter weight at birth, mean live kit birth weight, number of kits born alive, and preweaning kit survival and the effects on subsequent reproductive parameters including receptivity, services per kindling, kindling rate, gestation length, litter size (total and live), and litter weight at birth.

MATERIALS AND METHODS

The treatments used included injection at day 29 of each gestation with:

- $PGF_{2\alpha}$ (Lutalyse®, manufactured by Upjohn), 5 mg administered intramuscularly;
- Cloprostenol (Estrumate® a $PGF_{2\alpha}$ analog manufactured by Mobay Corp.); 35 μg administered intramuscularly;
- Fenprostalene (Bovilene®, a synthetic $PGF_{2\alpha}$ analog manufactured by Syntex Animal Health); 35 μg administered subcutaneously; or
- Sham intramuscular injection with 1 ml sterile saline (control).

Dosages of $PGF_{2\alpha}$ and cloprostenol used were those reported in the literature as being most effective (Ruffini-Castrovilli and Nordio-Baldissera, 1980; Partridge *et al.*, 1986) The dose of fenprostalene was based on that used for cloprostenol. Preliminary trials with fenprostalene had indicated that this dose was effective in inducing parturition (McNitt *et al.* 1994).

Animal Management

Management of does was as described by McNitt and Lukefahr (1990) and was similar to that normally used for commercial meat rabbits in the southern United States. The rabbits were housed in suspended, single deck, all wire cages (76 x 76 x 46 cm) inside a building with opened side panels that provided protection from rain and sun. Fans and a tube distribution system were used for air circulation when ambient temperatures exceeded about 23°C. The 17L:7D light cycle normally used in the rabbitry was maintained throughout the trial with automatic timers. Water was available continuously from automatic valves. A commercial, alfalfa-based, pelleted rabbit ration with a guaranteed minimum analysis of 18% crude protein and 2% crude fat and a maximum of 17% crude fiber was used.

Table 1 : Least-squares year means for reproductive characteristics of does treated with prostaglandin $F_{2\alpha}$, the analogs cloprostenol and fenprostalene or saline over a two year period. [1]

	1994	1995	1996
Number of litters	199	217	17
Gestation length (d)	31.4 ± 0.1	31.7 ± 0.1	31.5 ± 0.3
Total kits born per litter (n)	7.0 ± 0.4	7.1 ± 0.4	6.2 ± 0.8
Kits born live per litter (n)	5.8 ± 0.5^{ab}	6.4 ± 0.4^{b}	4.1 ± 0.9^{a}
Litter birth weight (g)	330 ± 19^{ab}	339 ± 17^{b}	250 ± 38^{a}
Nest score [2]	4.4 ± 0.4	5.4 ± 0.2	5.9 ± 0.5
Kits weaned per litter (n)	3.9 ± 0.7^{a}	5.4 ± 0.4^{b}	4.4 ± 1.0^{ab}
Kindling interval (d)	44.9 ± 2.5^{x}	52.5 ± 2.1^{y}	70.7 ± 5.4^{z}
Services per litter (n)	1.4 ± 0.1^{a}	1.6 ± 0.1^{ab}	2.3 ± 0.3^{b}
Lordosis score [3]	2.85 ± 0.10	2.91 ± 0.04	2.84 ± 0.14

[1] Means in the same row bearing different superscripts differ (a,b,c, P<0.05; x,y,z, P<0.01)

[2] A subjective score with 1= no fur pulled, no material nest and(or) kindled on wire; 2= wisps of fur pulled, no material nest; 3= fair amount of fur pulled, not mixed with nest material; 4= lots of fur pulled, not mixed with nest material; 5= fair amount of fur mixed with material nest, kits fairly well covered; 6= a well constructed nest with lots of fur well mixed with the material nest.

[3] A subjective score with 0 = none, 1 = slight, 2 = moderate, 3 = strong.

Because the productive life of the commercial meat doe is often less than the planned two year duration of the trial, 40 doe cages were used as the experimental units. For the entire period of the project (February 1994 - March 1996), each cage was assigned to one of the four treatment groups. To start the trial, a single nulliparous New Zealand White doe was placed in each cage. Throughout the trial, does that died or were culled for poor performance (e.g. more than four services per pregnancy or failure to rear two consecutive litters) were replaced with nulliparous does. Does in the cages were injected with the respective compound at 10:00 a.m. on day 29 of each gestation. Nest boxes were provided to the does at 28 d post-insemination. Attempts to remate does began at 7 d *post-partum* and were continued daily until the doe accepted service. Matings were random but in the majority of cases (>85%) does were not mated to a particular buck for more than a single gestation. Does were manually palpated 14 d post-insemination and non-pregnant does were remated to the same buck. Litters were weaned 28 d *post-partum*.

Traits Studied

Criteria used to compare the efficacy of $PGF_{2\alpha}$ and two synthetic $PGF_{2\alpha}$ analogs for inducing parturition in does included gestation length, nest score (a subjective score with 1 = no nest to 6 = a well constructed nest with lots of fur well mixed with the material nest), total number of kits born, number of kits born live, litter birth weight (total weight of live kits in the litter), and number of kits weaned at 28 d. Measures of subsequent reproductive performance included sexual receptivity, services required per litter and litter number and weight at birth and weaning. Sexual receptivity was based on degree of lordosis at mating (0 = none, 1 = slight, 2 = moderate, 3 = strong).

Statistical Analysis

Data used for analysis were those collected from second and subsequent litters, i.e. those occurring after at least one treatment had been administered. Preliminary analyses indicated that, in no case, was cage within treatment an important source of variation (less than 1% of random variation). Furthermore, treatment x season interaction was not significant. Only in the case of number of kits born live and kindling interval was there a significant treatment x year interaction but this probably arose because of low effective numbers in 1996. As a result, cage, and year and season interaction were not included in the final models. The linear and quadratic effects of parity were tested for all dependent variables. The only significant effect was the linear relationship between parity and the number of kits weaned and nest score. As a result of these preliminary analyses, the data were subjected to least-squares analysis of variance procedures (HARVEY 1990) according to the following mathematical model.

$$Y_{ijklm} = \mu + T_i + d_{ij} + Y_k + S_l + \varepsilon_{ijklm}$$

where

Y_{ijklm} = observed trait value;
μ = overall trait mean;
T_i = fixed effect of treatment;
d_{ij} = random effect of the j^{th} doe within the i^{th} treatment, assumed to be NID $(0, \sigma^2_d)$;
Y_k = fixed effect of the k^{th} year;
S_l = fixed effect of the l^{th} season;
ε_{ijklm} = the random error, assumed to be NID $(0, \sigma^2_\varepsilon)$.

Parity was included as a linear covariate only when analyzing the number of kits weaned and nest score. Linear contrasts involved all possible comparisons among treatment least squares means for the reproductive characteristics investigated.

RESULTS AND DISCUSSION

ANOVA Results

Individual doe repeatability accounted for significant variation in litter birth weight (16.9±5.1%), total kits born per litter (22.5±5.1%), kits born live per litter (19.5±5.0%), nest score (24.4±5.2%), and kits weaned per litter (14.6±4.8%). LUKEFAHR *et al.* (1983) reported somewhat higher values of 0.33, 0.26 and 0.23 for litter birth weight, total kits born per litter and kits weaned per litter, respectively, whereas LUKEFAHR and HAMILTON (1997) reported lower values of 0.14, 0.13, and 0.00 for the same traits.

As shown in Table 1, there were 199 observations in 1994, 217 in 1995 and only 17 in 1996. Consequently, the results from 1996 must be viewed with some caution. There were more kits born live in 1995 than in 1996 and more kits were weaned in 1995 than in 1994 (P<0.05). The nest score was numerically lower in 1994 which may have affected the percentage of kits weaned (67.2 and 84.4% for 1994 and 1995, respectively). The kindling interval in 1994 was shorter than in 1995 which, in turn was shorter than in 1996 (P<0.01). The reason for these discrepancies is not apparent although it certainly was affected (P<0.05) by the difference in the number of services required per litter. The last trait followed a similar pattern with the least services required in 1994 and the most in 1996. There may also have been some relationship to the larger litters in 1995 resulting in greater milk production by the does thus resulting in lowered subsequent reproductive performance.

From ANOVA, season had a strong influence on a number of the characteristics studied (Table 2.) The gestation length seen in Jul-Sep was greater (P<0.05) than the other seasons. MCNITT and MOODY (1991) found that the longest gestations were seen at the time of year when the litters had fewest kits (Jul. - Sep.) In the current work, the smallest litters were seen in both the Jul.-Sep. and Oct.- Dec. season. Litter birth weight (a function of the number of kits and their individual weights) was greater in Jan-Mar than in Jul-Sep. (P<0.05) and follows a pattern similar to the number of kits born. The kindling interval was longest (P<0.01) in the Oct.-Dec. period. During the same period, the conception rate was lowered (P<0.01) as indicated by the increase in the number of services required per litter. An earlier study in Louisiana (MCNITT and MOODY, 1990) also indicated that the conception rate was lowered in the latter portion of the year.

There were no significant curvilinear relationships between the dependent variables and parity. The linear effect of parity was important for nest score (P<0.01) with a

Table 2 : Least-squares season means for reproductive characteristics of does treated with prostaglandin $F_{2\alpha}$, the analogs cloprostenol and fenprostalene, or a saline control. [1]

	Jan. - March	April - June	July - Sept.	Oct. - Dec.
Number of litters	81	30	16	106
Gestation length (d)	31.2 ± 0.1^{a}	31.6 ± 0.1^{a}	31.9 ± 0.1^{b}	31.4 ± 0.1^{a}
Total kits born per litter (n)	7.2 ± 0.4^{b}	7.3 ± 0.4^{b}	6.3 ± 0.4^{a}	6.3 ± 0.4^{a}
Kits born live per litter (n)	5.6 ± 0.5^{ab}	6.1 ± 0.5^{b}	5.0 ± 0.5^{a}	5.0 ± 0.5^{ab}
Litter birth weight (g)	338 ± 19^{c}	310 ± 19^{bc}	279 ± 19^{a}	300 ± 20^{ab}
Nest score [2]	5.2 ± 0.2	5.0 ± 0.3	5.3 ± 0.3	5.4 ± 0.3
Kits weaned per litter (n)	4.2 ± 0.5	5.0 ± 0.5	4.4 ± 0.5	4.6 ± 0.5
Kindling interval (d)	56.1 ± 2.4^{x}	51.5 ± 2.5^{x}	52.9 ± 2.5^{x}	63.5 ± 2.6^{y}
Services per litter (n)	1.7 ± 0.1^{x}	$1.6 \pm .1^{x}$	1.6 ± 0.1^{x}	2.3 ± 0.1^{y}
Lordosis score [3]	2.90 ± 0.05	2.87 ± 0.06	2.80 ± 0.05	2.89 ± 0.06

[1, 2, 3], see footnotes of table 1

Table 3 : Actual production means for the cages used in the study.

Characteristic	Treatment			
	Fenprostalene	Cloprostenol	Prostaglandin $F_{2\alpha}$	Saline
Does per cage (n)	2.6±0.3	2.5±0.4	2.5±0.5	2.8±0.4
Litters per cage (n)	13.4±0.3	13.4±0.5	13.7±0.4	13.2±0.5
Mean time does were on trial (d)	417±43	428±62	471±57	397±47

slope of −0.13±.05. Hamilton *et al.* (1997) found no significant effects of parity on nest quality traits although they noted that primiparous does tended to pull less fur and construct less structured nests than older does. This effect was not seen in the present study however, because only second and subsequent gestations were included. Furthermore, parity trend accounted for only 1.90% of the total variation in nest score so probably does not have strong biological significance. Similarly, the linear effect of parity was important (P<0.05) for number of kits weaned per litter with a slope of −0.23±0.11. This accounted for only 1.4% of the total variation, however.

Treatment Effects

During the trial, there were 434 second and subsequent litters born to 93 does. Table 3 summarizes the results for all litters born during the experiment (including first litters) and indicates the uniform rate of replacement among the treatments. There were no treatment differences in terms of the mean number of does occupying each cage during the experiment (2.5 to 2.8) nor in the mean number of litters per cage. The length of time that the does stayed in the cages varied from 30 d to the full 730 days of the trial. The average times for the four treatments are shown in Table 3. As expected, the standard errors were large but there was also wide variation among the treatments with a much shorter tenure (397±47) for saline treated does compared to the longer 471±57 d for the $PGF_{2\alpha}$ treated does. There is no apparent reason for this discrepancy.

The effects of treatment on reproductive characteristics are shown in Table 4. As expected, gestation length was longer (P<0.01) for the saline treated animals than for those treated with the prostaglandin compounds. This is in agreement with the work of Ubilla *et al.* (1988, 1989), Rebollar *et al.* (1989), Ubilla and Rodriguez (1989a, b), Facchin *et al.* (1991, 1992) and Pimenta *et al.* (1996). Does treated with fenprostalene and cloprostenol kindled more kits per litter (P<0.01) than does treated with $PGF_{2\alpha}$ although does treated with saline were not different from any of the treatment groups. Similarly, the fenprostalene treated does had more kits born live per litter than the $PGF_{2\alpha}$ treated does. Does treated with cloprostenol and saline had intermediate numbers of live kits born. Because of the longer gestation and the numerically greater number of kits, the litter birth weight of the saline treated does was significantly greater than the $PGF_{2\alpha}$ treated does. The litter birth weight of the saline treated does was not different from the does receiving fenprostalene or cloprostenol. This probably was because of the larger litters produced by the fenprostalene and cloprostenol treated does. Treatment had no effect on the quality of the nest constructed.

Treatment had little effect on subsequent reproductive performance although the fenprostalene treated does showed the least degree of lordosis (P<0.05). This indicates a negative effect of the treatment on this behavioral response. Pimenta *et al.* (1996) found no effect of $PGF_{2\alpha}$ on percentage of does accepting service or percentage of does diagnosed pregnant at 11d after service. They

Table 4 : Least-squares means for the effects of prostaglandin $F_{2\alpha}$ and its analogs on reproductive efficiency of does [1]

	Fenprostalene	Cloprostenol	Prostaglandin $F_{2\alpha}$	Saline
Gestation length (d)	31.4 ± 0.4^{x}	31.1 ± 0.3^{x}	31.3 ± 0.2^{x}	31.9 ± 0.2^{y}
Total kits born per litter (n)	7.3 ± 0.5^{y}	7.2 ± 0.5^{y}	5.8 ± 0.5^{x}	6.7 ± 0.5^{xy}
Kits born live per litter (n)	6.0 ± 0.5^{b}	5.7 ± 0.5^{ab}	4.8 ± 0.5^{a}	5.3 ± 0.5^{ab}
Litter birth weight (g)	309 ± 22^{ab}	303 ± 22^{ab}	285 ± 20^{a}	330 ± 21^{b}
Nest Score[2]	5.3 ± 0.3	5.4 ± 0.3	5.1 ± 0.3	5.2 ± 0.3
Kits weaned per litter (n)	5.1 ± 0.5	4.7 ± 0.5	4.3 ± 0.5	4.2 ± 0.5
Kindling interval (d)	57.7 ± 2.7	57.0 ± 2.6	53.6 ± 2.4	55.7 ± 2.5
Services per litter (n)	1.9 ± 0.1	1.8 ± 0.1	1.7 ± 0.1	1.8 ± 0.1
Lordosis score[3]	2.78 ± 0.05^{a}	2.88 ± 0.05^{b}	2.87 ± 0.04^{b}	2.93 ± 0.05^{b}

1, 2, 3, see footnotes of table 1

attributed this to a different response to the $PGF_{2\alpha}$ than to the synthetic analogs used by UBILLA and RODRIGUEZ (1989a) and REBOLLAR *et al.* (1989). REBOLLAR *et al.* (1989), using artificial insemination and inducing ovulation with GnRH, found that induction of the previous parturition increased the fertility of the does in the subsequent litter. They attributed this to a more rapid fall in the level of plasma progesterone leading to an increased secretion of GnRH, leading to increased FSH and LH, thus resulting in a larger crop of follicles which could develop for the next cycle. The treatment may also reduce the number of does with abnormally high progesterone levels as reported by Boiti *et al.* (1996).

In contrast to the work of UBILLA *et al.* (1989), treatment with $PGF_{2\alpha}$ and the two analogs did not significantly shorten the kindling interval. There was no treatment effect on the number of services required for each litter. UBILLA and RODRIGUEZ (1989a) in a year long study using a $PGF_{2\alpha}$ analog, found an increase in the conception rate from 66.6% to 82.2% for non-treated and treated does, respectively. We found no differences in the long-term responses to $PGF_{2\alpha}$ and its synthetic analogs nor any effect on conception rate. The discrepancies in litter size born and born alive however, indicate some differences do exist in the responses to these compounds.

In conclusion, there appear to be differences between $PGF_{2\alpha}$ and its analogs in litter size born and born alive although no differences were observed in the other traits studied. Furthermore, despite the encouraging indications from the earlier trial with fenprostalene, from these results, it appears that routine use of prostaglandins or prostaglandin analogs does not improve reproductive performance in meat rabbits when natural service is used. In larger units in which artificial insemination and induction of ovulation with GnRH are practiced, reproductive efficiency may be increased.

Received : June 19th, 1997
Accepted : October 29th, 1997

REFERENCES

BOITI C., CANALI C., MONACI M., STRADAIOLI G., VERINI SUPPLIZI A., VACCA C., CASTELLINI C., FACCHIN E. 1996. Effect of postpartum progesterone levels on receptivity, ovarian response, embryo quality and development in rabbits. Proc. 6th World Rabbit Congress, Toulouse, July 1996. Vol. **2**, 45–50.

FACCHIN E., CASTELLINI C., BALLABIO R., 1991. Ciclo riproduttivo della coniglia e suio controllo farmacologico. Nota 2. la programmazione dei parti in coniglie di allevamento intensivo con prostaglandina sintetica (alfaprostol). Riv. Zoot. Vet. **19**,13–18.

FACCHIN E., CASTELLINI C., RASETTI G., BALLABIO R., 1992. L'impiegio di prostaglandina sintetica (alfaprostol) e di PMSG nella sincronizzazione degli estri e dei parti nella coniglia. Riv. Zoot. Vet. **20**,11–14.

HAMILTON H.H., LUKEFAHR S.D., MCNITT J.I., 1997. Maternal nest quality and its influence on litter survival and weaning performance in commercial rabbits. J. Anim. Sci. **75**,926–933.

HARVEY. W.R., 1990. User's Guide for LSMLMW and MIXMDL (PC-2 Version). Ohio State Univ., Columbus

LUKEFAHR S. D., HAMILTON H.H., 1997. Heritability and repeatability estimates of maternal performance traits in purebred and crossbred does. World Rabbit Sci. **5**, 99–105.

LUKEFAHR S., HOHENBOKEN W.D., CHEEKE P.R., PATTON N.M. 1983. Doe reproduction and preweaning litter performance of straightbred and crossbred rabbits. J. Anim. Sci. **57**, 1090–1099.

MCNITT J.I., 1992. Endocrinological approaches for commercial rabbit production. J. Appl. Rabbit Res. **15**,364–397.

MCNITT J.I., LUKEFAHR S.D., 1990. Effects of breed, parity, day of lactation and number of kits on milk production of rabbits. J. Anim. Sci. **68**,1505–1512.

MCNITT J.I., MOODY G.L. Jr., 1990. Effects of month, breed, and parity on doe productivity in southern Louisiana. J. Appl. Rabbit Res. **13**,169–175.

MCNITT J.I., MOODY G.L. Jr., 1991. Gestation lengths of four medium breeds in Louisiana. J. Appl. Rabbit Res. **14**,80–82.

MCNITT J.I., SIMON G.C., MELLAD K.E., 1994. Induction of kindling in rabbit does using fenprostalene, a prostaglandin $F_{2\alpha}$ analog. J. Anim. Sci. **72**(Suppl. 2),17.(Abstr.)

PARTRIDGE G.G., LAMB I.C, FINDLAY M., 1986. The use of a synthetic prostaglandin analogue (Cloprostenol) to control parturition in the commercial rabbit. Anim. Prod. **42**,281–286.

PIMENTA A., REBOLLAR P.G., ALVARINO J.M.R, ALONSO R., 1996. Induction of rabbit parturition by administration of a natural prostaglandin F2α . Proc. 6th World Rabbit Congress, Toulouse, July 1996. Vol. **2**,107–110.

REBOLLAR P.G., RODRIGUEZ J.M., DIAZ M., UBILLA E., 1989. Efecto de la induccion de parto con PGF2 alfa sobre la eficacia de la inseminacion artificial. XIV Simposium Cunicultura, Manresa, Spain. pp. 105–111.

RUFFINI-CASTROVILLI C., NORDIO-BALDISSERA C., 1980. Induction of labor with PGF_{2alpha} and post-natal growth in the rabbit. Proc. 2nd World Rabbit Congress, Barcelona, April, 1980. Vol **1**, 100–106.

UBILLA E., RODRIGUEZ J.M., 1989a. A note on the influence of routine induction of parturition by administration of a synthetic prostaglandin analogue on productivity in the rabbit. Anim. Prod. **49**,129–133.

UBILLA E., RODRIGUEZ. J.M., 1989b. Routine grouping of parturitions when using a new synthetic analogue of prostaglandin $PGF_{2\alpha}$(Etiproston) administered in rabbits on day 29 of pregnancy. Anim. Reprod. Sci. **19**,299–307.

UBILLA E., RODRIGUEZ J.M., DIAZ P., GOSALVEZ F., 1988. Effecto luteolitico de un nuevo analogo sintetico de la prostaglandina F_{2alfa} administrado en conejas en el dia 28 de gestacion. Invest. Agr. Prod. Sanid. Anim. **3**,173–181.

UBILLA E., RODRIGUEZ J. M., GARCIA L.A., FONTAN J., 1989. Influencia de la induccion rutinaria del parto mediante una prostaglandina F2 alfa sintetica (Etiprostin) sobre la productividad de un conejar. Medicina Veterinaria **6**:475–478.