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THE EFFECT OF PARITY, LITTER SIZE AND SEASON OF KINDLING ON SOME PRODUCTIVE TRAITS OF NEWZEALAND WHITE RABBITS

(With 3 Tables)

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(Received at 12/12/1993)

تأثير عدد البطون وعدد الخلفه عند الولاده والموسم على بعض الصفات الانتاجيه فى أرانب النيوزيلاندى الأبيض

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أجريت الدراسه على ١١٨ خلفه أنتجت من ٤٧ أنثى من الأرانب النيوزيلندى الأبيض لدراسة تأثير عدد البطون وحجم الخلفه وموسم الولاده على بعض الصفات الانتاجيه .

وكان لعدد البطون تأثيراً معنوياً على طول فترة الحمل ومتوسط وزن الخلفه الحيه عند الولاده ومتوسط وزن الخلفه عند الفطام بينما لم يكن لها تأثيراً معنوياً على وزن الأم عند الولاده وعدد الخلفه عند عمر ٢١ يومياً وعدد الخلفه عند الفطام . وكان لحجم الخلفه عند الولاده تأثيراً معنوياً على كل الصفات التى تم دراستها عدا وزن الأم عند الولاده وكان تأثير الموسم عند الولاده معنوياً على طول فترة الحمل ومتوسط وزن الخلفه عند عمر ٢١ يوماً وعند الفطام .

وكان الارتباط المظهرى بين وزن الأم عند الولادة واوزان الخلفه التى تم دراستها موجباً ومعنوياً .

SUMMARY

Records from 118 kindling's by 47 does of New Zealand white rabbits were analyzed to study the effect of parity, litter size and season of kindling on some productive traits. Parity of the doe had significant effect on gestation length, mean litter weight of kits born alive, mean litter weight at weaning, while there were no significant effects on dam weight at kindling, litter size and weight at 21 day and litter size at weaning. Moreover, all traits studied, except dam weight at kindling, are highly significant affected by the litter size at brith. The season of kindling had a significant effect on gestation length, mean litter weights at 21 day and weaning. The phenotypic correlations between doe weight at kindling and most of litter weights studied were positive and significant.

INTRODUCTION

Rabbit meat could be a very important source of protein for humans, not only because of its quality but also because rabbits can eat a high fiber feed and transform it into high quality, low fat meat. An important prerequisite to development of a viable rabbit meat industry is establishment of steady supplies of product throughout the year. However, there are numerous causes for current fluctuations in supply and one of the most important aspects of this fluctuations is the effect of season on productivity *(McNITT and MOODY, 1990).*

Productivity in rabbits can be considered a function of reproductive and growth efficiency. Litter size at birth is probably the most important characteristic of reproductive performance in rabbits *(FERRAZ* et al., *1991).* Litter size and weight at 21 days of age are a very good evaluation of doe's maternal ability. As young rabbits depend on their dams entirely until that age. The entire litter weight at 21 days could provide an estimate of the doe's milk production *(LEBAS, 1970 and LUKEFAHR* et al *1983). KHALIL* et al. *(1987)* divided doe productivity into ability to produce young (prolificacy) and maternal or nursing ability, and considered litter size and weight at birth and at weaning to be the most important estimates of doe productivity. Environmental effects must be considered in studies of productive traits, as in studies of

almost all traits. The most important environmental factors are season and parity *(CORREGAL, 1980; CORREGAL et al., 1980; LUKEFAHR et al., 1983; AFIFI and EMARA, 1987; KHALIL et al., 1987; ESTANY et al., 1989; KHALIL et al., 1989; LUKEFAHR et al., 1990; McNitt and LUKEFAHR, 1990, and McNitt and MOODY, 1990).*

The objective of this study was to investigate the effect of parity, litter size and season of kindling on some productive (dam weight at kindling, litter sizes and weights at 21 day and weaning) and reproductive trait (gestation length) of Newzealand white rabbits.

MATERIAL and METHODS

Records from 118 kindling's by does of Newzealand white rabbits were analyzed. Data were collected during 12 month period from January 1992 through December 1992.

The rabbits were housed in wire cages. A commercial pelleted ration containing 16% crude protein, 2.5% crude fat and 18% crude fiber was provided add libitum daily. Fresh water was continuously available via automatic nipples. Does were moved to the buck's cage for mating then returned to their cages and the date of mating was recorded. Pregnancy was tested 10 days after mating by abdominal palpation and does failed to conceive were soon remated. The average breed back interval was 14 days after kindling. Nest material were provided in the cage 27 days after successful mating, within 12 hours from the beginning of delivery and after expulsion of the placenta. The following data were recorded: the number of live kits in the litter and their entire weight, gestation length (Calculated from the day of conception to the day of Kindling), and doe weight at kindling.

All litters were checked daily and any dead kits were removed and recorded. After 21 days post kindling each doe was weighed, the number of kits was recorded and the entire litter was Weighed . Weaning occurred at 28 days after kindling and the number of kits and their entire weight was recorded.

Parity groped into three closses, the first parity, the second parity and the third and more parities. Three closses for litter sizes were from less than 5 litters to more than 10 litters. Season of kindlings was grouped into four seasons; winter (November, Decewber, January), spring (Feburary, March, April), summmer (May, June, July) and Autumn (August, September, October).

Data were analyzed using the General Linear Models Procedure (SAS, 1985) according to the following statistical modle:

$$Y_{ijkl} = U + P_i + L_j + S_k + e_{ijkl}$$

Were: Y_{ijkl} = observed value of a given dependent variable, U= Overall mean. P_i = Fixed effect of the parity (i=1,2 and 3). L_j = Fixed effect of the ith litter size (j= 1,2,3, where 1= from 1 to 5 litters. 2= from 5 to 10 litters, 3= more than 10 litters). Sk=fixed effect of the kth season (k=1,2,3 and 4, where 1=Winter, 2=Spring, Summer=3 and 4= Autumn) and e_{ijkl}= random error, N (0.0^{-2}).

RESULTS

Are presented in Tables 1-3.

DISCUSSION

The least squares analysis of variance and levels of significance due to the parity, season of kindling and litter size on different traits are presented in table 1. Table 2 gives the least squares means and standard errors for different traits.

1. Effect of parity:

Parity of the doe had significant effect on gestation length. mean litter weight of kits born alive, and mean litter weight at weaning. The mean doe weight at kindling was gradually increased from the first to the third party (4264.20 and 4451.20 g, respectively,. However, this increase in weight was nonsignificant. Similar results were obtained by *AFIFI and KADRY (1984)* who found that parity effects were not significant ($P<0.05$) for doe weight at conception or at other stages of gestation.

The mean gestation length was significantly higher in second parity. Similarly, the mean litter weight born alive was significantly higher in second parity (518.11 g), this may indicate increase in litter size born alive in second parity which is reflected on their weight. These results agreed with these reported by *FERRAZ* et al. *(1991)*. Litter sizes at 21 day of age weaning were not affected significantly by parity. However, litter weight only at weaning was significantly affectted by the parity. The mean litter size at 21 day of age was 7.26 in second parity. However, litter size at weaning was highest at 3rd parity. This might have arisen as a result of the increase in maternal ability of the does as parity increased *(LUKEFAHR* et al., *1983)*. Similarly, the mean litter

weight both at 21 day of and at weaning was higher at second parity (2530.95 and 4402.11 g, respectively). The increased litter weight at 21 day of age is a reflection of the increased milk producing ability of doe at second parity *(LEBAS, 1970; LUKEFAHR et al., 1983 and McNITT and MOODY, 1990).*

Parity effects on litter size born and/or litter weight born were found to be non-significant by other investigators *(AFIFI et al., 1976; KHALIL, 1980; AFIFI et al., 1982; LUKEFAHR et al., 1983 and AFIFI and EMARA, 1985).* On the other hand, the effect of parity was very important ($P<0.01$) for all litter sizes and weights at 21 day and weaning with tendency towards an increase in litter size from the 1st to 2nd parity *(FERRAZ et al., 1991) and KHALIL and KHALIL (1991).*

2. Effect of Litter size:

All the traits studied, except dam weight at kindling, were highly significantly affected by the size of litters at birth (Table 1). The mean doe weight at kindling for the different classes of litter size was nearly the same (ranged between 4347.14 and 4357.56 g). Gestation length was shorter (31.37 day) when the doe carried 9 higher number of kits (Table 2). Similar observations were reported by *DIM et al. (1990)* who found that the greater the number of kits per litter, the shorter the gestation length and *McNITT and MOODY (1991)* who found that as litter size increased from 2 to 14 kits, gestation length declined from 33.83 to 31.40 day. The mean weight of litter born alive was highest for the does delivered higher number of kits. The mean litter weight born alive ranged between 359.49 and 586.28 g for the does delivered less than 5 kits and more than 10 kits, respectively. Moreover, litter size at 21 day of age and at weaning (8.86 and 8.84, respectively) was higher for the does delivered more kits alive. Similar observations were reproted by *KHALIL and KHALIL (1991).*

3. Effect of season of kindling:

The season of kindling had a significant effect on gestation length, mean litter weight at 21 day of age and mean litter weight at weaning (Table 1). However. season of kindling had no significant effect on dam at kindling, litter weight born alive. litter size at 21 day and weaning. The mean doe weight at kindling was highest during autumn (4474.01 g). Also, the mean gestation length was longest during autumn (32.58 day). *McNITT and MOODY (1991)* reported a significant effect for season on gestation length with the longest gestations occuring in summer when the smallest litters were born. The mean litter weight born alive was highest during winter (508. 73 g). The

increased mean litter weight born alive during winter is in agreement with results reported by *McNITT and MOODy (1990).* and do not agree with those of *PATTON and CKEEKE (1986).*

The mean litter size at 21 day of age declined steadily from winter (7.51) to summer (6.68). There was a slow increase (6.96) in autumn. This may indicate better productivity of does during autumn and winter seasons. These results are in agreement with those of *McNITT and MOODY (1990).* Mean litter weight at 21 day of age was highest (2618.41 g) during autumn followed by winter season (2505.38 g). This might have arisen as a result of the increase in milk production of the does during that time. These results coincides with the findings of *LUKEFAHR* et al., *1983 and McNITT and MOODY (1990).* The mean number of kits weaned per litter was not affected significahtly by season of kindling. It was highest during winter (7.39) and lowest during summer (6.67). The mean litter at weaning was highest (4534.28 g) during autumn followed by winter (4422.91 g) and was lowest during summer (3759.11 g). This may indicate better growth of kits during winter, which agreed with the results reported by *McNITT and MOODY (1990).*

Similar results were also obtained by *AFIFI and KADRY (1984) and FERRAZ* et al., *(1991).* They reported that season of kindling had no effect on litter size at birth, litter size alive at birth, litter weight at birth, litter size and weight at 21 day and weaning.

4. Phenotypic correlations amongst different traits:

Phenotypic correlations amongst the different traits under investigation are presented in Table 3.

There were positive significant phenotypic correlations between dam weight at kindling with each of gestation length (0.221) and litter weight at 21 day (0.187) and weaning (0.180). This indicate that as the dam weight increased, the litter weight at 21 day and weaning weight also increased. On the other hand, gestation length had negative significant phenotypic correlations with each of litter weight born alive (- 0.216), litter size at 21 day (- 0.269) and weaning (- 0.272), while there were no phenotypic correlations with each of litter weight at 21 day and weaning.

Litter weight born alive had positive highly significant phenotypic correlations with each of litter size at 21 day (0.839), and weaning (0.831) and litter weight at 21 day (0.568) and weaning (0.600). Moreeover, litter size at 21 day had positive highly significant phenotypic correlations with

each of litter weight at 21 day (0.648) and weaning (0.639) and litter size at weaning (0.987). Similar results were recorded by *LUKEFAHR* et al., *(1983) and KHALIL and KHALIL (1991).* In addition, litter weight at 21 day had positive highly significant correlation with each of litter size at weaning (0.650) and litter weight at weaning (0.739). The litter size at weaning had a positive highly significant phenotypic correlation with litter weight at weaning (0.662).

It is rather difficult to know the exact nature of that correlation because of associated environmental influences acting on the doe during gestation and at kindling. Reviewed studies on litter traits in rabbits have indicated a favorable positive phenotypic correlation between of doe at kindling and size and weight of litter produced size and weight *(RAGAB and WANIS, 1960, VENGE, 1963, and KHALIL* et al., *1989).*

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Table (1): Least squares analysis for the effects of parity, litter size and season of kindling on some traits.

S. O. V.	D.F.	Mean Squares						
		Dam weight at kindling	Gestation length	Litter weight born alive	Litter size at 21 day	Litter weight at 21 day	Litter size at weaning	Litter weight at weaning
Parity	2	258803.69	1.98 *	43381.04 **	1.04	220239.40	0.43	3734710.20 *
Litter size	2	2044.90	3.84 **	52688.23 **	143.06 **	4053151.10 **	140.74 **	12036520.63 **
Season of kindling	3	232131.32	8.45 **	7320.31	3.07	1270143.40 *	2.68	3335225.05 *
Error	110	259898.03	0.71	8284.49	2.56	454810.88	2.61	1241095.00

* Significant at level (P < 0.05).

** Highly significant at level (P < 0.01).

Table (2): Least squares means and their standard errors for the effects of parity, litter size and season of kindling on some trails.

Item	N	X + S.E						
		Dam weight at kindling	Gestation length	Litter weight born alive	Litter size at 21 day	Litter weight at 21 day	Litter size at weaning	Litter weight at weaning
Parity:								
1	57	4264.28+ 76.79 [a]	31.52+0.13 [b]	447.96+13.71 [b]	6.93+0.24 [a]	2405.14+181.58 [a]	6.91+0.24 [a]	3885.32 + 167.80 [b]
2	35	4406.59+ 98.55 [a]	31.99+0.15 [a]	518.11+16.17 [a]	7.26+0.28 [a]	2530.95+119.79 [a]	7.11+0.29 [a]	4402.11 + 197.80 [a]
3	26	4451.28+125.09 [a]	31.71+0.21 [ab]	409.67+22.33 [ab]	7.17+0.39 [a]	2325.08+165.47 [a]	7.14+0.40 [a]	4398.85 + 275.34 [ab]
Litter size:								
1 (≤5 Litters)	39	4357.56+ 82.84 [a]	32.05+0.14 [a]	359.49+15.91 [c]	5.13+0.26 [c]	2136.31+110.45 [b]	5.13+0.26 [c]	3594.85 + 179.87 [b]
2 (6-10 Litters)	36	4347.14+ 86.90 [a]	31.88+0.17 [ab]	490.42+18.62 [b]	7.02+0.26 [b]	2586.42+110.75 [a]	7.06+0.27 [b]	4295.80 + 201.26 [a]
>5(7 10 Litters)	43	4340.77+ 73.46 [a]	31.37+0.14 [b]	586.28+11.41 [a]	8.06+0.24 [a]	2727.30+102.94 [a]	8.04+0.24 [a]	4607.37 + 161.56 [a]
Season of kindling:								
1 Winter	32	4426.61+ 96.88 [a]	31.39+0.16 [b]	508.73+17.30 [a]	7.51+0.30 [a]	2505.30+128.16 [ab]	7.39+0.31 [a]	4422.91 + 211.71 [a]
2 Spring	23	4379.32+117.34 [a]	31.36+0.19 [b]	475.36+20.95 [a]	7.33+0.37 [a]	2211.89+155.23 [b]	7.30+0.37 [a]	4198.74 + 256.43 [ab]
3 Summer	30	4216.84+106.86 [a]	31.64+0.18 [b]	477.87+18.94 [a]	6.68+0.33 [a]	2452.54+140.30 [ab]	6.67+0.34 [a]	3759.11 + 231.77 [b]
4 Autumn	33	4474.81+107.88 [a]	32.58+0.18 [a]	479.82+19.12 [a]	6.96+0.34 [a]	2618.41+141.66 [a]	6.86+0.34 [a]	4534.28 + 234.01 [a]

Means within the same classification, in each category, with different superscripts are significant different ($P < 0.05$) from each others.

Table (3): Phenotypic correlations amongst the different traits.

Item	Gestation length	Litter weight born alive	Litter size at 21 day	Litter weight at 21 day	Litter size at weaning	Litter weight at weaning
Dam weight at kindling	0.221 *	0.110	0.056	0.187 *	0.049	0.188 *
Gestation length		-0.216 *	-0.269 **	-0.065	-0.272 **	-0.015
Litter weight born alive			0.839 **	0.568 **	0.831 **	0.609 **
Litter size at 21 day				0.648 **	0.987 **	0.639 **
Litter weight at 21 day					0.650 **	0.739 **
Litter size at weaning						0.662 **
Litter weight at weaning						----

* Significant at level (P<0.05).
** Highly significant at level (P<0.01).