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EFFECT OF REMATING INTERVAL AND MATING TYPE ON SOME PRODUCTIVE AND REPRODUCTIVE PERFORMANCE TRAITS OF NEW ZEALAND WHITE DOE RABBITS UNDER SUMMER EGYPTIAN CONDITIONS

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Data of 166 litters produced by 50 New Zealand White (NZW) adult female rabbits of 6 months of age were used to study the effect of five remating intervals (1, 9, 18, 21 and 28 days after parturition) and an other thirty adult females rabbits at the same age were used to study the effect of two mating types (natural and forced mating for does which refused natural mating) on productive and reproductive performance traits of rabbits, under summer Egyptian subtropical conditions.

Remating interval, the results showed that the litter size at 21 days and at weaning , litter and bunny weight at birth, 21 days and at weaning and bunny preweaning gain of does remated at 28 days were significantly (P<0.01or 0.05) higher than other remating intervals. The preweaning mortality rate was significantly (P<0.01) higher in does remated 1 day than other remating intervals. Daily milk yield was significantly (P<0.01) increased with 64.8% in does remated at 28 days than in does remated at 1 day after parturition. The daily feed and water intake were significantly (P<0.05) increased in does remated at 1 or 28 days than in does remated 18 or 21 days. The final margin was higher in does remated at 1 day than in the other remating intervals. The final does weight were significantly (P<0.05) decreased with 7.2% in does remated 1day than in does remated 28 days. In does remated 1 day the difference between starter and final does weight was higher than other remating intervals, while the lowest value was recorded in does remated 28 days after parturition. Parturition interval, number of services/ conception gestation period and conception rate were significantly (P<0.05) decreased, while the number of parity/ doe was significantly (P<0.05) increased with 89.1% in does remated at 1 day than that in does remated at 28 days after parturition. The highest conception rate and efficiency of doe production (E.D.P) were recorded in does remated 1 day, while the lowest value was recorded in does remated

21 days. The serum total protein, albumin, oestradiol 17-β and prolactin were significantly (P <0.05 or 0.01) affected, while the serum globulin insignificantly affected by remating time.

Mating type, in naturally mating during summer, the litter size and weight at birth, 21 days and weaning were significantly (P<0.05or <0.01) higher by 27.5, 26.7, 53.1, 23.8, 32.5 and 57.1 %, respectively, than in forced mating. Bunny weight at birth, 21 days and weaning, bunny preweaning gain and preweaning mortality were insignificantly affected by mating type. The number of services/ conception, calculated milk yield, feed intake and water intake were significantly (P<0.05or <0.01) increased in does mated naturally than in does mated handily, also the conception rate and water/feed ratio were affected by mating types. The serum total protein, albumin and globulin were not significantly affected by mating type, while it could be observed that the group of does which was naturally mated showed a significant (P <0.01) decrease level of prolactin than in those forced mated. On the contrary, the does which were naturally mated showed a significant (P <0.05) increase in oestradiol 17-β than in those forced mated.

Key words: Heat stress, mating type, remating interval, productive reproductive & traits.

Heat stress is one of the most serious problems facing rabbit production in Egypt. It influences animal welfare, performance, yield and quality of products (El-Maghawry, 1990; Barakat, 2001; Azoz and El-Kholy, 2006; El-Aaser, 2007 and Abdel-Monem *et al.*, 2008)

The time of mating following parturition appeared to have a more effect on patterns of behaviour and fertility (Mendez *et al.*, 1986). Productivity of early or late remating has occupied many investigators without reaching an unanimous conclusion because the higher annual litter number of the early remating does not always give a higher total number of young which obtained annually per doe. Partridge *et al.*(1984) and Cervera *et al.* (1993) reported that presentation of doe to male at 1 to 2 days post- partum increased the number of parturitions per year without affecting the size of litters at weaning . However, other studies showed that increasing remating interval was associated with high litter size at weaning (Mendez et al., 1986) and high number of rabbits weaned per doe per year (Harris *et al.*, 1982).

One of the most interesting principles in the management of rabbit is the selection of the suitable type and time of mating. Numerical productivity of the doe is a very important economic trait in rabbit production (Armero and

Blasco, 1992). Preweaning litter size traits are probably the most important traits in reproductive performance of multiparous animals. In many studies , blood constituents have been used as an indicator to monitor health (Zamet *et al.*, 1979), reproduction (Parker and Blowey, 1976), and physiological status of the animals (Hussen *et al.*, 1992). However, the literature about the suitable type of mating are lacking.

Therefore, the present work was planned to determine the effect of remating intervals (1, 9, 18, 21 and 28 days) after parturition and to evaluate the effect of mating types (natural and forced mating by hand) on doe productive and reproductive performance traits, some blood components as well as, post weaning litter performance, in summer conditions of Egypt.

MATERIALS AND METHODS

The present study was carried out tow experiments at the Department of Animal Production, Faculty of Agriculture, Zagazig University, Zagazig, Egypt. The practical work was conducted at a commercial private farm in Zagazig city during the period from May to October, 2007.

Experiment 1:

Data of 166 litters produced by 50 New Zealand White (NZW) adult female rabbits of 6 months of age nearly similar in average initial weight were used to study the effect of five remating intervals (1, 9, 18, 21 and 28 days after parturition). Rabbits were randomly divided into 5 treatment groups (10 animals in each).

Experiment 2:

Thirty New Zealand White (NZW) adult female rabbits at sex months of age were used to study the effect of two mating types (natural and forced mating by catch hand). Rabbits were randomly divided into 2 treatment groups (15 animals in each). All groups were nearly similar in average initial body weights.

The basal diet consisted of 28% alfalfa hay, 18% barley, 18% soybean meal (44%), 25% wheat bran, 6% yellow corn, 3 % molasses, 1.1% limestone, 0.3% sodium chloride and 0.6 % vitamin and mineral premix. The basal diet contained of 18.2 % crude protein, 13.4% crude fiber, 2.3% ether extract, 2656 digestible energy (kcal/kg) according to NRC (1977).

All rabbits were kept under the same managerial, hygienic and environmental conditions.

Does in each experiment were individually reared in wire cages. Their offspring's were collectively raised in cages, in the same batteries, in a well ventilated building, fresh water was automatically available all the time by

stainless steel nipples fixed in each cages. All doe cages were equipped with feeders and nipples. At mating, rabbits were individually transferred to the buck cages for copulation and returned to their own hatches, each doe was palpated at 10 days post-mating to be rebred until pregnancy was establish. Within 12 hours after kindling, litter kits were recorded and weaned at 30 days of age.

The traits studied were some performance traits (feed and water intake, gestation length, litter size and weight and bunny weight at birth, 21 days and weaning, pre-weaning gain, pre-weaning mortality, conception rate, parturition interval, number of parity, number of services / conception, efficiency of doe production and economical study) and some blood components (plasma total proteins, albumin, globulin, oestradiol 17-β and prolactin).

Doe milk consumed by the pups from birth to 21 days of age was estimated by the following equation:

Y = Litter weight gain during the period 0-21days (kg) / 0.56

Where, Y was the milk consumed by pups during the period 0-21days of age, 0.56 was standard figure given by Cowie (1969) for the NZW strain

Efficiency of doe production (EDP) was calculated by following suggested equation:

$$EDP=\left[\frac{(365/x)Y}{10.4x9}\right]100$$

Where, x was the remeating intervals, Y was the litter size at birth, 365=days of year, 10.4= the best mean to number of parity and 9 = The best mean of litter size at birth.

After mating by 8 hours the blood samples were collected from 3 does in each treatment. Blood was collected from the marginal ear vein after shaving and cleaning with alcohol in less than 2 minutes into dry clean centrifuge tubes containing some drops of heparin. Plasma was separated by centrifugation at 3000 rpm for 20 minutes and kept in a deep freezer at -20oC until analysis. Total proteins, albumin, oestradiol 17-β and prolactin concentrations in plasma were estimated using commercial kits according to the procedure outlined by the manufacturer. Globulin values were obtained by subtracting the values of albumin from the corresponding values of total proteins.

In order to study the combined effects of temperature and humidity, temperature humidity index (THI) was calculated according to the formula of Marai *et al.* (2001) as follows:

THI= dboC-{(0.31-0.31RH)(dboC-14)},

Where dbo C= dry bulb temperature in Celsius and RH = RH % /100. The estimated values of THI were classified as follows: <22.2 = Absence of heat

stress, 22.2 – <23.2= Moderate heat stress, 23.3 – <25.5 = Severe heat stress and 25.5 and more = Very severe heat stress.

Data obtained were statistically analyzed by using completely randomize design according to Snedecor and Cochran (1982) by the following model:

$X_{ik} = \mu + P_i + E_{ik}$,

Where μ = General mean, Pi = Fixed effect of i^{th} remating intervals 1, 9,12, 18, 21 and 28 days after parturition) or mating types (natural and forced mating by catch hand) and Eik = Random error.

Differences among means were tested by Duncan's multiple range test (Duncan, 1955).

RESULTS AND DISCUSSION

The Temperature – humidity index (THI) values estimated were 18.9 at winter (mild period) and 24.7 at summer (hot period), indicating absence of heat stress during winter (less than 22.2) and exposure to severe heat stress during the hot period (23.3-25.5) similar to that reported by Marai *et al.*(1996).

Remating interval (Experiment 1):

Data presented in Table 1 show that the litter size at 21 days and at weaning, litter weight and bunny weight at birth, 21 days and at weaning and bunny preweaning gain of does remated at 28 days were significantly ($P < 0.01$ or 0.05) higher than other remating intervals. The low results obtained for litter size at birth, 21 days and at weaning in does remated at 18 or 21 days after parturition. Also, the low results obtained for litter weight at birth, 21 days and at weaning in does remated at 1 day after parturition. This may be due to the short time for reserve recovery between weaning and the next parturition (Toson *et al.*, 1995 and Toson, 2000). Late mating allows a wider resting period from weaning to parturition. Consequently, does will have a longer time to accumulate reserves (Partridge *et al.*, 1984, Mendez *et al.*, 1986 and Tawfeek, 1995)

Data in Table 1 show that the preweaning mortality rate in does remated 1 day was significantly ($P < 0.01$) higher than other remating intervals. This may be due to the higher litter size at birth and lower milk production of the pregnant does during lactation period in does remated one-day after parturition. These results not agree with those obtained by Toson *et al.* (1995). Daily milk yield was significantly ($P<0.01$) increased with 64.8% in does remated at 28 days after parturition than in does remated at 1 day. These results may be attributed to the variation of litters weight gain from birth to 21 days by does remated 1 and 28 days after parturition. The daily feed and water intake were significantly

Table 1. Effect of remating interval on productive performance and economic study of NZW doe traits under subtropical hot conditions of Egypt.

Items	Remating intervals after parturition (Days) at 1th	9th	18th	21th	28th	Sig.
Productive performance:						
Litter size at:						
Birth	6.7 [a] ±0.38	4.3 [b] ±0.65	4.0 [b] ±0.54	3.9 [c] ±0.84	6.9 [a] ±0.50	**
21 days	4.4 [b] ±0.53	3.9 [bc] ±0.61	3.6 [c] ±0.41	3.5 [c] ±0.78	5.8 [a] ±0.54	**
Weaning	3.9 [b] ±0.46	3.3 [b] ±0.61	3.0 [b] ±0.64	3.1 [b] ±0.74	5.6 [a] ±0.53	**
Litter weight (g) at:						
Birth	265.0 [b] ±5.1	192.1 [c] ±6.7	178.4 [c] ±7.0	178.3 [c] ±6.1	325.5 [a] ±8.3	**
21 days	1244.0 [b] ±21	1175.1 [b] ±28	1147.9 [b] ±37	1125.6 [b] ±19	1940.1 [a] ±26	**
Weaning	1840.0 [b] ±33	1687.3 [b] ±39	1672.8 [b] ±46	1786.8 [b] ±40	3392.5 [a] ±35	**
Bunny weight (g) at:						
Birth	39.55 [b] ±0.87	44.67 [a] ±0.57	44.60 [a] ±1.00	45.73 [a] ±1.3	47.17 [a] ±1.2	**
21 days	282.7 [b] ±10.0	301.3 [ab] ±9.5	318.85 [a] ±8.88	321.6 [a] ±11.3	334.5 [a] ±8.79	*
Weaning	471.8 [b] ±10.2	511.3 [ab] ±11.2	557.6 [ab] ±11.0	576.4 [a] ±13.7	605.8 [a] ±7.63	*
Bunny pre weaning gain (g)	432.3 [b] ±9.69	466.6 [b] ±11.0	513.0 [a] ±12.31	530.7 [a] ±13.9	558.6 [a] ±7.89	**
Daily milk yield (g)	74.1 [b] ±5.3	69.9 [b] ±3.7	68.3 [b] ±3.7	67.0 [b] ±4.2	115.5 [a] ±6.3	**
pre weaning mortality (number)	2.8 [a] ± 0.45	1.0 [b] ±0.27	1.0 [b] ±0.21	08 [b] ±0.2	1.3 [b] ±0.24	**
Fed intake (g)	295.2 [a] ±4.37	245.3 [ab] ±5.6	214.4 [b] ±5.0	217.3 [b] ±5.1	235.0 [a] ±8.41	*
Water intake (ml)	448.2 [a] ±6.2	358.2 [ab] ±4.9	330.4 [b] ±4.1	310.9 [b] ±5.3	322.7 [b] ±4.9	*
Water/ Feed (%)	151.8151.8	146.0	154.1	143.1	137.3	
Economic study:						
Feed cost (LE)	106.3	88.3	77.2	78.2	84.6	
No of bunny weaned/doe	19.0	11.6	8.7	8.6	14.4	
Return from liter size at weaning (LE)	228	139.2	104	103.2	172.8	
Final margin (LE)	121.7	50.9	27.2	25	88.2	

Price: Experimental diet = 2.0 LE per kg and weaning rabbit= 12 LE per head. Margin per doe = Return from all weaning rabbits per doe during the experimental period – feed cost . Other doe costs were assumed constant.

NS = Not significant,* = P<0.05 and ** = P<0.01, Sig.=Significance.

Means bearing different letters in the same column within each factor differ significantly (P≤0.05).

($P < 0.05$) increased in does remated 1 or 28 days than in does remated at 18 or 21 days (Table 1). These results may be attributed to the smaller size of litters born by does remated 1 and 28 days after parturition. Similar results were obtained by Toson *et al.* (1995), who found that the highest daily feed intake was recorded for does remated 28 days after parturition, while the lowest value was recorded for does remated 14 days after parturition.

The final margin was higher in does remated 1 or 28 days, while the lowest value was recorded in does remated 18 or 21 days (Table 1). These results may be attributed to the number of bunny weaned by does remated at 1 and 28 days after parturition. Data in Table 2 show that the final does weight was significantly ($P<0.05$) decreased with 7.2% in does remated at 1 day than in does remated at 28 days. In does remated 1 day the difference between starter and final does weight was higher than other remating intervals, while the lowest value was recorded in does remated 28 days after parturition . This may be due to the short time for reserve recovery between weaning and the next parturition (Toson *et al.,* 1995 and Toson, 2000). Late mating allows a wider resting period from weaning to parturition. Consequently, does will have a longer time to accumulate reserves (Partridge *et al.,* 1984, Mendez *et al.,* 1986 and Tawfeek, 1995). Parturition interval, number of services/ conception, gestation period and conception rate were significantly ($P < 0.05$) decreased, while the number of parity / doe was significantly ($P < 0.05$) increased with 89.1% in does remated at 1 day than in does remated at 28 days. The highest conception rate and efficiency of doe production (E.D.P) were recorded in does remated 1 days, while the lowest value was recorded in does remated 21 days (Table 1). These results show that the proportion of does remated immediately after parturition or after weaning their litters (at 28 days) have higher response to pregnancy than those mated 12, 18 or 21 days after parturition. Van-done Broeck and Lampo (1975) found that the conception rate of doe remated 28 days after parturition was higher than that of doe remated 11 days after parturition. Foxcroft and Hasnian (1973) attributed the lower conception rate of does rebred 14 days after parturition to depression of ovulation response to mating due to suckling

Data in Table 2 show that the serum total protein, albumin, oestradiol 17-β and prolactin were significantly ($P < 0.05$ or 0.01) affected, while the serum globulin insignificantly affected by remating time. Realizing of prolactin and gonadotrophin hormones cause the decrease in ovulation rate (Foxcroft and Hasanain, 1973), and cause the increase in milk yield (Yamani *et al.,* 1991).

Mating type (Experiment 2):

In naturally mating during summer, the litter size and weight at birth, 21 days and weaning were significantly ($P<0.05$or 0.01) increased by 27.5, 26.7, 53.1, 23.8, 32.5 and 57.1 % , respectively than in forced mating (Table3).

Table 2. Effect of remating interval on doe weight, reproductive performance, efficiency of doe production (E.D.P) and some blood components of NZW doe rabbits under subtropical hot conditions of Egypt..

Items	Remating intervals after parturition (Days) at					Sig.
	1th	9th	18th	21th	28th	
Starter doe weight (g)	3111.8 ±24.67	3169.2 ±32.55	3132.5 ±30.23	3166.7 ±33.2	3143.1±31.02	NS
Final doe weight (g)	2830.2 c ±21.9	2970.5b±27.9	2981.9 a ±24.7	3010.1a±30.	3049.6 a ±30.'	*
Final doe weight (%)	92.8	97.4	97.8	98.7	100	
Shining doe weight (%)	- 9.1	- 6.3	- 4.8	- 4.9	- 3.0	
Reproductive performance:						
Parturition interval (Days)	37^{e}±3.2	51^{bc} ±4.0	62^{a} ±3.6	65^{a} ±4.6	70^{a} ±4.4	*
No. of parity / doe	4.86^{a} ±0.41	3.53^{ab} ±0.49	2.90^{b} ±0.25	2.77^{bc}±0.35	2.57^{c}±0.34	*
No. of services / conception)	1.4^{e}±0.14	2.1^{b} ±0.18	2.2^{b} ±0.24	2.9^{a} ±0.20	1.7^{c} ±0.17	*
Gestation length (days)	30.97^{b}±0.11	32.41^{a} ±0.16	32.65^{a} ±0.18	32.91^{a} ±0.10	32.83^{a} ±0.14	*
Conception rate (%)	78	63	65	40	72	
E.D.P	70.6	32.9	25.2	23.4	38.4	
Some blood components:						
Total protein g/dl	6.3^{b} ±0.04	6.8^{a}±0.07	6.8^{a}±0.03	7.0^{a}±0.05	5.9^{b} ±0.03	*
Albumin g/dl	3.2^{b} ±0.03	3.5^{b} ±0.02	3.5^{ab}±0.03	3.9^{a}±0.04	3.0^{b} ±0.03	*
Globulin g/dl	3.1±0.04	3.3±0.03	3.3±0.06	3.1±0.03	2.9±0.02	
Oestradiol 17-β pg/ml	16.2^{a}±0.5	15.2^{a}±0.9	12.9^{bc} ±0.7	10.7^{c} ±0.5	12.3^{c} ±0.6	*
Prolactin ng/ml	15.2^{c}±1.5	19.7^{c}±2.3	27.3^{a}±1.9	30.4^{a}±1.2	18.1^{c}±2.1	**

Means bearing different letters in the same column within each factor differ significantly (P≤0.05).
NS = Not significant, * = P<0.05 and ** = P<0.01.
E.D.P =Efficiency of Doe Production

Table 3. Effect of mating type on productive, reproductive traits, economic study and some blood components of NZW doe rabbits under subtropical hot conditions of Egypt.

Items	Natural mating (Free)	Hand mating (Catching)	Sig.
Litter size at			
Birth	6.5±0.42	5.1±0.51	*
21 days	5.7±0.45	4.5±0.47	*
Weaning	4.9±0.38	3.2±0.29	*
Litter weight (g) (g) at			
Birth	285.4±7.9	230.5±5.3	*
21 days	2095.3±27.1	1581.3±21.8	**
Weaning	2411.3±32.5	1535.0±23.4	**
Bunny weight (g) at			
Birth	43.9±1.9	45.2±2.6	NS
21 days	367.6±8.1	351.4±8.7	NS
Weaning	492.1±9.30	479.7±10.01	NS
No. of parity/doe	4.5±0.21	3.5±0.27	*
Bunny preweaning gain (g)	448.2±9.9	434.5±10.3	NS
Pre weaning mortality (number)	1.6±0.11	1.9±0.15	NS
No. of services/conception	1.63±0.17	2.17±0.21	*
Conception rate (%)	69.3	54.8	
Total milk yield (g)	3741.6±79.5	2823.8±64.3	**
Feed intake (g)	312.5±4.9	274.9±5.1	*
Water intake (ml)	372.8±7.1	319.4±6.0	*
Water / Feed ratio	119.3	116.2	
Economic study:			
Feed cost (LE)	112.5	98.96	
No of bunny weaned/doe(experimental period)	22.1	11.2	
Return from liter size at weaning (LE)	265.2	134.2	
Final margin (LE)	152.7	35.24	
Some blood components:			
Total protein g/dl	5.9±0.06	6.1±0.05	NS
Albumin g/dl	3.0±0.03	3.1±0.04	NS
Globulin g/dl	2.9±0.02	3.0 ±0.03	NS
Oestradiol 17-β pg/ml	14.2±0.9	11.1±0.7	*
Prolactin ng/ml	17.6±1.3	24.3±1.9	**

Price: Experimental diet = 2.0 LE per kg and weaning rabbit= 12 LE per head. Margin per doe = Return from all weaning rabbits per doe during the experimental period – feed cost . Other doe costs were assumed constant.

NS = Not significant,* = $P<0.05$ and ** = $P<0.01$, Sig.=Significance.

This result due to the effect of fear-provoking stimuli and stress of hand mating and the higher litter weight at weaning of does naturally mated attributed to the higher milk yield. The obtained results are in fairly agreement with those reported by El-Maghawry *et al.* (1988), Tawfeek and El-Gaafary (1991) and Karousa *et al.* (1999), who found that means of litter weight were significantly higher in natural mating than in handing mating.

Bunny weight at birth, 21 days and weaning, puny preweaning gain and preweaning mortality were not significantly affected by mating type. Similar trend were obtained by El-Maghawry *et al.*,(1988); Tawfeek and El-Gaafary (1991) and Karousa *et al.*(1999).

Table 3 show that the number of services/ conception, total milk yield, feed intake and water intake were significantly ($P<0.05$ or 0.01) increased on does mated naturally than that of does mated handily. Also, the conception rate and water/feed ratio were increased on does mated naturally than that of does mated handily. The low value of conception rate of does which were forced mated by hand attributed to the high level of prolactin and low level of oestradiol 17-β hormones in blood during summer season in preovulatory period due to the handling of does during mating, which casusing a stress induced release of prolactin and low level of oestradiol 17-β hormones. Ovulation in the doe rabbit is brought about by physical stimulation of the perineal, pudendal and /or vaginal areas of the doe that result in multiple, broad-based nerve stimuli to the hypothalamus, this result in release of gonadotropin releasing hormone that causes the luteinizing hormone spike that actually initiates the ovulatory process (Ramirez and Beyer, 1988).

The final margin was higher for does mated naturally than in forced mating (Table3). These results may be attributed to the number of parity and the number of bunny weaned by does mated naturally.

Data in Table 3 show that the serum total protein, albumin and globulin were insignificantly affected by mating type, while it could be observed that the group of does which was naturally mated showed a significant ($P<0.01$) decrease level of prolactin than in those hand mated. On the contrary, the does which were naturally mated showed a significant ($P<0.05$) increase in oestradiol 17-β than in those hand mated. These results may be attributed to the handing by the human which was considered likely to be a psychological stressor for does. Stress depressed reproductive performance in several animal species due to the hypothalamic release of releasing factor (Moberg, 1991 and Tantin *et al.*, 1995).

Conclusively, it could be concluded the results of this study that late remating of does after parturition from 18, 21 or 28 days and using forced mating depressed productive and reproductive performance, under summer conditions of Egypt.

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تأثير الفترة اللازمة لإعادة التلقيح بعد الولادة ونوع التلقيح على أداء إناث الأرانب النيوزيلندى الأبيض تحت ظروف الصيف في مصر

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تم استخدام إجمالي ٣٥ أنثي أرانب نيوزيلندي أبيض عند عمر ٦ شهور ذات متوسط وزن جسم متساوى لدراسة تأثير خمس فترات بين تلقيحتين (١، ٩، ١٨، ٢١، ٢٨ يوم بعد

الولادة)، وكذلك تم استخدام عدد ٣٠ أنثي أرانب نيوزيلندى أبيض بالغة في نفس العمر لدراسة أثر نوعين من التلقيح (التلقيح الطبيعي والتلقيح الإجباري بواسطة اليد) على صفات الأداء الإنتاجي والتناسلي للأرانب تحت ظروف الصيف في مصر.

نتائج الفترة بين تلقيحتين أظهرت أن وزن وحجم البطن ووزن الخلفة الواحدة عند الميلاد و ٢١ يوم والفطام وكذلك الزيادة في وزن الخلفة قبل الفطام قد تأثرت معنوياً (٠,٠٥، ٠,٠١) بفترات التلقيح بعد الولادة. كانت نسبة النفوق قبل الفطام أعلي معنوياً (٠,٠١) لدى خلفة الأمهات التي تم تلقيحها بعد يوم من الولادة عن باقي الفترات بين التلقيحات. ازدادات كمية اللبن معنوياً (٠,٠١) بنسبة ٦٤,٨% في الأمهات التي تم إعادة تلقيحها بعد ٢٨ يوم من الولادة عن تلك التي تم إعادة تلقيحها بعد يوم واحد من الولادة. استهلاك اليومي من العلف والماء ازداد معنوياً (٠,٠٥، ٠,٠١) في الأمهات التي تم تلقيحها بعد يوم وبعد 28 يوم من الولادة عن تلك التي تم إعادة تلقيحها بعد ١٨و ٢١ يوم من الولادة. العائد النهائي من الأمهات التي تم إعادة تلقيحها بعد يوم واحد من الولادة كان من العائد من الأمهات التي تم تلقيحها بفترات مختلفة بعد الولادة. أعلي تغير سلبي في وزن الجسم للأمهات كان في تلك التي تم إعادة تلقيحها بعد يوم واحد من الولادة. انخفضت معنوياً (٠,٠٥) الفترة بين ولادتين وعدد التلقيحات اللازمة للتقيحة المخصبة ومدة الحمل ومعدل الحمل، بينما ازداد معنوياً (٠,٠٥) عدد البطون لكل أم بنسبة ٨٩,٨% للأمهات التي تم إعادة تلقيحها بعد يوم واحد من الولادة عن تلك التي تم إعادة تلقيحها بعد ٢١ يوم من الولادة. تم تسجيل أعلى معدل حمل وأعلي كفاءة إنتاجية للأم للأمهات التي تم إعادة تلقيحها بعد يوم واحد من الولادة، بينما سجلت أقل القيم للأمهات التي تم إعادة تلقيحها بعد يوم ٢١ من الولادة. تأثر معنوياً (٠,٠٥، ٠,٠١) محتوي سيرم الدم من البروتين الكلي والألبومين والاستراديول ١٧ بيتا والبرولاكتين بالفترات بين التلقيحتين، بينما لم تتأثر قيم الجلوبيولين بالفترات بين التلقيحتين.

بالنسبة لنوع التلقيح، فقد ازدادات معنوياً (٠,٠٥، ٠,٠١) حجم ووزن البطن عند الميلاد و ٢١ يوم والفطام بنسب ٢٧,٥، ٢٦,٧، ٣٥,١، ٢٣,٨، ٣٢,٥، ٥٧,١% علي التوالي في التلقيح الطبيعي عن التلقيح الإجباري. لم يتأثر معنوياً كل من وزن الخلفة الواحدة عند الميلاد و ٢١ يوم والفطام وكذلك الزيادة في وزن الخلفة الواحدة ونسبة النفوق قبل الفطام بنوع التلقيح. ازدادت معنوياً (٠,٠٥، ٠,٠١) كل من عدد التلقيحات اللازمة للحمل، وكمية اللبن المحسوبة واستهلاك العلف والمياه للأمهات التي تم تلقيحها طبيعياً عن تلك التي تم تلقيحها إجبارياً باليد، كذلك تأثر كل من معدل الحمل ونسبة استهلاك العلف للمياه. لم يتأثر معنوياً كل من محتوي سيرم الدم من البروتين الكلي والألبومين والجلوبيولين بنوع التلقيح، ولكن لوحظ انخفاض معنوي (٠,٠١) في البرولاكتين لدى الأمهات التي تم تلقيحها طبيعياً عن تلك التي تم تلقيحها إجبارياً. وعلي العكس من ذلك فإن الأمهات التي تم تلقيحها طبعياً قد ازداد معنوياً (٠,٠٥) لديها هرمون الأستراديول ١٧ بيتا عن تلك التي تم تلقيحها إجبارياً.