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MAGNITUDE AND DIRECTION OF GENETIC-ENVIRONMENTAL INTERACTION IN RABBITS WITH SPECIAL REFERENCE TO LIVE AND SLAUGHTER PERFORMANCE AND CARCASS CUT-OUT

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SUMMARY : The data were collected on sixty New Zealand White (NZW) and sixty Californian (CAL) weaned male rabbits used to investigate the magnitude and direction of genetic environmental interaction. Half the rabbits in each group was fed *ad libitum* on commercial pelleted ration containing Zinc bacitracin (ZIN) and the other half on ration containing Flavomycin (FLA). For all rabbits, daily gain, daily feed intake and feed conversion rate were calculated for entire interval from weaning (0) to final weight (8 weeks) and sub-intervals (0–4 and 4–8 weeks). Half the rabbits in each breed-promoter type group (n = 15) were slaughtered after 8 weeks from weaning and evaluated for slaughter and carcass cut-out traits. Significant interactions of breed with promoter type were detected fo carcass percentage and for the proportion of the carcass weight occurring in the fore and hind limbs (P<0.05). The knowledge of such interaction may lead to recommend the specific use of FLA for NZW rabbits and the specific use of ZIN for CAL. Besides, the absence of interaction of breed with promoter type in terms of live performance and yield of non–limb carcass components lead to conclude that while the faster gainer and more efficient feed converter breed (NZW) under one promoter type treatment was also the best under the other promoter type. NZW tended (P<0.01) under both types of promoters to have more proportion of the carcass weight occurring in the head and less proportion in the trunk.

RÉSUMÉ : Amplitude et direction de l'interaction génétique-environement chez le lapin, spécialement en ce qui concerne les performances à l'abattage et la découpe de la carcasse.
Les données ont été collectées sur des lapins mâles servés, soixante Néo-Zélandais Blancs (NZW) et soixante Californiens (CAL), qui ont été utilisés pour étudier l'amplitude et la direction des interactions génétique-environement. La moitié des lapins de chaque groupe ont été nourris ad libitum *avec un granulé du commerce contenant du Zinc Bacitracine (ZIN) et l'autre moitié avec une ration contenant de la Flavomycine (FLA). Pour tous les lapins, le gain de poids journalier, la consommation journalière et l'indice de consommation ont été calculés pour la période complète allant du sevrage (0) au poids final (8 semaines) et pour les intervals intermédiaires (0–4 semaines et 4–8 semaines). La moitié des lapins de chaque race (n = 15) ont été abattus à 8 semaines après le sevrage et les performances à l'abattage et la découpe des carcasses ont été évaluées.*
Des interactions significatives de la race avec le type d'activateur de croissance ont été détectées pour le rendement de la carcasse et pour la proportion des pattes avant et arrière par rapport au pois de la carcasse (P<0.05). La connaissance de telles interactions peut conduire à recommander l'usage spécifique de FLA pour les lapins NZW et de ZIN pour les CAL. En outre l'abscence d'interaction de la race avec le type d'activateur de croissance en terme de performances d'élevage et de rendement des composants de la carcasse autres que les pattes, amènent à conclure que la race détenant le gain le plus rapide et le meilleur indice de consommation (NZW) soumis à un seul des activateurs de croissance est aussi la meilleure avec les autres activateurs. Sous les deux traitements les NZW tendent (P<0.01) a avoir, par rapport au pois de la carcasse, un poids de tête plus élevé et un poids du tronc moins élevé.

INTRODUCTION

Knowledge of the magnitude and direction of genetic–environmental interaction is important when deciding on the environment which maximizes performances for specific genetic groups. According to the degree of genetic–environmental interaction , the phenotypic raking of genotypes is altered by changes in the environment (DICKERSON, 1962).

By tradition, domestic commercial rabbit producers maintain purebred New Zealand White (NZW) and Californian (CAL) stocks. The suggested use in rabbit production practices, of different types of growth promoters (GREPPI *et al.*, 1982 ; OCKERMAN, 1982) raises the question as to whether or not the conventional rabbit purebreds rank in a similar manner under different types of growth promoters. LEBAS (1992) pointed out that the diets of rabbits may influence the final classification of the genotypes.

This study was designed to investigate the magnitude and direction of genetic–environment interactions in NZW and CAL rabbits subject to treatment with two types of growth promoters.

MATERIAL AND METHODS

This study was conducted at the Rabbit Farm of University of Zagazig, Faculty of Agriculture, Zagazig, Egypt. The data were collected on sixty New Zealand White (NZW) and sixty Californian (CAL) weaned male rabbits (at approximately 35 days). All rabbits were allowed, for 8 weeks from weaning, to eat *ad libitum* a commercial pelleted ration. The pelleted ration was consisting of 25 % barley, 25 % wheat bran, 31 % alfalfa hay, 14 % soybean meal, 3 % molasses, 1.6 % limestone, 0.3 % sodium chloride and 0.1 % vitamin and mineral premix. The ration contained 16.8 % crude protein, 13.25 % crude fibre and 2.11 % ether extract.

Half the rabbits in each breed group were fed a ration containing Zinc bacitracin (ZIN) and the other half on a ration containing Flavomycin (FLA). Originally, for the purpose of a detailed growth promoting study the dose/promoter type was variated (10 animals/dose/type/breed) to compare ZIN at 20, 40 or 80 mg/kg diet with FLA at 2, 4 or 8 mg/kg diet. However, for the purpose of the present investigation of the interaction of breed with promoter type the variation source dose/type breed was corrected for through its inclusion in the model.

All rabbits were weekly weighted permitting the calculation of average daily gain (g/day) together with average daily feed intake (g/day) and feed conversion (g feed/g gain) for the whole interval from weaning (0) to slaughter (8 weeks) and for sub–intervals (0–4 and 4–8 weeks).

Half the rabbits (n = 15) in each breed–promoter type–group were slaughtered then dressed (BLASCO *et al.*, 1992) and separated the carcass and some non-carcass components (alimentary tract, liver, kidney fat and heart). The carcass was jointed into four cuts (head, fore limbs, hind limbs and trunk).

The data were analysed by least squares procedure of the General linear Model Program of SAS (1982) according to the following model :

$$Y_{ijkl} = U + B_i + T_j + BT_{ij} + D_{k(ij)} + E_{ijkl} \quad (1)$$

Where

Y_{ijkl} = the analysed trait for the l^{th} animal from the i^{th} breed, j^{th} treatment and k^{th} dose,
U = the overall mean,
B_i = the fixed effect of the i^{th} breed (i = 1...2),
T_j = the fixed effect of the j^{th} treatment (j =1.2),
BT_{ij} = the interaction between the i^{th} breed and the j^{th} treatment,
$D_{k(ij)}$ = the fixed effect of the k^{th} dose within the i^{th} breed and the j^{th} treatment,
E_{ijkl} = the random error.

Means within factors were separated by Duncan's new multiple range test (DUNCAN, 1955).

Slaughter data were analyse by analysis of covariance according to the following model :

$$Y_{ijkl} = U + B_i + T_j + BT_{ij} + b(x_{ijkl} - \bar{x}) + E_{ijkl} \quad (2)$$

Where
Y_{ijkl}, U, B_i, T_j, BT_{ij}, $D_{k(ij)}$ and E_{ijkl} are defined in the previous model (1),
b = regression coefficient of y on x,
x_{ijkl} = slaughter weight on the l^{th} animal in the i^{th} breed, j^{th} treatment and k^{th} dose and $\bar{x}$ is the arithmetic mean of the x's.

RESULTS AND DISCUSSION

Live performance

Least squares means for daily gain, feed intake and feed conversion are summarized in Table 1 along with the mean squares for the sources of variations.

Daily gain

The interaction of rabbit breed with promoter type was not significant for rate gain (P>0.10) between 0 and 8 weeks of treatment. Swine genotype x feeding regime interactions for rate of gain were reported to be non significant (OMTVEDT *et al.*, 1962 ; CAMERON *et al.*, 1988) or significant (SALMELA *et al.*, 1969).

The average daily gain for NZW rabbits was greater (P<0.001) than that for CAL during the intervals from 0 to 4 or to 8 weeks of trial. Rabbits on FLA did not differ significantly (P>0.10) in rate of gain from those fed the ZIN.

The high level of ZIN (80mg) reduced the daily gain more than other both levels (P<0.01 only in CAL), while the high level of FLA recorded higher daily gain (P<0.01) than the other levels in both breeds.

A significant increase in rate of gain were reported from use of ZIN (KING, 1976 ; BERTA *et al.*, 1983) and FLA (DAMIAN *et al.*, 1982 ; OCKERMAN, 1982). On the other hand, these findings do not agree with those obtained by CASADY *et al.* (1964) and KING (1966, 1967), who found that feeding of antibiotics to growing rabbits did not influence the rate of live weight gain.

Table 1 : Least squares means (± standard error) and analysis of variance (mean squares) for live performance traits.

Classi-fication	No.	Average daily gain (g/day) for (weeks from weaning) (0–4)	(4–8)	(0–8)	Average daily feed intake (g/day) for (weeks from weaning) (0–4)	(4–8)	(0–8)	Feed conversion ratio (g feed/g gain) for (weeks from weaning) (0–4)	(4–8)	(0–8)
Breed										
NZW	60	33 ± 1.11	29 ± 0.53	31 ± 0.48	95 ± 0.59	132 ± 0.81	114 ± 0.43	3.47 ± 0.13	4.86 ± 0.15	4.08 ± 0.09
CAL	60	29 ± 0.88	28 ± 0.41	28 ± 0.33	94 ± 0.42	131 ± 0.72	113 ± 0.31	3.12 ± 0.10	4.66 ± 0.11	3.71 ± 0.07
Treatment										
ZIN	60	31 ± 0.99	28 ± 0.43	30 ± 0.41	95 ± 0.45	132 ± 0.52	113 ± 0.41	3.39 ± 0.11	4.77 ± 0.14	3.97 ± 0.07
FLA	60	30 ± 1.07	28 ± 0.51	29 ± 0.52	94 ± 0.57	132 ± 0.69	113 ± 0.52	3.20 ± 0.12	4.75 ± 0.12	3.82 ± 0.05
Breed x Treatment										
NZW x ZIN	30	31 ± 1.40	29 ± 0.86	30 ± 0.71	96 ± 0.74	132 ± 1.12	114 ± 0.67	3.25 ± 0.17	4.65 ± 0.14	3.83 ± 0.10
NZW x FLA	30	34 ± 1.73	29 ± 1.15	31 ± 0.92	94 ± 0.89	133 ± 0.94	113 ± 0.74	2.98 ± 0.22	4.66 ± 0.26	3.58 ± 0.15
CAL x ZIN	30	28 ± 1.37	28 ± 0.83	28 ± 0.76	94 ± 0.44	131 ± 1.61	113 ± 0.91	3.52 ± 0.15	4.89 ± 0.18	4.10 ± 0.10
CAL x FLA	30	29 ± 1.13	28 ± 0.83	28 ± 0.70	94 ± 0.72	132 ± 0.89	113 ± 0.48	3.41 ± 0.14	4.84 ± 0.15	4.05 ± 0.11
Dose x Breed x Treatment										
20/ZIN/NZW	10	31 ± 2.23^{b}	29 ± 1.90	30 ± 0.88^{b}	97 ± 1.30^{a}	134 ± 1.60	116 ± 1.35	3.30 ± 0.30^{a}	4.73 ± 0.28	3.87 ± 0.14^{b}
40/ZIN/NZW	10	35 ± 2.66^{a}	30 ± 1.56	32 ± 1.41^{a}	96 ± 1.41^{a}	131 ± 2.15	114 ± 0.95	2.95 ± 0.28^{b}	4.56 ± 0.30	3.59 ± 0.15^{b}
80/ZIN/NZW	10	28 ± 1.85^{b}	28 ± 0.70	28 ± 1.04^{bc}	96 ± 1.06^{ab}	132 ± 1.96	114 ± 1.04	3.52 ± 0.25^{a}	4.66 ± 0.10	4.06 ± 0.17^{a}
20/ZIN/CAL	10	31 ± 2.72^{b}	29 ± 0.90	30 ± 1.46^{b}	95 ± 0.66^{ab}	133 ± 2.06	114 ± 1.19	3.29 ± 0.25^{a}	4.62 ± 0.15	3.89 ± 0.15^{b}
40/ZIN/CAL	10	30 ± 2.28^{b}	28 ± 1.29	29 ± 1.12^{b}	94 ± 0.87^{b}	132 ± 1.58	113 ± 1.07	3.29 ± 0.25^{a}	4.88 ± 0.22	3.96 ± 0.13^{b}
80/ZIN/CAL	10	25 ± 1.38^{c}	26 ± 1.85	26 ± 0.89^{c}	94 ± 0.71^{b}	128 ± 3.92	111 ± 2.16	3.95 ± 0.25^{a}	5.15 ± 0.46	4.42 ± 0.19^{a}
2/FLA/NZW	10	34 ± 3.03^{a}	30 ± 1.89	32 ± 1.57^{a}	95 ± 1.05^{ab}	131 ± 1.98	113 ± 1.20	3.02 ± 0.31^{b}	4.49 ± 0.31	3.59 ± 0.18^{b}
4/FLA/NZW	10	30 ± 3.08^{b}	25 ± 1.77	28 ± 0.98^{b}	95 ± 1.63^{ab}	134 ± 1.10	114 ± 0.72	3.51 ± 0.42^{a}	5.58 ± 0.43	4.18 ± 0.12^{a}
8/FLA/NZW	10	37 ± 2.41^{a}	31 ± 1.86	34 ± 1.52^{a}	94 ± 1.78^{b}	132 ± 1.58	111 ± 1.57	2.64 ± 0.20^{b}	4.48 ± 0.31	3.34 ± 0.14^{b}
2/FLA/CAL	10	29 ± 2.26^{b}	25 ± 1.24	27 ± 1.22^{c}	94 ± 1.21^{b}	131 ± 1.72	113 ± 0.80	3.47 ± 0.29^{a}	5.33 ± 0.30	4.27 ± 0.23^{a}
4/FLA/CAL	10	24 ± 1.18^{c}	29 ± 1.49	27 ± 0.94^{c}	94 ± 1.17^{b}	132 ± 1.60	113 ± 0.86	3.96 ± 0.18^{a}	4.64 ± 0.22	4.29 ± 0.14^{a}
8/FLA/CAL	10	33 ± 1.10^{a}	30 ± 1.30	32 ± 0.85^{a}	93 ± 1.40^{b}	132 ± 1.43	112 ± 0.90	2.80 ± 0.09^{b}	4.54 ± 0.19	3.59 ± 0.10^{b}

	d.f.	MS	MS	MS	MS	MS	MS	MS	MS	MS
B	1	460.10***	7.26	190.09***	60.77*	29.27	25.02	3.23*	1.19	3.72***
T	1	54.93	0.06	12.85	46.12+	7.81	12.99	1.02	0.01	0.63
B x T	1	27.43	2.66	3.25	11.34	0.31	12.72	0.19	0.03	0.31
Dose/T/B	8	132.27*	40.24	63.52***	6.66	23.91	13.32	1.68*	0.89	0.89*
Error	108	53.19	24.02	14.24	15.60	41.38	15.08	0.79	1.06	0.37

+ P<0.10 ; * P<0.05 ; *** P<0.001 ; a,b,c, Means in the same column with different superscripts differ significantly.

Daily feed intake

Interaction of breed with promoter type was not detected (P>0.10) at different age intervals.

The average daily gain feed intake was greater (P<0.05) for NZW compared with CAL and tended (P<0.10) to be greater for rabbits fed on ZIN as compared with FLA only during the interval from 0 to 4 weeks treatment.

Feed conversion ratio

No significant interaction of rabbit breed with promoter type was detected (P>0.10) over the three age intervals considered. However, FOWLER and ENSMINGER (1960) showed significant effect of genotype x plane of nutrition on the efficiency of feed utilization.

The average feed conversion was significantly (P<0.05) greater for NZW rabbits than for CAL rabbits for the first 4 and 8 weeks postweaning.

Minor differences (P<0.10) were detected between rabbits fed on FLA and those fed on ZIN for the rate of feed conversion. However, MORDENTI and ZAGHINI (1979) reported an improvement in feed conversion efficiency for poultry and pigs ranging between 3 and 4 %.

Increasing the level of ZIN improved the feed conversion ratio, while rabbits fed diets supplemented with high level of FLA reduced the efficiency of feed conversion (P<0.05). BERTA *et al.* (1983) reported that the addition of ZIN to rabbits diets improved feed conversion ratio.

Slaughter traits

Least square means for weights of the hot carcass, alimentary tract, kidneys, kidney fat and heart adjusted to constant slaughter weight are given in Table 2 with the mean squares for sources or their variation.

Carcass yield

A breed x promoter interaction was detected (P<0.05) for carcass weight adjusted to slaughter weight. A comparison of the means in Table 2 reveals a reversal in the relative position of NZW and CAL between the two types of promoters. OMTVEDT *et al.* (1962) reported significant interaction between swine genotype with management systems for dressing percentage.

Alimentary tract and liver yields

The interaction of rabbit breed with promoter was significant for the adjusted weights of the

Table 2 : Least squares means (± standard error) and analysis of variance (mean squares) for slaughter traits adjusted to constant slaughter weight

Classification	No.	Slaughter traits: Hot carcass weight (g)	Alimentary tract weight (g)	Liver weight (g)	Kidneys weight (g)	Kidney fat weight (g)	Heart weight (g)
Breed							
NZW	30	1393 ± 4.64	420 ± 5.48	82 ± 1.83	16 ± 0.29	25 ± 0.71	6 ± 0.09
CAL	30	1376 ± 4.64	459 ± 5.48	85 ± 1.83	15 ± 0.29	23 ± 0.71	5 ± 0.09
Treatment							
ZIN	30	1379 ± 4.54	440 ± 5.36	83 ± 1.79	16 ± 0.28	25 ± 0.70	6 ± 0.09
FLA	30	1390 ± 4.54	439 ± 5.36	83 ± 1.79	15 ± 0.28	22 ± 0.70	6 ± 0.09
Breed x Treatment							
NZW x ZIN	15	1380 ± 6.45	428 ± 7.63	84 ± 2.55	17 ± 0.40	26 ± 0.99	6 ± 0.12
NZW x FLA	15	1405 ± 6.52	411 ± 7.69	81 ± 2.57	16 ± 0.40	24 ± 1.00	6 ± 0.12
CAL x ZIN	15	1378 ± 6.42	451 ± 7.58	82 ± 2.54	15 ± 0.40	25 ± 0.98	6 ± 0.12
CAL x FLA	15	1374 ± 6.64	466 ± 7.83	89 ± 2.62	15 ± 0.41	21 ± 1.02	6 ± 0.13
Dose x Treatment x Breed							
20/ZIN/NZW	5	1400 ± 56.10^{b}	463 ± 14.68^{a}	83 ± 4.88	17 ± 1.51	31 ± 2.61^{a}	6 ± 0.16
40/ZIN/NZW	5	1424 ± 20.44^{a}	422 ± 7.12^{b}	85 ± 4.91	18 ± 0.54	25 ± 0.99^{b}	6 ± 0.15
80/ZIN/NZW	5	1394 ± 57.17^{b}	422 ± 7.44^{b}	85 ± 5.49	16 ± 0.46	22 ± 1.24^{c}	6 ± 0.24
20/ZIN/CAL	5	1444 ± 99.64^{a}	454 ± 44.85^{a}	77 ± 3.10	15 ± 0.95	26 ± 1.37^{b}	6 ± 0.25
40/ZIN/CAL	5	1391 ± 40.39^{b}	462 ± 7.70^{a}	84 ± 2.64	15 ± 0.44	28 ± 1.71^{a}	6 ± 0.21
80/ZIN/CAL	5	1272 ± 52.99^{c}	430 ± 14.33^{b}	85 ± 6.59	15 ± 0.58	20 ± 2.84^{c}	6 ± 0.21
2/FLA/NZW	5	1473 ± 46.98^{a}	467 ± 23.98^{a}	89 ± 4.57	17 ± 0.62	25 ± 0.89^{b}	6 ± 0.25
4/FLA/NZW	5	1356 ± 38.76^{c}	420 ± 15.36^{b}	80 ± 5.65	15 ± 0.69	20 ± 2.18^{c}	6 ± 0.20
8/FLA/NZW	5	1496 ± 32.95^{a}	378 ± 11.50^{c}	76 ± 4.95	17 ± 0.37	29 ± 2.64^{a}	6 ± 0.17
2/FLA/CAL	5	1318 ± 49.10^{c}	468 ± 17.03^{a}	87 ± 3.54	14 ± 0.39	20 ± 1.08^{c}	5 ± 0.25
4/FLA/CAL	5	1278 ± 49.94^{c}	433 ± 19.12^{b}	87 ± 3.71	15 ± 0.65	21 ± 1.09^{c}	6 ± 0.26
8/FLA/CAL	5	1366 ± 41.08^{b}	452 ± 16.33^{a}	88 ± 2.55	15 ± 0.27	19 ± 1.17^{c}	6 ± 0.21
	d.f.	MS	MS	MS	MS	MS	MS
B	1	3803*	20728***	139	21.3***	61.6*	1.94***
T	1	1721+	11.9	48.7	2.7	122.6***	0.17
Regression on slaughter weight	1	622746***	48856***	436*	7.0+	128.0***	0.78+
B x T	1	2914*	3931*	334+	1.1	36.6	0.60
Dose/T/B	8	2420***	3637***	110	1.9	54.5***	0.12
Error	47	617	860	96	2.3	14.5	0.22

+ P<0.10 ; * : P<0.050 ; *** : P<0.001 ; a,b,c : Means in the same column with different superscripts differ significantly (P<0.05)

Table 3 : Least squares means (± standard error) and analysis of variance (mean squares) for carcass cuts adjusted to constant slaughter weight.

Classification	No.	Fore limb Weight (g)	Hind limb Weight (g)	Trunk Weight (g)	Head Weight (g)
Breed					
New Zealand White (NZW)	30	314 ± 4.55	441 ± 2.75	365 ± 3.34	151 ± 0.12
Californian (CAL)	30	293 ± 4.55	442 ± 2.75	373 ± 3.34	141 ± 0.10
Treatment					
Zincbacitracin (ZIN)	30	300 ± 4.45	443 ± 2.69	368 ± 3.27	145 ± 1.19
Flavomycin (FLA)	30	307 ± 4.45	440 ± 2.69	369 ± 3.27	150 ± 1.09
Breed x Treatment					
NZW x ZIN	15	305 ± 6.33	439 ± 3.83	363 ± 4.65	149 ± 2.11
NZW x FLA	15	323 ± 6.39	444 ± 3.86	367 ± 4.69	150 ± 2.09
CAL x ZIN	15	294 ± 6.29	447 ± 3.81	374 ± 4.62	140 ± 1.18
CAL x FLA	15	291 ± 6.50	437 ± 3.93	372 ± 4.77	141 ± 1.23
Dose x Treatment x Breed					
20/ZIN/NZW	5	308 ± 13.09	452 ± 22.31[a]	374 ± 27.52[ab]	135 ± 5.40
40/ZIN/NZW	5	330 ± 4.86	437 ± 10.39[ab]	374 ± 5.85[ab]	155 ± 3.37
80/ZIN/NZW	5	295 ± 10.57	454 ± 22.43[a]	364 ± 23.06[ab]	157 ± 2.87
20/ZIN/CAL	5	310 ± 29.41	469 ± 33.90[a]	401 ± 31.52[a]	148 ± 8.58
40/ZIN/CAL	5	301 ± 4.59	453 ± 16.44[a]	372 ± 18.26[ab]	139 ± 3.49
80/ZIN/CAL	5	266 ± 13.57	410 ± 16.49[b]	339 ± 14.36[b]	136 ± 3.53
2/FLA/NZW	5	341 ± 21.48	476 ± 11.82[a]	374 ± 16.68[ab]	152 ± 3.07
4/FLA/NZW	5	315 ± 9.30	429 ± 18.72[ab]	351 ± 11.26[ab]	147 ± 2.66
8/FLA/NZW	5	339 ± 10.47	466 ± 13.00[a]	411 ± 9.98[a]	158 ± 3.55
2/FLA/CAL	5	281 ± 13.31	404 ± 14.88[b]	375 ± 13.87[ab]	137 ± 4.03
4/FLA/CAL	5	276 ± 14.43	407 ± 17.67[b]	333 ± 14.06[b]	138 ± 5.95
8/FLA/CAL	5	279 ± 23.83	443 ± 16.01[a]	356 ± 13.12[ab]	146 ± 3.82
	d.f.	MS	MS	MS	MS
B	1	6353***	3.87	891.4+	4642+
T	1	827	103.7	19.4	1855
Regression on slaughter weight	1	31921***	74789***	63469***	264
B x T	1	1695+	936*	121	1631
Dose/T/B	8	208	1063***	96.7**	1937
Error	47	592	217	319	1234

+ : P<0.10 ; * : P<0.05 ; **P<0.01 ; ***P<0.001 ; a,b,c : means in the same column with different superscripts differ significantly (P<0.05).

alimentary tract (P<0.05) and liver (P<0.10). This was partially due to the fact that under the ZIN treatment NZW rabbits averaged higher alimentary tract and heavier liver than the CAL, but the positions were reversed under the treatment with FLA.

Kidneys, kidney fat and heart yields

No significant interaction of rabbit breed with promoter type was detected (P<0.10) for the weights of kidneys, kidney fat and heart adjusted to constant slaughter weight.

NZW rabbits recorded significantly (P<0.05) heavier adjusted weights of the three offal components. However, the effect of promoter type was only significant (P<0.001) on kidney fat where deposition was greater with ZIN than with FLA.

Carcass cut out

Table 3 summarizes yield of fore limb, hind limb, trunk and head as weights adjusted to constant slaughter weight. Mean squares for the sources of their variation were also given.

Yield of limbs

Interaction lf rabbit breed with promoter type was detected for the weight of fore limbs (P<0.10) and of hind limbs (P<0.05) after adjustment to constant slaughter weight. Table 3 reveals a reversal in the relative positions of NZW and CAL between the two types of promoters. Breeding treatment interaction for the limb weight has been previously reported for pigs (SALMELA *et al.*, 1960 ; OMTVEDT *et al.*, 1962).

Yields of trunk and head

The interaction breed x promoter was not significant (P>0.10) for the yield of the non–limb components of the carcass. This is in general agreement with the findings of OMTVEDT *et al.* (1962) on pigs.

As compared with CAL rabbits, NZW rabbits tended (P<0.010) to have more proportion of the carcass weight in the head and less in the trunk.

The promoter type showed non significant effect on the weight of the trunk and head of the rabbit when corrected to constant slaughter weight.

CONCLUSION

Although the environmental factor of this study (promoter type) does not represent the extremes, rabbit breeds interacted significantly with promoter type in terms of yield of carcass and fore and hind limbs (adjusted to slaughter weight). The knowledge of this interaction could lead to recommend the specific use of FLA for NZW rabbits and the specific use of ZIN for CAL rabbits when targeting superior carcass yield–related traits. However, the interaction of genotype and promoter type appeared unimportant for live performance, that is the faster gainer and more efficient feed converter breed under the other promoter type. Further studies involving extreme environmental conditions and more distinct genotype are needed before recommending specific breeding stocks to specific environmental conditions.

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