6. REFERENCES

Abdella, M.M., Afifi, E.A., El-Sayaad, G.A.E. and El-Madhagi, K.S.S. (1990). Effect of dietary protein level, fiber level and other factors on rabbits performance. I. Productive performance of rabbit doe's. Annals of Agric. Sci., Moshtohor, 28(4): 2101-2112, Egypt.

Abd El-Raouf, H.M. (1993). Genetic studies for some economic traits in rabbits. M.Sc. Thesis, Fac. Agric., Moshtohor, Zagazig Univ., Egypt.

Afifi, E.A., Khalil, M.H. and Emara, M.E. (1989). Effects on maternal performance and litter preweaning traits in doe traits. J. Animal Breeding and Genetics, 106: 358-362, Germany.

Afifi, E.A., Yamani, K.A., Marai, I.F.M. and El-Maghawry, A.M. (1992). Environmenal and genetic aspects of litter traits in New Zealand White and Californian rabbits under the Egyptian conditions. J. Appl. Rabbit Res., 15: 335-351, USA.

Ahlborn, G. and Dempfle, L. (1992). Genetic parameters for milk production and body size in Zew Zealand Holstein-Friesian and Jersey. Livest. Prod. Sci., 31: 205-219.

Anderson, R.D., Henderson, H.V., Pukelsheim, F. and Searle, S.R. (1984). Best estimation of variance components from balanced data, with arbitrary kurtosis. Math. Operationsforsch. Statist. Ser. Statist., 15: 163.

Asker, A.A.S. (1989). Studies on the reproduction of female rabbits. M.Sc. Thesis, Factulty of Agriculture, Zagazig University, Egypt.

Bartelli, M. and Altomonte, V. (1968). Experimental tests on rabbits. Comparison of milk yield and prolificacy of some breeds of rabbits. Comparison of growth of some crosses. Coniglicolture, 5(1): 33-38. (A.B.A., 36, No. 3009).

Baselga, M., Gomez, E., Cifre, P. and Camacho, J. (1992a). Genetic diversity of litter size traits between parities in rabbit. Proc. 5th World Rabbit Congress, 25-30 July, 1992, Oregon, Corvallis, USA, Vol. A, 198-206, .

Baselga, M., Blasco, A. and Garcia, F. (1992b). Genetic parameters for economic traits in rabbit populations. Proc. 2nd World Congress on Genetics Applied to Livestock Production, October 1992, Spain, 6: 471-480.

Becker, W.A. (1984). Manual of Quantitative Genetics. (Fourth Edition). Academic Enterprises, Pullmon, W.A., USA.

Bento, J., Ferraz, S. and Johnson, R.K. (1993). Animal model estimation of genetic parameters and response to selection for litter size and weight, growth and backfat in closed seedstock populations of Large White and Landrace Swine. J. Anim. Sci., 71: 850-858.

Benyshek, L.L. (1981). Heritabilities for growth and carcass traits estimated from data on Herefords under commercial conditions. J. Anim. Sci., 53: 49.

Blasco, A., Ouhayoun, J. and Masoero, G. (1992). Status of rabbit meat and carcass: Criteria and terminology. Options mediterraneennes-Serie Seminaries, 17-, 105-120, Spain.

Blasco, A., Santacreu, M.A., Thompson, R. and Haley, C.S. (1993). Estimates of genetic parameters for ovulation rate, prenatal survival and litter size in rabbits from an elliptical selection experiment. (Bibliographic citation): Livestock Prod. Sci., 34(1-2): 163-174.

Burn, T.M. and Rouvier, R. (1984). Genetic effect on traits of litterrs produced by crossing 3 strains of rabbits. Genetic Sel. Evol., 16(3): 367-383, France.

Cameron, N.D. (1988). Genetic relationships between growth and food intake in performance tested ram lambs: An investigation of variance component estimation procedures. J. Anim. Breed. Genet., 105: 431-440.

Campos, A.P., Rochambeau, H.D., Rouvier, R. and Poujardieu, B. (1980). The rabbit selection scheme in Mexico: objectives and primary results. Proceeding of 2nd World Rabbit Congress, April, Barcelona, Spain.

Chauhan, V.P.S. (1991). Comparison of estimates of heritabiltiy of milk yield of Murrah buffaloes from Restricted Maximum Likelihood and Henderson' method III. Indian J. Anim. Sci., 61(8): 880-881.

Colleau, J.J., Beaumont, C. and Regaldo, D. (1989). Restrictied Maximum Likelihood (REML) estimation of genetic parameters for type traits in Normande cattle breed. Livest. Prod. Sci., 23: 47-66.

Corbeil, R.R. and Searle, S.R. (1976). Restricted maximum likelihood (REML) estimation of variance components in the mixed model. Technometrics, 18: 31.

El-Desoki, A.E.M. (1991). Study of the effect of some genetic and environmental factors affecting meat yield from some foreign and local breeds of rabbits and their crosses. M. Sc. Thesis, Fac. Agric., Mansoura Univ., Egypt.

El-Maghawry, A.M., Yamani, K.A. and Marai, M.F.I. (1988). A preliminary study on performance of some productive traits in New Zealand White and Californian rabbits under Egyptian environments. Proceeding of the 4th World Rabbit Congress, Budapest, Hungary, 10-14 October, 264-275.

El-Maghawry, A.M. (1990). Genetic and Environmental factors affecting performance of broiler rabbits. Ph.D. Thesis, Fac. of Agric., Zagazig Univ., Zagazig, Egypt.

El-Qen, R.Y.N. (1988). Genetic and environmental studies on rabbits. M. Sc. Thesis, Fac. of Agric., Tanta Univ., Egypt.

El-Raffa, A.M.E. (1994). Some factors affecting economical productive and reproductive traits in rabbits. Ph.D. Thesis, Fac. of Agric., Alexandria Univ., Egypt.

Farghaly, H.M., El-Darawany, A.A. and Yamani, K.A. (1993). Mortality rate in purebred commercial rabbits under Egyptian conditions. Proceeding of the First International Conference on Rabbit Production in Hot climates, Cairo, 6-8 September, 1994.

Farghaly, H.M. and El-Darawany, A. A. (1994). Genetic and non-genetic factros affecting reproductive performance in exotic breeds under Egyptian conditions. Proceeding of the First International Conference on rabbit production in Hot climates, Cairo, 6-8 September, 1994.

Ferraz, J.B.S., Johnson, R.K. and Eler, J.P. (1991). Genetic parameters for reproductive traits of rabbits. J. Appl. Rabbit Res., 14: 166-171.

Ferraz, J.B.S., Johnson, R.K. and Van Velck, L.D. (1992). Estimation of genetic trends and genetic parameters for reproductive and growth traits of rabbits raised in subtropics with animal models. Appl. Rabbit Res., 15: 131-142.

Finzi, A. (1985). Experimental rabbit breeding outdoors. Rivista di Coniglicoltura, 22(9): 38-42. (A.B.A., 54, No. 4767).

Gama, L.T, Boldman, K.G. and Johnson, R.K. (1991). Estimates of genetic parameters for direct and maternal effects on embryonic survival in swine. J. Anim. Sci. 69: 4801-4809.

Garcia, F., Blasco, A., Baselga, M. and Salvador, A. (1980). Genetic analysis of some productive traits in meat rabbits. 2nd World Rabbit Congress, April, Barcelona, Spain.

Garcia, F., Baselga, M., Blasco, A. and Deltoro, J. (1982a). Genetic analysis of some productive traits in meat rabbits. I. Numeric traits. 2nd World Rabbit Congress on Genetics Applied to Livestock Production, 4-8 October, Madrid, Spain, 7: 557-562.

Gracia, F., Baselga, M., Blasco, A. and Deltoro, J. (1982b). Genetic analysis of some productive traits in meat rabbits. II. Ponderal traits. Proc. 2nd World Congress on Genetics Applied to Livestock Production, 4-8 October, Madrid, Spain, 7: 575-579.

Gecele, C.P., Fuenzalida, L. and Carvajal, B.S. (1985). Analysis of intensive reproductive management in rabbits. Memories, Association Latinoamericana de production Animal, 18: 131. (A.B.A., 55: No. 3158).

Gerstmayr, S. (1992). Impact of data structure on the reliability of the estimated genetic parameters in an animal model with maternal effect. J. Animal Breeding Genetics, 109: 321-336.

Gianola, D., Foulley, J.L. and Fernando, R.L. (1986). Prediction of breeding values when variances are not known. Genet. Sel. Evol., 18(4): 485.

Gill, J.L. (1991). Biases in balanced experiments with uncontrolled random factors. J. Animal Breeding Genetics, 108: 69-79.

Grandi, A. and Stefanetti, P. (1987). The performance of New Zealand White, Californian and Blue Vienna rabbits and their crosses. Revista di Coniglicoultura, 24(1): 53-58. (A.B.A., 55, No. 6496).

Gutierrez, J.P., Canon, J. and Rico, M. (1994). Comparison of two models for estimation of variance components in a sample of Spanish Hosltein Friesians. J. Animal Breeding Genetics, 111: 169-174.

Harris, D.J.; Cheeke, P.R. and Patton, N.M. (1982). Effect of diet, light and breeding schedule on rabbit performance. J. Appl. Rabbit Res., 5: 33.

Hartley, H.O. and Rao, J.N.K. (1967). Maximum Likelihood estimation for the mixed analysis of variance model. Biometrika, 54: 93-108.

Harvey, W.R. (1990). User's Guide for LSMLMW. Mixed Model Least-Squares and Maximum Likelihood Computer Program. PC-Version 2, Ohio State Univ., Columbus (Mimeograph), USA.

Harville, D.A. (1977). Maximum Likelihood approaches to variance component estimation and to related problems. J. Anim. Sci., 72: 320.

Hassan, N.S. (1988). Reproduction of New Zealand rabbits. M.Sc. Thesis, Fac. Agric., Cairo Univ., Egypt.

Hassan, N.S. (1995). A study on the prediction of doe rabbits transmitting ability. Ph.D. Thesis, Fac. of Agric., Ain Shams Univ., Cairo, Egypt.

Hassan, N.S., El-Tawil, E.A., Shahin Karima, A. and Gad, H.A.M. (1994). Performance of New Zealand White doe as affected by different environmental factros. Proceeding of the First International Conference on Rabbit Production in Hot climate, 6-8 September, Cairo, Egypt.

Henderson, C.R. (1984). General flexibility of linear model techniques for sire evaluation. J. Dairy Sci., 57: 963-972.

Hilmy, A.F. (1991). Some productive aspects in rabbits. M. Sc. Thesis, Fac. of Agric., Moshtohor, Zagazig Univ., Egypt.

Hocking, R.R. and Kunter, M.H. (1975). Some analytical and numerical comparisons of estimators for the mixed A.O.V. model. Biometrics, 31: 19-27.

Hulot, F. and Matheron, G. (1980). Comparison of reproduction in two rabbits breeds. Effect of age and season. 2nd World Rabbit Congress. April, Barcelona, Spain.

Hulot, F. and Matheron, G. (1981). The influence of genotype, age and season on the reproduction components in the female rabbits. Annals de Geneticque et de Selection Animale, 13(2): 131-150.

Kadry, A.E. and Afifi, E.A. (1984). Heritability estimates of litter traits in Bauscat rabbits. Al-Azhar J. Agric. Res., Egytian, (1): 24-30.

Keele, J.W., Long, T.E. and Johnson, R.K. (1991). Comparison of methods of estimating variance components in pigs. J. Anim. Sci., 69: 1428-1434.

Khalil, M.H. (1989). Estimates of genetic and phenotypic parameters for weaning and preweaning body weights and gain in Bouscat and Giza White rabbit. Annals of Agric. Sci., Moshtohor, 27(3): 1557-1574, Egypt.

Khalil, M.H. (1993a). Genetic evaluation of the lactational performance in Giza White rabbits and its relation with preweaning litter traits. Egyptian J. of Rabbit Sci., 3(1): 113-127.

Khalil, M.H. (1993b). Diversity of repeatabiltiy between parities for litter traits and reproductice intervals in doe rabbits. World Rabbit Sci., 1(4): 140-145, Frence.

Khalil, M.H. (1994). Lactational performance of Giza White rabbits and its relation with pre-weaning litter traits. Anim. Prod., 59: 141-145, UK.

Khalil, M.H. and Afifi, E.A. (1991). Doe litter performance of Bouscat and Giza White rabbits. Egyptian J. of Rabbit Sci., 1(2): 172-184.

Khalil, M.H. and Mansour, H. (1987). Factors affecting reproductive performance of female rabbits. J. Applied Rabbit Research, 10(3):140-145, USA.

Khalil, M.H., Owen, J.B. and Afifi, E.A. (1986). A review of phenotypic and genetic parameters associated with meat production traits in rabbits. Animal Breeding Abstracts, 54(9): 724-749 (Article), UK.

Khalil, M.H., Afifi, E.A. and Emara, M.E. (1987a). Doe litter performance at weaning for two breeds of rabbits with special emphasis on sire and doe effects. J. Applied Rabbit Research, 10(1): 12-18, USA.

Khalil, M.H., Owen, J.B. and Afifi, E.A. (1987b). A genetic analysis of litter traits in Bouscat and Giza White rabbits. Anim. Prod., 45: 123-134, UK.

Khalil, M.H., Afifi, E.A. and Owen, J.B. (1987c). A genetic analysis of body weight traits in young Bauscat and Giza White rabbits. Anim. Prod., 45: 123-134, UK.

Khalil, M.H., Afifi, E.A., Emara, M.E. and Owen, J.B. (1988). Genetic and phenotypic aspects of doe productivity in four breeds of rabbits. J. Agric. Sci., Cambridge, 110: 191-197.

Khalil, M.H., Afifi, E.A., Youssef, Y.M.K. and Khadr, A.F. (1995). Heterosis, maternal and direct genetic effects for litter performance and reproductive intervals in rabbits crosses. World Rabbit Sci., 3(3): 99-105, France.

Kuhlers, D.L., Jungst, S.B. and Little, J.A. (1994). An experimental comparison of equivalent terminal and rotational crossbreeding systems in Swine: Sow and litter performance. J. Anim. Sci., 72: 584-590.

Lahiri, S. S. and Mahajan, J. M. (1982). Note on the inheritance of age at first breeding, litter size and weight in rabbits. Indian J. Anim. Sci., 52(11): 1148-1150.

Lampo, P. and Broeck, L. Vanden (1975). The influence of the heritability of some breeding parameters and the correlation between these parameters in rabbits. Archiv fur Geflugelkunde, 39(6): 208-211.

Lui, J.F., Malheiros, J.B., Carregal, R.D. and Giannoni, M.A. (1987). Effect of sire, dam and parity on body weight at birth, weaning and slaughter. Ars Veterinaria, 3(1): 127-137. (A.B.A., 57, No. 1300).

Lukefahr, S.D. (1982). Evaluation of rabbit breeds and crosses for overall commercial productivity. Ph.D. Thesis, Oregon State Univ., Corvallis, USA.

Lukefahr, S.D., Hohenboken, W.D., Cheeke, P.R. and Patton, N.M. (1983a). Doe reproduction and preweaning litter performance of straightbred and crossbred rabbits. J. Anim. Sci., 57(5): 1090-1099.

Lukefahr, S.D., Hohenboken, W.D., Cheeke, P.R. and Patton, N.M. (1983b). Characterization of straightbred and crossbred rabbits for milk production and associative traits. J. Anim. Sci., 57(5): 1100-1107.

Lukefahr, S.D., Hohenboken, W.D., Cheeke, P.R. and Patton, N.M. (1984). Genetic effects on maternal performance and litter preweaning and postweaning traits in rabbits. Anim. Prod., 38: 293-300.

Lukefahr, S.D., Hohenboken, W.D., Cheeke, P.R. and Patton,N.M. (1990). Prediction and causation of litter market traits from preweaning and weaning characteristics in commercial meat rabbits. J. Anim. Sci., 68: 2222-2234.

Masoero, G., Ubertalle, A., Mazzocco, P. and Battaglini, L.M. (1985). Terminal crossing of New Zealand White and Californian rabbits. (1) Characteristics on the live animal. Annalidell Istituto Sperimentale per la Zootecnia, 18(2): 93-109. (A.B.A., 55, No. 1264).

McCarter, M.N., Mabry, J.W., Bettrand, J.K. and Benyshek, L.L. (1987). Components of variance and covariance for reproductive traits in swine estimated from Yorkshire field data. J. Anim. Sci., 64: 1285-1291.

McReynolds, W.E. (1974). Genetic parameters of early growth in a population of New Zealand White rabbits. Ph.D. Dissertation, Ohio State Univ., USA.

Meyer, K. (1985). Genetic parameters for dairy production of Australian Black and White cows. Livestock Production Sci., 12: 205-219.

Meyer, K.L. and Thompson, R. (1984). Bias in variance and covariance component estimators due to selection on a correlated trait. Z. Tierz. Zuechtungsbiol., 101: 33-50, Germany.

Mohamed, K.I. (1989). Studies on some productive traits in rabbits under the environmental conditions of El-Minia Governorate. M. Sc. Thesis, Fac. of Agric., El-Minia Univ., Egypt.

Narayan, A.D., Rawat, S. and Saxena, M.C. (1985). Phenotypic variability and heritability of litter size in rabbits selected for large litter size. Indian J. Anim. Sci., 55(9): 790-794.

Nossier, F.M. (1970). A study of some economical characteristics in some local and foreign breeds of rabbits. M. Sci., Thesis, Fac. Agric., Cairo Univ., Egypt.

Oudah, S.M. (1990). Studies on some rabbit breeds and their crosses. M. Sc. Thesis, Fac. of Agric., Mansoura Univ., Egypt.

Ozimba, C.E. and Lukefahr, S.D. (1991). Comparison of rabbit breed types of postweaning litter growth, feed efficiency and survival performance traits. J. Anim. Sci., 69: 3494-3500.

Panella, F., Castellini, C. and Facchin, E. (1994). Heritability of some male reproductive traits in rabbit. Proceeding of the First International Conference on Rabbit Production in Hot Climates, 6-8 September, Cairo, Egypt.

Panella, F. Battaglini, M., Castellini, C., Rosati, A and Facchin, E. (1992). Comparison between two genetic evaluation indexes in rabbit. J. Appl. Rabbit Res., 15: 190-197.

Petterson, H.D. and Thompson, R. (1971). Recovery of inter-block information when block sizes are unequal. Biometrika, 58: 545-554.

Ponc De Leon, R. (1978). Effect of breed on reproduction and preweaning performance in rabbits under a rotational crossbreeding system. Memoria, Association Latinoamericana de Production Animal, 13: 173. (A.B.A., 47, No. 10).

Quaas, R.L. (1976). Computing the diagonal elements and inverse of a large numerator relationship matrix. Biometrika 58: 545.

Raharjo, Y.C., Cheeke, P.R. and Patton, N.M. (1986). Growth and reproductive performance of rabbits on a moderately low crude protein diet with or without methionine or urea supplementation. J. Anim. Sci., 63: 795-803.

Raheja, K.L. (1992). Comparative study of variance-covariance components of economic traits between different lactations estimated from single trait and multi-trait procedures. Indian J. Anim. Sci., 62(5): 467-472.

Ramon, J., Utrillas, O., Rafel, O. and Oerucho, I.R.T.A. (1992). Demographic analysis of a synthetic population, selected for the global objective of litter weight at 60 days old through overlapping generations. J. App. Rabbit Res., 15: 229-239.

Randi, E. (1982). Productivity traits in two rabbit breeds: New Zealand White and Californian. Rivista di Zoot. Vet., 10(2): 81-86. (A.B.A., 52, No. 2859).

Randi, E. and Scossiroli, R.E. (1980). Genetic analysis of production traits in Italian New Zealand White and Californian pure-breed populations. 2nd World Rabbit Congress, April, Barcelona, Spain.

Reverter, A., Golden, B.L., Bourdon, R.M. and Brinks, J.S. (1994). Method ***R*** variance components procedure: Application on the simple breeding value model. J. Anim. Sci., 72: 2247-2253.

Roberts, J.D. and Lukefahr, S.D. (1992). Evaluation of Californian, Champagne D'Argent, New Zealand White and Palmino as potential sire breeds: I. Postweaning litter traits. J. Appl. Rabbit Res., 15: 274-286.

Rodriguez, I., Sanz, J., Alonso, F. and Acosta, M. (1985). Factors affecting gestation length in rabbits. Archivos de Zootechnia, 34 (139): 183-193. (A.B.A., 54: No. 1243).

Ronningen, K. (1972). The effect of selection on heritabilities estimated by twice the parent-offspring regression or twice the parent-offspring correlation. Acta Agric. Scand., 22: 200-204.

Rouvier, R., Poujardieu, B. and Vrillon, J.L. (1973). Statistical analysis of the breeding performance of female rabbits: Environmental factors, correlations and repeatabilities. Ann. Genet. Sel. Anim., 5(1): 83-107.

Rouvier, R. (1979). Physiological effects of selection on aspects of ponderal and numerical productivity in domestic rabbits. Proc. of Symposium held at Harrogate, July 1979, Commonwealth Agricultural Burean, U.K.

Rouvier, R. (1980). Genetic of rabbit (oryctolagus cuniculus). 2nd World Rabbit Congress, April, Barcelona, Spain.

Rothschild, M.F., Henderson, C.R. and Quaas, R.L. (1979). Effects of selection on variances and covariances of simulated first and second lactation. J. Dairy Sci., 62: 996-1002.

Sallam, M.T., Hassan, H.A., Touny, S.H. and Mohammed, K.I. (1989). Comparison of productivity and performance of three breeds of rabbits under small-holder system in El-Mini Governorate. Minia J. Agric. Res. & Dev., 11(4): 1795-1816.

Santacreu, M.A., Gou, P. and Blasco, A. (1992). Relationships between ovulation rate, embryo survival and litter size in rabbits. Animal Production, 55: 271-276.

Schutz,, M.M., Hasen, L.B., Steuernagel, G.R., Reneau, J.K. and Kuck, A.L. (1990). Genetic parameters for somatic cells, protein and fat in milk of Holsteins. J. Dairy Sci., 73: 494-502.

Searle, S.R. (1971). Topics in variance component estimation. Biometrics, 27: 1-76.

Searle, S.R. (1989). Variance components - Some history and a summary account of estimation methods. J. Animal Breeding Genetics, 106: 1-29.

Sedki, A.E. (1991). Some behavioral studies on rabbits. M. Sc. Thesis, Fac. of Agric., Zagazig Univ., Egypt.

See, M.T., Mabry, J.W, and Bertrand, J.K. (1993). Restricted maximum likelihood estimation of variance components from field data for number of pigs born alive. J. Anim. Sci., 71: 2905-2909.

Smith, S.P. and Graser, H.U. (1986). Estimating variance components in a class of mixed models by Restricted Maximum Likelihood. J. Dairy Sci., 69: 1156-1165.

Sorensen, D.A. and Kennedy, B.W. (1984). Estimation of genetic variances from unselected and selected populations. J. Anim. Sci., 58(5): 1213-1223.

Southwood, O.L. and Kennedy, B.W. (1990). Estimation of direct and maternal genetic variance for litter size in Canadian Yorkshire and Landrace swine using an animal model. J. Anim. Sci., 68: 1841.

Southwood, O.I. and Kennedy, B.W. (1992). Genetic and environmental trends for litter size in Swine. J. Anim. Sci., 69: 3177-3182.

Strang, G.S. and King, J.W.B. (1970). Litter productivity in Large White pigs. 2. Heritability and repeatability estimates. Anim. Prod., 12: 235.

Strang, G.S. and Smith, C. (1979). A note on the heritability of litter traits in pigs. Anim. Prod., 28: 403.

Swalve, H.H., Topf, C. and Langholz, H.J. (1992). Estimation of genetic parameters for differently recorded fertility data in dairy cattle. J. Animal Breeding Genetics, 109: 241-251.

Swiger, L.A., Harvey, W.R. Everson, D.O. and Gregory, K.E. (1964). The variance of intraclass correlation involving groups with one observation. Biometrics, 20: 818-826.

Tag El-Din, T.H. and Mervat, A.A. (1989). Some reproductive and meat yield traits in four rabbit breeds under small scale system of production. J. Agric. Sci., Mansoura Univ., 14(3): 1981-1991, Egypt.

Teepker, G. and Swalve, H.H. (1988). Estimation of genetic parameters for milk production in the first three lactations. Livestock Prod. Sci., 20: 193-202.

Thompson, R. and Moor, J.R. (1963). Non-negative estimates of variance component. Technometrices, 5: 441.

Thompson, R. (1979). Sire evaluation. Biometrics, 35(1): 339-353.

Van, Tassell, C.P., Casella, G. and Pollak, E.J. (1995). Effects of selection on estimates of variance components using Gibbs sampling and Restricted Maximum Likelihood. J. Dairy Sci., 78: 678-692.

Villanueva, B., Wray, V.R. and Thompson, R. (1993). Prediction of asymptotic rates of response from selection on multiple tratis using univariate and multiple best linear unbiased predictors.

Vrillon, J.L., Donal, R., Poujardieu, B., Rouvier, R., Theau, M. Duzert, R. Centis, A. and Roustan, A. (1979). Selection and testing of sire lines of rabbits for terminal crossing 1972-1975. Bull. Tech. Dep. Genet. Anim. (Inst. Natn. Rech. Agron., France. No. 28).

Wiggans, G.R. and Van Raden, P.M. (1995). Calculation and use of inbreeding coefficients for genetic evaluation of United States dairy cattle. J. Dairy Sci., 78: 1584-1590.

Xu, S., Atchley, W.R. and Muir, W.M. (1994). Partial and conditional maximum likelihood for variance-components estimation. J. Animal Breeding Genetics, 111: 178-188.

Yamani, K.A.O., Daader, A.H. and Asker, A.A. (1991). Non-genetic factors affecting rabbits production in Egypt. Option Mediteraneenes - Serie Seminires, 17: 159-172, Spain.

Youssef, Y.M.K. (1992). The productive performance of purebred and crossbred rabbits. M. Sc. Thesis, Fac. of Agric., Moshtohor, Zagazig Univ., Banha Branch, Egypt.

7. APPENDICES

Appendix (1). Least-squares means (LSM) and their standard errors (SE) of different year-season subclasses for number of services per conception and reproductive intervals in Californian rabbits.

Year-season subclass	NSC			DO		KI	
	No.	LSM	SE	LSM	SE	LSM	SE
1st parity							
1987- Autumn	80	1.7	.07	20.3	1.10	50.7	.91
- Winter	57	1.7	.08	21.5	1.33	51.9	1.11
- Spring	58	1.6	.09	19.5	1.37	49.9	1.15
- Summer	65	1.8	.08	21.7	1.26	51.5	1.06
1988- Autumn	11	1.6	.19	19.6	2.85	49.6	2.41
- Winter	41	1.8	.09	21.1	1.46	51.6	1.23
- Spring	43	1.8	.10	21.1	1.49	50.4	1.25
- Summer	18	2.1	.15	22.9	2.30	50.7	1.94
2nd parity							
1987- Autumn	64	1.4	.09	18.5	1.46	48.2	1.13
- Winter	52	1.6	.10	20.7	1.64	49.6	1.27
- Spring	61	1.6	.10	21.2	1.58	50.5	1.22
- Summer	52	1.7	.10	23.2	1.65	51.1	1.27
1988- Autumn	12	1.4	.20	18.5	3.19	49.7	2.46
- Winter	49	1.3	.11	16.4	1.75	47.8	1.35
- Spring	46	1.3	.11	18.5	1.72	48.6	1.32
- Summer	31	1.6	.13	19.9	2.10	48.8	1.62
3rd parity							
1987- Autumn	61	1.4	.09	18.0	1.40	48.7	1.11
- Winter	38	1.4	.12	18.4	1.75	48.7	1.39
- Spring	49	1.3	.10	17.7	1.58	48.8	1.25
- Summer	64	1.7	.09	21.3	1.40	51.3	1.11
1988- Autumn	21	1.5	.15	22.2	2.31	50.7	1.84
- Winter	42	1.7	.11	22.2	1.65	50.8	1.32
- Spring	48	1.5	.10	20.1	1.56	49.0	1.24
- Summer	43	1.7	.11	23.2	1.66	51.1	1.32
4th parity							
1987- Autumn	62	1.4	.10	18.0	1.51	48.6	1.14
- Winter	33	1.5	.13	20.8	1.98	50.5	1.50
- Spring	41	1.5	.12	19.9	1.82	49.5	1.38
- Summer	57	1.5	.11	20.7	1.62	49.5	1.23
1988- Autumn	35	1.4	.14	17.6	2.03	48.2	1.54
- Winter	38	1.6	.12	19.4	1.80	49.0	1.36
- Spring	48	1.6	.12	21.1	1.84	50.0	1.39
- Summer	44	1.8	.12	24.4	1.83	51.6	1.38

Appendix (1). Cont.

Year-season subclasses	NSC			DO			KI	
	NO.	LSM	SE	No.	LSM	SE	LSM	SE
5th parity								
1987- Autumn	61	1.4	.09		18.5	1.37	48.6	1.11
- Winter	22	1.3	.15		17.7	2.22	48.1	1.80
- Spring	28	1.6	.13		19.0	1.92	49.4	1.56
- Summer	48	1.6	.10		22.5	1.53	51.0	1.24
1988- Autumn	44	1.3	.11		18.0	1.69	48.5	1.37
- Winter	51	1.3	.09		17.0	1.41	47.8	1.14
- Spring	28	1.5	.12		17.3	1.91	47.8	1.55
- Summer	44	1.5	.11		20.3	1.69	48.6	1.37
6th parity								
1987- Autumn	47	1.5	.11		18.7	1.76	49.0	1.31
- Winter	14	1.2	.20		15.5	3.09	45.5	2.30
- Spring	20	1.9	.16		29.1	2.51	55.7	1.86
- Summer	35	1.4	.13		19.2	1.95	48.2	1.45
1988- Autumn	39	1.6	.13		21.8	2.02	51.0	1.50
- Winter	50	1.6	.10		20.4	1.58	50.0	1.18
- Spring	35	1.5	.12		19.5	1.85	49.2	1.38
- Summer	32	1.9	.15		22.2	2.34	50.5	1.74
7th parity								
1987- Autumn	31	1.5	.13	28	18.7	1.87	49.8	1.91
- Winter	11	1.4	.21	10	18.3	3.05	49.2	3.13
- Spring	11	1.7	.23	10	21.6	3.24	52.2	3.32
- Summer	22	1.5	.15	21	17.0	2.21	47.9	2.26
1988- Autumn	22	1.4	.18	22	16.2	2.54	47.2	2.60
- Winter	51	1.6	.11	48	20.0	1.55	51.0	1.58
- Spring	32	1.4	.13	31	17.1	1.81	48.0	1.85
- Summer	22	1.4	.15	21	15.8	2.12	46.8	2.17

NSC= Number of services per conception, DO= Days open,
KI = Kindling interval.

Appendix (2). Least-squares means (LSM) and their standard errors (SE) of different year-season subclasses for litter traits at birth in Californian rabbits.

Year-season subclass	NO.	LSB		NBA		NBD	
		LSM	SE	LSM	SE	LSM	SE
1st parity							
1987- Autumn	90	9.3	.24	7.4	.25	1.8	.21
- Winter	61	9.3	.31	7.8	.32	1.5	.27
- Spring	46	7.1	.34	6.1	.36	1.0	.30
- Summer	57	8.3	.31	7.0	.33	1.3	.28
1988- Autumn	11	9.0	.70	7.6	.73	1.3	.62
- Winter	43	8.7	.33	7.2	.35	1.5	.30
- Spring	21	7.2	.47	6.1	.50	1.1	.42
- Summer	9	7.4	.70	6.7	.73	0.6	.62
2nd parity							
1987- Autumn	80	9.1	.16	8.5	.17	0.5	.12
- Winter	57	8.6	.20	8.2	.21	0.4	.15
- Spring	58	7.6	.20	7.3	.22	0.3	.16
- Summer	65	8.4	.19	7.7	.20	0.7	.14
1988- Autumn	11	9.5	.44	8.9	.47	0.5	.34
- Winter	41	9.3	.22	8.9	.24	0.4	.17
- Spring	43	8.1	.22	7.8	.24	0.3	.17
- Summer	18	7.7	.35	7.0	.38	0.6	.27
3rd parity							
1987- Autumn	64	8.5	.18	7.9	.18	0.5	.12
- Winter	52	8.3	.20	7.7	.20	0.5	.14
- Spring	61	7.7	.20	7.2	.19	0.5	.14
- Summer	52	8.0	.20	7.6	.20	0.4	.14
1988- Autumn	12	8.9	.40	8.0	.39	0.9	.28
- Winter	49	8.1	.22	7.6	.21	0.4	.15
- Spring	46	7.2	.21	6.7	.21	0.4	.15
- Summer	31	7.2	.26	6.9	.25	0.2	.18
4th parity							
1987- Autumn	61	8.3	.24	7.7	.24	0.5	.16
- Winter	38	8.0	.30	7.6	.30	0.4	.21
- Spring	49	7.1	.27	6.6	.27	0.4	.18
- Summer	64	7.2	.24	6.7	.24	0.5	.16
1988- Autumn	21	8.8	.40	7.5	.40	1.3	.27
- Winter	42	8.5	.29	7.6	.28	0.8	.19
- Spring	48	7.2	.27	6.3	.27	0.8	.18
- Summer	43	7.7	.29	7.1	.28	0.6	.20

Appendix (2). Cont.

Year-season subclass	LSB		NBA			NBD	
	NO.	LSM	SE	No.	LSM	SE	LSM	SE
5th parity								
1987- Autumn	62	8.1	.20	62	7.4	.22	0.6	.16
- Winter	33	7.9	.27	33	7.4	.29	0.7	.21
- Spring	41	7.1	.24	41	6.5	.26	0.6	.19
- Summer	56	7.3	.22	57	6.6	.24	0.7	.17
1988- Autumn	35	8.3	.27	35	7.6	.30	0.6	.21
- Winter	38	7.8	.24	38	7.3	.26	0.5	.19
- Spring	48	6.7	.25	48	6.2	.27	0.4	.19
- Summer	44	7.2	.25	44	7.0	.27	0.2	.19
6th parity								
1987- Autumn	61	8.1	.23		7.5	.27	0.6	.19
- Winter	22	7.8	.38		6.8	.43	0.9	.31
- Spring	28	6.4	.32		6.1	.37	0.3	.27
- Summer	48	7.3	.26		6.9	.30	0.3	.22
1988- Autumn	44	8.2	.28		7.1	.33	1.0	.24
- Winter	51	7.6	.24		6.9	.28	0.6	.20
- Spring	28	6.3	.32		5.7	.37	0.6	.27
- Summer	44	7.3	.28		6.3	.33	0.9	.24
7th parity								
1987- Autumn	47	8.4	.29		6.8	.35	1.5	.31
- Winter	14	7.3	.52		6.3	.62	0.9	.55
- Spring	20	7.0	.42		5.8	.51	1.2	.45
- Summer	35	7.2	.32		5.9	.39	1.2	.35
1988- Autumn	39	8.0	.33		7.3	.41	0.7	.36
- Winter	50	8.2	.26		7.2	.32	0.9	.28
- Spring	35	6.5	.31		5.5	.37	1.0	.33
- Summer	32	6.4	.39		5.6	.47	0.8	.42
8th parity								
1987- Autumn	31	7.5	.34		6.1	.44	1.4	.39
- Winter	11	6.9	.55		5.5	.72	1.3	.63
- Spring	11	7.5	.60		6.3	.79	0.6	.69
- Summer	22	7.0	.41		6.0	.52	0.7	.46
1988- Autumn	22	7.6	.48		6.2	.63	1.2	.55
- Winter	51	7.1	.29		5.5	.37	1.7	.33
- Spring	32	6.1	.34		4.7	.44	1.5	.39
- Summer	22	7.1	.40		5.8	.52	1.3	.45

LSB= Litter size at birth, NBA= Number born alive,
NBD= Number born dead.

Appendix (3). Least-squares means (LSM) and their standard errors (SE) of different year-season subclasses for litter traits at weaning in Californian rabbits.

Year-season subclass		LSW		LWW		AWW		NDW		
	No.	LSM	SE	LSM	SE	LSM	SE	No.	LSM	SE
1st parity										
1987- Autumn	94	5.3	.17	2818	86	531	5	94	2.0	.20
- Winter	63	5.7	.22	2939	109	513	7	63	2.0	.26
- Spring	47	4.9	.24	2508	120	515	7	47	1.1	.29
- Summer	55	5.5	.23	2792	113	508	7	55	1.5	.27
1988- Autumn	11	5.6	.50	2878	241	506	16	11	2.1	.59
- Winter	44	5.0	.24	2673	118	529	7	44	2.1	.28
- Spring	24	4.6	.31	2373	154	521	10	24	1.5	.38
- Summer	9	5.1	.50	2694	242	526	16	9	1.6	.60
2nd parity										
1987- Autumn	81	6.6	.13	3332	68	506	3	80	1.9	.15
- Winter	57	7.0	.17	3431	84	490	4	57	1.1	.18
- Spring	58	6.2	.17	3135	87	505	5	58	1.0	.18
- Summer	65	6.5	.16	3303	79	501	4	65	1.1	.17
1988- Autumn	11	6.7	.37	3329	184	491	10	11	2.2	.39
- Winter	41	7.1	.18	3514	93	495	5	41	1.8	.20
- Spring	43	6.3	.19	3192	95	500	5	43	1.4	.20
- Summer	18	6.2	.30	3118	148	505	8	18	.8	.31
3rd parity										
1987- Autumn	63	6.4	.16	3276	77	513	4	64	1.5	.17
- Winter	52	6.4	.18	3232	86	504	5	52	1.3	.19
- Spring	61	5.9	.17	2994	83	501	5	61	1.1	.18
- Summer	52	6.3	.18	3206	86	505	5	52	1.1	.19
1988- Autumn	12	5.8	.34	3077	167	526	10	12	2.2	.37
- Winter	49	6.1	.19	3146	91	508	5	49	1.5	.20
- Spring	45	6.0	.19	3022	91	498	5	46	.9	.20
- Summer	31	5.8	.23	2961	110	514	6	31	1.2	.24
4th parity										
1987- Autumn	61	6.2	.19	3155	97	503	8	61	1.4	.18
- Winter	38	6.0	.25	3075	123	506	10	38	1.4	.23
- Spring	49	5.5	.22	2860	110	521	9	49	.9	.21
- Summer	64	5.8	.19	2944	98	509	8	64	.8	.18
1988- Autumn	21	6.1	.33	3229	163	528	13	21	1.4	.31
- Winter	41	6.1	.24	3181	118	516	9	42	1.7	.22
- Spring	48	5.2	.22	2702	109	526	8	48	1.2	.20
- Summer	43	5.8	.23	2936	116	505	9	43	1.3	.22

Appendix (3). Cont.

Year-season subclass	NO	LSW LSM	LSW SE	LWW LSM	LWW SE	AWW LSM	AWW SE	NDW No.	NDW LSM	NDW SE
5th parity										
1987- Autumn	62	5.9	.19	3086	100	519	9	62	1.3	.19
- Winter	33	5.6	.25	2991	131	534	12	33	1.6	.26
- Spring	41	5.4	.23	2744	121	504	11	41	1.1	.23
- Summer	56	5.6	.21	2919	109	519	10	56	1.0	.21
1988- Autumn	35	6.1	.26	3144	134	514	13	35	1.5	.26
- Winter	38	5.8	.23	3019	120	531	11	38	1.5	.23
- Spring	48	5.2	.24	2659	122	506	12	48	0.9	.24
- Summer	44	6.0	.23	2994	121	497	11	44	1.0	.24
6th parity										
1987- Autumn	60	6.1	.23	3109	111	511	6	60	1.4	.22
- Winter	22	5.8	.37	2928	179	506	11	22	1.0	.35
- Spring	28	5.5	.32	2698	155	490	9	28	0.6	.30
- Summer	48	5.5	.25	2804	123	516	7	48	1.4	.24
1988- Autumn	44	5.3	.28	2789	137	529	8	44	1.7	.27
- Winter	50	5.6	.24	2913	114	516	7	50	1.3	.22
- Spring	28	4.4	.32	2283	155	521	9	28	1.2	.30
- Summer	44	5.1	.28	2628	136	510	8	44	1.1	.27
7th parity										
1987- Autumn	46	5.2	.29	2688	142	518	7	47	1.7	.28
- Winter	14	5.8	.50	3077	248	527	13	14	0.4	.48
- Spring	19	5.0	.42	2634	208	519	11	20	0.8	.39
- Summer	35	4.5	.32	2330	157	518	8	35	1.3	.31
1988- Autumn	38	5.4	.33	2864	165	532	9	39	2.1	.32
- Winter	49	5.4	.26	2807	128	523	7	50	1.9	.25
- Spring	34	4.4	.31	2287	151	530	8	35	1.3	.29
- Summer	32	4.7	.38	2466	189	523	10	32	0.8	.36
8th parity										
1987- Autumn	28	4.9	.40	2583	198	520	9	28	1.4	.33
- Winter	10	5.8	.64	3097	319	531	15	10	0.0	.55
- Spring	10	5.4	.68	2719	338	494	16	10	1.6	.58
- Summer	21	5.1	.47	2601	232	509	11	21	1.3	.39
1988- Autumn	22	4.9	.53	2562	266	525	13	22	1.5	.45
- Winter	48	4.2	.33	2186	165	529	7	48	1.4	.27
- Spring	31	4.0	.38	2083	192	530	9	31	0.5	.32
- Summer	21	5.0	.45	2538	224	508	10	21	0.8	.38

LSW= Litter size at weaning, LWW= litter weight at weaning, AWW= Average weight per litter at weaning, NDW= number dead before weaning.

Appendix (4). Least-squares means (LSM) and their standard errors (SE) of different year-season subclasses for number of services per conception and reproductive intervals in New Zealand White rabbits.

Year-season subclass	NSC			DO		KI		
	No.	LSM	SE	LSM	SE	No.	LSM	SE
1st parity								
1986-Autumn	12	1.6	.22	18.4	3.08		49.1	2.67
-Winter	4	2.5	.33	27.2	4.73		55.3	4.09
-Spring	14	1.6	.18	18.0	2.64		47.8	2.28
-Summer	7	1.6	.25	19.1	3.59		46.5	3.11
1987-Autumn	41	1.8	.11	20.0	1.67		49.4	1.44
-Winter	10	1.8	.21	20.4	2.98		51.1	2.58
-Spring	33	1.5	.12	17.6	1.73		47.7	1.49
-Summer	34	1.7	.11	20.4	1.66		49.6	1.43
1988-Autumn	17	1.8	.17	18.3	2.45		49.3	2.11
-Winter	53	1.6	.10	16.7	1.44		47.7	1.23
-Spring	70	1.7	.09	19.5	1.32		50.1	1.13
-Summer	26	1.9	.13	23.4	1.91		52.4	1.64
2nd parity								
1986-Autumn	11	1.1	.21	14.7	3.32	9	44.7	2.99
-Winter	8	1.1	.24	9.8	3.71	5	44.2	3.80
-Spring	6	1.5	.29	18.0	4.43	5	47.3	3.96
-Summer	23	1.5	.14	20.1	2.25	16	46.3	2.18
1987-Autumn	45	1.2	.10	14.2	1.60	45	44.4	1.29
-Winter	14	1.5	.19	17.0	2.93	12	47.2	2.60
-Spring	11	1.6	.21	15.5	3.23	11	44.9	2.64
-Summer	34	1.6	.11	19.5	1.78	31	49.8	1.54
1988-Autumn	25	1.3	.14	14.2	2.15	25	44.4	1.75
-Winter	45	1.4	.11	16.2	1.68	44	47.0	1.38
-Spring	76	1.5	.08	16.9	1.31	72	46.8	1.12
-Summer	52	1.7	.10	20.0	1.62	48	48.1	1.37
3rd parity								
1987-Autumn	41	1.4	.13	16.4	1.89		46.3	1.52
-Winter	12	1.4	.23	16.1	3.34		46.6	2.68
-Spring	13	1.3	.22	12.6	3.27		42.5	2.62
-Summer	39	1.4	.13	15.5	1.89		44.2	1.52
1988-Autumn	28	1.7	.15	20.8	2.17		49.3	1.74
-Winter	30	1.6	.15	19.4	2.19		50.0	1.76
-Spring	50	1.5	.11	17.6	1.67		47.9	1.35
-Summer	54	1.7	.11	20.3	1.61		49.5	1.30
1989-Autumn	12	1.6	.22	18.7	3.27		49.1	2.61
-Winter	10	1.6	.24	14.5	3.56		45.2	2.85
-Spring	15	1.3	.21	15.8	3.09		46.5	2.48
-Summer	7	1.6	.29	18.9	4.20		46.9	3.36

Appendix (4). Cont.

Year-season subclass	No.	NSC LSM	NSC SE	DO LSM	DO SE	KI LSM	KI SE
4th parity							
1987-Autumn	44	1.6	.12	18.5	1.76	47.7	1.46
-Winter	10	1.2	.24	15.6	3.53	45.1	2.93
-Spring	15	1.7	.21	19.1	3.02	48.5	2.51
-Summer	14	1.9	.21	19.0	3.13	49.6	2.60
1988-Autumn	42	1.5	.13	18.6	1.93	48.0	1.60
-Winter	37	1.4	.13	15.8	1.89	46.1	1.57
-Spring	34	1.6	.14	19.7	2.11	48.5	1.75
-Summer	62	1.6	.10	17.5	1.52	47.6	1.26
1989-Autumn	14	1.4	.20	17.2	3.01	47.6	2.49
-Winter	12	1.4	.22	16.8	3.28	47.8	2.72
-Spring	9	1.6	.27	21.7	3.97	50.3	3.29
-Summer	11	2.0	.25	24.7	3.64	54.5	3.02
5th parity							
1987-Autumn	32	1.2	.13	9.8	2.08	41.0	1.71
-Winter	12	1.0	.21	10.3	3.20	41.7	2.64
-Spring	13	1.4	.21	16.0	3.15	45.5	2.60
-Summer	10	1.4	.23	10.6	3.59	40.6	2.96
1988-Autumn	61	1.4	.10	16.4	1.59	45.9	1.30
-Winter	29	1.2	.14	12.7	2.13	43.2	1.76
-Spring	33	1.7	.13	19.3	2.05	49.1	1.69
-Summer	40	1.7	.12	22.2	1.95	50.2	1.60
1989-Autumn	13	1.7	.20	19.2	3.06	48.9	2.52
-Winter	22	1.4	.16	20.4	2.50	50.3	2.06
-Spring	8	1.5	.26	15.2	4.03	45.5	3.33
-Summer	12	1.9	.24	26.8	3.70	54.3	3.05
6th parity							
1987-Autumn	16	1.5	.19	15.5	2.88	45.6	2.34
-Winter	20	1.2	.17	14.2	2.67	44.4	2.18
-Spring	12	1.0	.22	11.2	3.43	41.3	2.80
-Summer	11	1.8	.22	23.2	3.38	49.5	2.75
1988-Autumn	58	1.3	.10	14.7	1.62	44.5	1.32
-Winter	22	1.5	.15	15.8	2.38	46.9	1.94
-Spring	36	1.7	.12	21.0	1.95	49.9	1.59
-Summer	31	1.7	.14	19.4	2.25	49.3	1.83
1989-Autumn	16	1.5	.19	17.9	3.00	47.7	2.44
-Winter	32	1.6	.14	18.1	2.19	47.5	1.78
-Spring	11	1.4	.23	14.8	3.48	44.8	2.83
-Summer	6	2.5	.32	34.1	4.84	57.3	3.95

Appendix (4). Cont.

Year-season subclass	No.	NSC LSM	NSC SE	DO LSM	DO SE	KI LSM	KI SE
7th parity							
1987-Autumn	8	1.9	.28	17.7	4.25	49.1	3.42
-Winter	15	1.6	.20	17.2	3.05	46.8	2.45
-Spring	11	1.7	.24	20.4	3.72	48.9	2.99
-Summer	13	1.5	.23	15.2	3.49	43.1	2.81
1988-Autumn	32	1.5	.15	18.7	2.31	47.8	1.85
-Winter	17	1.4	.18	14.5	2.79	45.9	2.24
-Spring	23	1.4	.17	15.2	2.57	46.2	2.06
-Summer	28	1.7	.15	21.0	2.31	50.2	1.85
1989-Autumn	7	1.9	.34	20.9	5.24	49.8	4.22
-Winter	38	1.4	.13	17.2	1.99	47.3	1.59
-Spring	16	1.8	.21	24.5	3.22	52.7	2.59
-Summer	6	1.6	.34	25.6	5.23	51.2	4.22
8th parity							
1987-Autumn	17	1.4	.21	13.1	3.30	44.2	2.63
-Winter	6	1.6	.32	15.8	5.03	47.7	4.00
-Spring	16	1.7	.22	17.1	3.39	47.9	2.70
-Summer	16	1.4	.22	16.2	3.41	46.0	2.71
1988-Autumn	20	1.7	.18	19.6	2.87	47.5	2.28
-Winter	10	1.7	.25	17.4	3.92	47.7	3.12
-Spring	18	1.6	.20	16.9	3.08	46.5	2.45
-Summer	22	1.6	.18	17.2	2.82	47.2	2.25
1989-Autumn	3	1.6	.56	30.3	8.70	58.6	6.92
-Winter	40	1.4	.15	18.0	2.32	46.8	1.85
-Spring	40	1.7	.14	19.6	2.25	49.0	1.79
-Summer	24	1.9	.18	22.4	2.79	50.4	2.22

NSC= Number of services per conception, DO= Days open,
KI = Kindling interval.

Appendix (5). Least-squares means (LSM) and their standard errors (SE) of different year-season subclasses for litter traits at birth in New Zealand White rabbits.

Year-season subclass	LSB			NBA			NBD		
	No.	LSM	SE	No.	LSM	SE	No.	LSM	SE
1st parity									
1986-Autumn	8	10.0	.79		7.9	.77		2.1	.70
-Winter	5	8.4	1.02		7.5	.98		0.8	.89
-Spring	14	8.5	.63		7.5	.61		0.9	.56
-Summer	10	8.3	.76		8.8	.73		-.4	.67
1987-Autumn	39	9.6	.38		8.1	.38		1.5	.34
-Winter	17	10.4	.55		8.9	.54		1.4	.49
-Spring	28	9.1	.42		7.3	.42		1.7	.38
-Summer	35	7.6	.40		6.3	.39		1.2	.35
1988-Autumn	14	9.9	.61		8.5	.59		1.3	.54
-Winter	67	10.4	.29		8.3	.29		2.1	.26
-Spring	32	9.3	.44		7.6	.43		1.7	.39
-Summer	19	6.8	.53		5.7	.51		1.0	.47
2nd parity									
1986-Autumn	12	9.8	.56		8.1	.50		1.7	.37
-Winter	4	7.8	.87		8.0	.77		.1	.57
-Spring	14	8.8	.48		7.4	.43		1.3	.32
-Summer	7	8.1	.66		7.2	.59		0.8	.43
1987-Autumn	41	9.1	.30		8.6	.27		0.5	.21
-Winter	10	9.2	.55		8.7	.49		0.5	.36
-Spring	33	9.0	.32		8.3	.28		0.6	.22
-Summer	34	7.9	.30		7.4	.27		0.4	.21
1988-Autumn	17	9.4	.45		8.9	.40		0.5	.30
-Winter	53	9.0	.26		8.5	.23		0.4	.18
-Spring	70	8.7	.24		8.2	.21		0.5	.17
-Summer	26	7.5	.35		7.0	.31		0.5	.24
3rd parity									
1986-Autumn	11	8.9	.49	9	7.6	.53	11	0.9	.32
-Winter	8	8.5	.55	5	7.1	.67	8	0.9	.36
-Spring	6	6.7	.66	5	5.5	.70	6	0.4	.43
-Summer	23	7.0	.33	16	6.5	.39	23	0.5	.22
1987-Autumn	45	8.8	.24	45	8.4	.23	45	0.4	.15
-Winter	14	7.3	.43	12	8.2	.46	14	0.3	.28
-Spring	11	7.0	.48	11	6.8	.47	11	0.1	.31
-Summer	34	7.0	.26	31	6.4	.27	34	0.4	.17
1988-Autumn	25	8.6	.32	25	7.9	.31	25	0.6	.21
-Winter	45	8.6	.25	44	8.2	.25	45	0.4	.16
-Spring	76	7.9	.20	72	7.4	.20	76	0.4	.12
-Summer	52	7.1	.24	48	7.0	.24	52	0.2	.16

Appendix (5). Cont.

Year-season subclass	No.	LSB		NBA		NBD	
		LSM	SE	LSM	SE	LSM	SE
4th parity							
1987-Autumn	41	8.6	.29	8.1	.30	0.5	.19
-Winter	12	8.5	.52	7.2	.54	1.2	.33
-Spring	13	7.7	.51	7.0	.52	0.7	.33
-Summer	39	7.6	.29	7.0	.30	0.6	.19
1988-Autumn	28	9.4	.34	8.4	.35	0.9	.22
-Winter	30	8.6	.34	8.0	.35	0.5	.22
-Spring	50	7.4	.26	7.0	.27	0.4	.17
-Summer	54	7.3	.25	6.9	.26	0.3	.16
1989-Autumn	12	7.9	.51	7.1	.52	0.7	.33
-Winter	10	7.8	.55	7.0	.57	0.7	.36
-Spring	15	6.7	.48	6.1	.50	0.6	.31
-Summer	7	7.5	.66	6.3	.67	1.1	.42
5th parity							
1987-Autumn	44	8.7	.27	7.5	.28	1.1	.19
-Winter	10	8.9	.55	8.1	.56	0.7	.38
-Spring	15	7.1	.47	6.4	.48	0.6	.33
-Summer	14	6.8	.49	6.6	.50	0.1	.34
1988-Autumn	42	8.9	.30	8.3	.31	0.5	.21
-Winter	37	8.5	.29	7.8	.30	0.7	.20
-Spring	34	7.1	.33	6.9	.33	0.2	.23
-Summer	62	7.4	.24	7.2	.24	0.2	.16
1989-Autumn	14	8.5	.47	7.5	.48	0.9	.32
-Winter	12	8.8	.51	7.9	.52	0.9	.35
-Spring	9	5.5	.62	5.1	.63	0.4	.43
-Summer	11	6.0	.57	5.7	.58	0.3	.39
6th parity							
1987-Autumn	32	8.7	.36	7.4	.41	1.3	.33
-Winter	12	8.6	.56	7.1	.63	1.4	.51
-Spring	13	7.7	.56	7.0	.62	0.6	.50
-Summer	10	6.4	.64	5.6	.71	0.8	.57
1988-Autumn	61	8.6	.27	7.2	.30	1.3	.25
-Winter	29	8.5	.37	7.3	.42	1.1	.34
-Spring	33	7.5	.36	6.8	.40	0.6	.32
-Summer	40	6.6	.34	6.4	.38	0.2	.31
1989-Autumn	13	7.7	.54	7.4	.61	0.3	.49
-Winter	22	8.5	.44	7.8	.49	0.7	.40
-Spring	8	6.9	.71	5.7	.80	1.1	.64
-Summer	12	6.8	.65	6.2	.74	0.5	.59

Appendix (5). Cont.

Year-season subclass	LSB			NBA			NBD		
	No.	LSM	SE	No.	LSM	SE	No.	LSM	SE
7th parity									
1987-Autumn	16	8.9	.44		8.7	.51		0.1	.43
-Winter	20	7.8	.41		7.6	.47		0.2	.40
-Spring	12	7.0	.52		6.6	.61		0.4	.52
-Summer	11	7.3	.51		6.9	.60		0.3	.51
1988-Autumn	58	8.3	.25		7.4	.28		0.8	.24
-Winter	22	7.9	.36		6.9	.42		0.9	.36
-Spring	36	8.6	.30		7.3	.34		1.2	.29
-Summer	31	6.4	.34		5.6	.40		0.8	.34
1989-Autumn	16	8.1	.46		7.0	.53		1.1	.45
-Winter	32	8.7	.33		7.9	.39		0.8	.33
-Spring	11	7.2	.53		6.4	.62		0.7	.52
-Summer	6	6.6	.74		6.6	.86		0.0	.73
8th parity									
1987-Autumn	8	8.4	.61	25	7.0	.45	8	0.5	.69
-Winter	15	8.2	.44	21	7.1	.48	15	1.0	.49
-Spring	11	6.7	.53	28	5.8	.43	11	0.7	.61
-Summer	13	7.8	.50	29	5.8	.43	13	1.5	.57
1988-Autumn	32	8.1	.34	53	7.0	.32	32	1.4	.37
-Winter	17	8.6	.40	27	6.5	.42	17	2.0	.45
-Spring	23	7.9	.37	41	6.7	.35	23	0.8	.41
-Summer	28	6.9	.33	50	6.5	.31	28	0.3	.37
1989-Autumn	7	8.4	.75	10	6.7	.78	7	1.7	.86
-Winter	38	8.1	.29	81	6.9	.27	38	1.0	.32
-Spring	16	8.8	.46	56	7.2	.31	16	0.7	.52
-Summer	6	6.2	.75	30	6.1	.41	6	0.5	.86
9th parity									
1987-Autumn	17	8.0	.57	17	6.5	.63		1.4	.45
-Winter	6	6.7	.86	6	6.8	.95		0.1	.69
-Spring	15	6.9	.61	16	5.8	.64		0.9	.46
-Summer	16	6.2	.60	16	5.4	.65		0.8	.46
1988-Autumn	18	8.1	.53	20	6.9	.55		0.6	.39
-Winter	8	8.7	.74	10	6.9	.74		1.0	.54
-Spring	15	7.0	.57	18	6.4	.59		0.3	.42
-Summer	21	6.6	.50	22	6.0	.54		0.5	.38
1989-Autumn	3	5.9	1.51	3	5.2	1.65		0.9	1.19
-Winter	34	8.0	.43	40	6.9	.45		1.0	.32
-Spring	34	7.7	.41	40	7.0	.43		0.5	.31
-Summer	21	7.8	.52	24	6.6	.53		0.9	.38

LSB= Litter size at birth, NBA= Number born alive,
NBD= Number born dead.

Appendix (6). Least-squares means (LSM) and standard errors (SE) of different year-season subclasses for litter traits at weaning in New Zealand White rabbits.

Year-season subclass	LSW			LWW		AWW		NDW		
	No.	LSM	SE	LSM	SE	LSM	SE	No.	LSM	SE
1st parity										
1986-Autumn	8	5.1	.53	2824	270	573	16	8	2.6	.61
-Winter	5	6.4	.68	3649	346	574	21	5	1.1	.78
-Spring	14	6.1	.43	3393	216	547	13	14	1.4	.49
-Summer	10	6.6	.51	3566	258	543	15	10	2.1	.58
1987-Autumn	39	5.2	.26	2779	132	529	8	39	2.8	.30
-Winter	17	5.4	.37	2844	190	527	11	17	3.4	.43
-Spring	27	4.9	.30	2542	150	511	9	28	2.4	.33
-Summer	33	4.8	.28	2549	140	531	8	35	1.7	.31
1988-Autumn	14	5.4	.41	2936	208	533	12	14	3.1	.47
-Winter	67	5.3	.20	2814	102	527	6	67	2.9	.23
-Spring	32	5.6	.30	2866	150	511	9	32	2.0	.34
-Summer	19	4.3	.36	2392	182	555	11	19	1.4	.41
2nd parity										
1986-Autumn	18	6.3	.32	3585	154	564	11	12	1.5	.44
-Winter	5	5.4	.53	3106	254	583	18	4	2.8	.68
-Spring	20	5.5	.27	3085	131	554	9	14	1.8	.38
-Summer	10	5.2	.37	2845	181	550	13	7	1.5	.51
1987-Autumn	43	6.6	.20	3484	97	528	7	41	1.7	.24
-Winter	10	6.3	.37	3353	178	537	12	10	2.5	.43
-Spring	34	6.4	.20	3243	100	508	7	33	1.9	.25
-Summer	34	6.1	.20	3162	100	516	7	34	1.4	.24
1988-Autumn	17	6.5	.30	3509	146	539	10	17	2.3	.35
-Winter	59	6.6	.16	3413	79	517	5	53	2.1	.20
-Spring	76	6.7	.15	3344	75	499	5	70	1.5	.19
-Summer	27	6.0	.23	3089	113	510	8	26	0.8	.27
3rd parity										
1986-Autumn	9	5.8	.45	3293	219	563	16	11	1.7	.39
-Winter	5	5.9	.57	3326	279	570	20	8	1.6	.44
-Spring	5	4.5	.59	2444	290	550	21	6	1.8	.52
-Summer	16	5.3	.33	2917	160	556	11	23	1.2	.27
1987-Autumn	45	6.2	.19	3229	95	522	6	45	2.2	.19
-Winter	12	6.3	.39	3328	190	529	13	14	1.7	.35
-Spring	11	5.0	.39	2662	193	525	14	11	1.9	.38
-Summer	31	5.0	.23	2626	113	520	8	34	1.4	.21
1988-Autumn	25	6.0	.26	3168	128	524	9	25	1.8	.25
-Winter	44	6.4	.21	3382	101	526	7	45	1.7	.20
-Spring	72	6.3	.17	3206	82	506	6	76	1.1	.16
-Summer	48	5.8	.20	2974	100	511	7	52	1.1	.19

Appendix (6). Cont.

Year-season subclass	LSW		LWW		AWW		NDW		
	No.	LSM	SE	LSM	SE	LSM	SE	No.	LSM	SE
4th parity										
1987-Autumn	40	5.7	.24	3031	120	531	9	41	2.4	.26
-Winter	12	5.2	.43	3041	210	585	16	12	2.0	.46
-Spring	13	5.2	.42	3027	207	577	15	13	1.8	.45
-Summer	39	5.3	.24	2849	120	543	9	39	1.7	.26
1988-Autumn	28	6.2	.28	3329	136	530	10	28	2.1	.29
-Winter	30	6.0	.28	3207	138	533	10	30	2.0	.30
-Spring	50	6.1	.21	3101	105	508	8	50	0.9	.23
-Summer	52	5.8	.21	2945	103	508	8	54	1.3	.22
1989-Autumn	12	6.0	.42	3073	205	506	15	12	1.2	.44
-Winter	10	5.5	.46	2933	224	529	17	10	1.5	.49
-Spring	15	5.0	.40	2651	194	533	14	15	1.1	.42
-Summer	6	5.2	.59	2710	288	520	22	7	1.0	.57
5th parity										
1987-Autumn	44	5.5	.23	2934	114	535	6	44	2.0	.21
-Winter	10	6.3	.46	3382	229	535	12	10	1.8	.43
-Spring	15	5.4	.39	3098	196	567	10	15	0.9	.36
-Summer	14	5.2	.41	2742	203	531	11	14	1.4	.38
1988-Autumn	42	6.6	.25	3388	125	513	6	42	1.7	.23
-Winter	37	6.0	.25	3168	123	526	6	37	1.7	.23
-Spring	34	5.4	.27	2763	137	510	7	34	1.5	.25
-Summer	62	5.9	.20	3024	99	511	5	62	1.3	.18
1989-Autumn	14	5.4	.39	2837	195	527	10	14	2.2	.36
-Winter	12	5.6	.43	3008	214	538	11	12	2.3	.40
-Spring	9	4.1	.52	2191	258	532	14	9	1.0	.48
-Summer	10	5.0	.49	2653	246	527	13	11	1.1	.44
6th parity										
1987-Autumn	31	5.4	.33	3088	167	587	13	32	2.1	.31
-Winter	12	5.8	.51	3138	256	544	20	12	1.2	.47
-Spring	12	4.7	.52	2720	260	575	21	13	2.6	.47
-Summer	10	4.7	.57	2676	286	585	23	10	1.0	.53
1988-Autumn	60	5.6	.25	2908	125	521	10	61	1.7	.23
-Winter	28	5.8	.34	3064	172	527	14	29	1.6	.31
-Spring	32	5.2	.33	2678	165	512	13	33	1.8	.30
-Summer	38	5.0	.31	2629	157	525	12	40	1.4	.29
1989-Autumn	13	5.6	.49	2904	243	508	19	13	1.9	.45
-Winter	21	5.3	.41	2862	203	536	16	22	2.6	.37
-Spring	8	4.7	.65	2537	321	516	26	8	1.1	.60
-Summer	12	5.6	.59	2768	296	510	24	12	0.6	.55

Appendix (6). Cont.

Year-season subclass	LSW			LWW		AWW		NDW		
	No.	LSM	SE	LSM	SE	LSM	SE	No.	LSM	SE
7th parity										
1987-Autumn	16	5.7	.42	3122	208	548	13	16	3.0	.41
-Winter	20	6.0	.38	3372	193	562	12	20	1.7	.38
-Spring	12	5.7	.50	3027	248	530	16	12	1.0	.49
-Summer	10	5.7	.51	3272	257	567	16	11	1.9	.48
1988-Autumn	57	5.7	.24	2977	120	526	7	58	1.6	.23
-Winter	20	5.7	.36	2974	181	519	11	22	1.8	.34
-Spring	35	5.6	.28	2924	143	519	9	36	1.8	.28
-Summer	30	4.7	.33	2487	166	533	10	31	1.0	.32
1989-Autumn	15	4.7	.45	2377	227	515	14	16	2.5	.43
-Winter	31	6.0	.32	3172	162	530	10	32	2.1	.31
-Spring	11	4.8	.51	2539	254	527	16	11	1.3	.50
-Summer	6	5.1	.70	2618	352	507	23	6	1.3	.70
8th parity										
1987-Autumn	8	6.1	.68	3262	339	539	20	25	1.7	.41
-Winter	15	5.0	.48	2883	242	590	14	21	2.3	.43
-Spring	11	4.7	.60	2734	297	568	17	28	1.5	.39
-Summer	13	5.1	.56	2909	278	561	16	29	0.8	.39
1988-Autumn	32	5.4	.36	2849	182	526	11	53	1.8	.29
-Winter	17	4.0	.44	2183	221	543	13	27	2.5	.38
-Spring	23	5.2	.41	2731	203	523	12	41	2.2	.32
-Summer	28	5.0	.36	2702	182	546	11	50	1.7	.28
1989-Autumn	7	4.4	.84	2242	419	511	24	10	2.4	.71
-Winter	38	5.6	.31	2899	155	521	9	81	1.9	.24
-Spring	16	4.8	.51	2438	256	518	15	56	2.6	.28
-Summer	6	3.8	.84	2197	419	584	24	30	2.1	.37
9th parity										
1987-Autumn	17	4.8	.51	2696	267	564	19	17	1.9	.59
-Winter	6	4.2	.79	2683	409	623	29	6	2.4	.90
-Spring	15	4.5	.55	2706	286	600	20	15	1.5	.61
-Summer	16	4.9	.55	2754	284	557	20	16	0.4	.61
1988-Autumn	18	5.4	.47	2837	246	532	17	18	2.0	.51
-Winter	8	4.9	.68	2661	350	544	25	8	3.1	.70
-Spring	15	4.2	.52	2286	269	546	19	15	2.9	.55
-Summer	21	4.2	.45	2194	233	540	16	21	2.0	.50
1989-Autumn	3	3.4	1.39	2180	719	607	51	3	1.2	1.56
-Winter	34	5.4	.38	2890	198	536	14	34	1.8	.41
-Spring	34	5.1	.37	2765	191	536	13	34	2.6	.40
-Summer	21	5.1	.47	2537	244	506	17	21	2.1	.50

LSW= Litter size at weaning, LWW= litter weight at weaning, AWW= Average weight per litter at weaning, NDW= number dead before weaning.