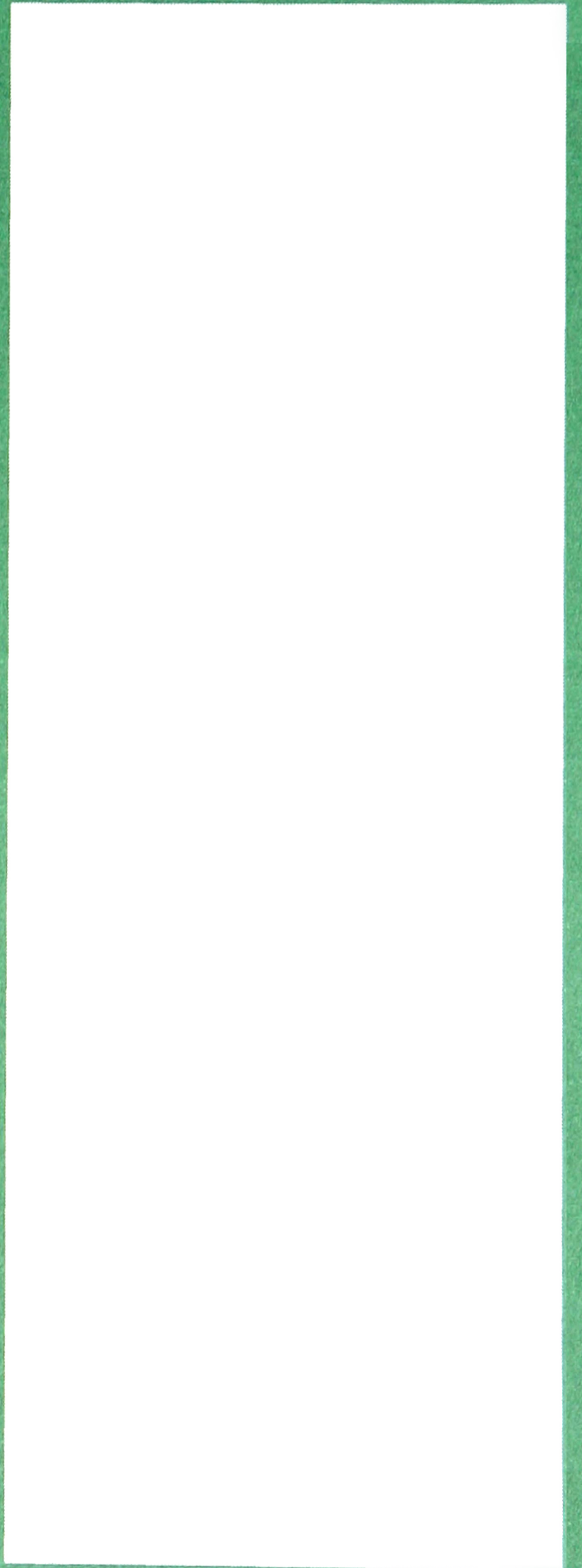
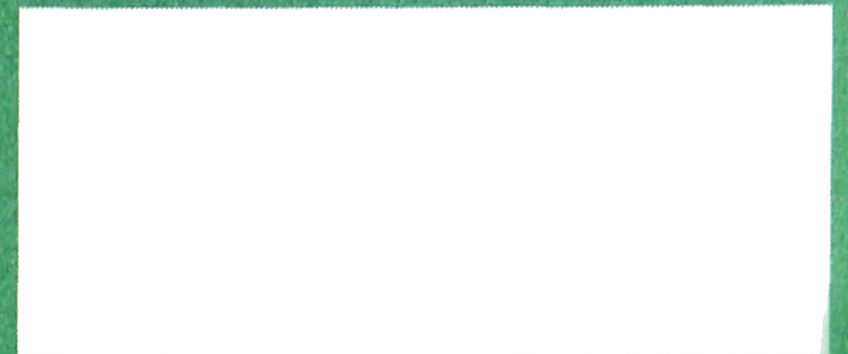


Neonatal Survival and Growth



*British Society of Animal Production
Occasional Publication No. 15*

British Society of Animal Production

The British Society of Animal Production was established in 1943 with the aim of providing the opportunity for those with an interest in animals and animal production to exchange views, ideas and information.

It has developed into an energetic and active society with over 1300 members from over 30 countries throughout the world. Today as ever the Society is the natural meeting point for all of those with an interest in animal production. Its membership is drawn from research, education, advisory work, commerce and practical livestock industry.

The Society organizes a major scientific meeting once a year and occasional specialist meetings on key issues facing animal production. If you would like to join or receive further information about the Society contact: The Secretary, BSAP, PO Box 3, Penicuik, Midlothian EH26 0RZ.

Animal Production

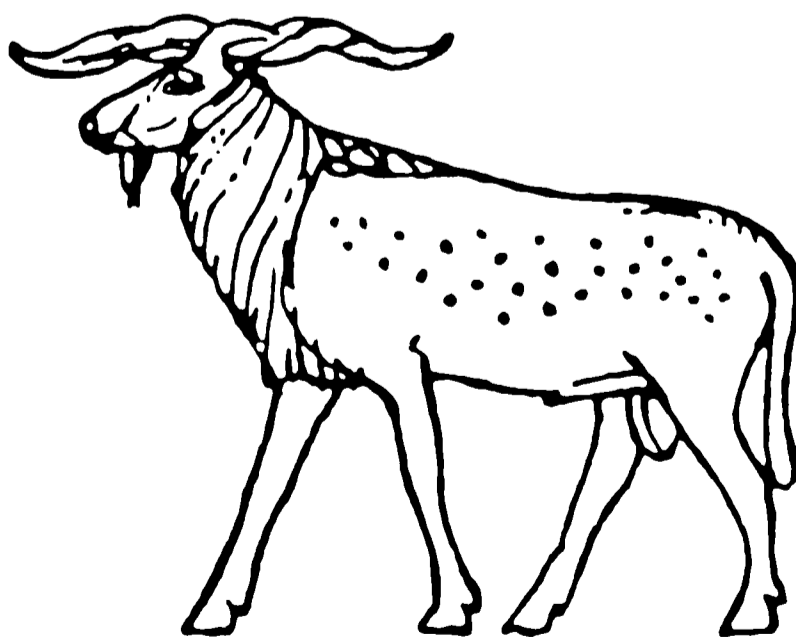
The Society's Journal is *Animal Production* which publishes fundamental and applied research and is a major scientific title of international repute. Original research from basic and applied sciences relevant to all aspects of animal production can be found in it.

Animal Production is published six times a year in two volumes. Annual subscription is £120.00 (or \$240.00 in the USA and Canada) and the price for a single part is £20.00 (or \$40.00) net.

Information regarding subscriptions and sales (current and back numbers of the Journal and the Proceedings) can be obtained from: Durrant Periodicals, Winton Lea, Pencaitland, East Lothian, Scotland EH34 5AY.

Occasional Publications

The British Society of Animal Production's *Occasional Publication* Series contains the full papers presented at certain symposia organized by the Society. A full list of titles is given on the back cover of this Publication. Copies may be obtained from the British Society of Animal Production, PO Box No. 3, Penicuik, Midlothian EH26 0RZ, Scotland.



Inside cover illustration: Ancient Egyptian corkscrew-horned sheep. Beni Hassan ca. 2000 BC (after Griffith, 1896)

NEONATAL SURVIVAL AND GROWTH

Proceedings of a symposium organized by
THE BRITISH SOCIETY OF ANIMAL PRODUCTION
and held at Leeds in July 1991

BSAP OCCASIONAL PUBLICATION

Number 15

edited by M. A. VARLEY, P. E. V. WILLIAMS and T. L. J. LAWRENCE

technical editors HILARY DAVIES and MARIE C. PITKETHLY

BSAP
EDINBURGH
1992

Occ. Publ. Br. Soc. Anim. Prod. No. 15

ISBN 0 906562 15 5
© 1992 THE BRITISH SOCIETY OF ANIMAL PRODUCTION
Printed in Great Britain by D. & J. Croal Ltd., Haddington.

ACKNOWLEDGEMENTS

The Society is indebted to the following organizations who have kindly provided sponsorship for the conference:

J Bibby Agriculture Ltd
BOCM Silcock Ltd
BP Nutrition (UK) Ltd
Cranswick Mill Ltd
Central Soya UK Ltd
Finnfeeds International
Pig Improvement International
Pye Milk Products

Thanks are also due to:

Professor J. M. Forbes, Dr V. R. Fowler, Dr M. Kay, Dr M. A. Varley, Professor A. J. F. Webster and Dr P. E. V. Williams
for chairing the sessions

and to:

Dr M. A. Varley and Dr P. E. V. Williams
for organizing the symposium.

LIST OF DELEGATES

Allen, Mr A. J.	Fisons.
Andrews, Dr A. H.	Royal Veterinary College, Hatfield.
Bassett, Dr J. M.	University of Oxford.
Batley, Mr I.	Unilever Research, Bedford.
Black, Dr W. J. M.	BSAP Hon. Treasurer, Edinburgh.
Bong, Mr L.	University of Nottingham.
Boyd, Mr P. A.	Cranswick Mill Ltd, Driffield.
Byron, Mr J. R.	British Denkavit, Poole, Dorset.
Canavan, Mr J.	University of Leeds.
Clark, Miss L.	University of Reading.
Close, Dr W. H.	Close Consultancy, Reading.
Cooksley, Miss J.	Farmers Guardian, Rotherham.
Darby, Mr C.	University of Reading.
Darling, Mrs J.	BSAP, Edinburgh.
Davies, Mr D. A. R.	University of Liverpool.
Davies, Mrs F.	ADAS, Woodthorne, Wolverhampton.
Desmond, Miss T.	Unilever Research, Bedford.
Fisher, Dr G.	Scottish Agricultural College, Auchincruive.
Fletcher, Dr J. M.	Unilever Research, Bedford.
Forbes, Prof. J. M.	University of Leeds.
Gibson, Mr J. E.	Parnutt Foods Ltd, Sleaford.
Hardy, Dr B.	Dalgety Agriculture Ltd, Bristol.
Haythornthwaite, Mr A.	Nu-Wave Health Products, Warton, Preston.
Herpin, Dr P.	INRA, France.
Hodgson, Dr J. C.	Moredun Research Institute, Edinburgh.
Hughes, Dr P. E.	University of Melbourne, Australia.
Kay, Dr M.	Scottish Agricultural College, Aberdeen.
Kelly, Dr D.	Rowett Research Institute, Aberdeen.
King, Dr T.	Rowett Research Institute, Aberdeen.
Lawrence, Dr A. B.	Scottish Agricultural College, Edinburgh.
Le Dividich, Dr J.	INRA France.
Levene, Prof. M.	University of Leeds.
Lomax, Dr M. A.	University of Reading.
McArthur, Dr A. J.	University of Nottingham.
Meyer, Ms K.	UCNW, Bangor.
Miller, Dr E. L.	University of Cambridge.
Mitchell, Dr L. M.	Scottish Agricultural College, Aberdeen.
Munday, Mrs H. S.	Waltham Centre for Pet Nutrition, Melton Mowbray.
Neil, Mrs M.	Swedish University of Agricultural Sciences.
Newbold, Dr J. R.	Unilever Research, Sharnbrook.
O'Connor, Dr C.	Scottish Agricultural College, Edinburgh.
O'Grady, Dr J. F.	IAWS Group PLC, Dublin.
Ousey, Ms J.	Rossdale & Partners Veterinary Surgeons, Newmarket.
Overend, Dr M. A.	NUTECH Ltd, Lichfield.
Owers, Dr M. J.	Pauls Agriculture Ltd, Ipswich.
Partridge, Dr G. G.	BP Nutrition (UK) Ltd, Northwich.
Pattinson, Ms S.	University of Liverpool.
Phillips, Mrs K.	ADAS, Woodthorne, Wolverhampton.
Pritchard, Mrs K.	University of Nottingham.
Rowan, Dr T.	University of Liverpool.
Smith, Prof. M. W.	AFRC, IAPGR, Cambridge.

Speeding, Mr A.	RASE, Stoneleigh, Warwickshire.
Steele, Mr M. A.	BSAP Secretary, Edinburgh.
Stobo, Dr I.	PYE Milk Products, Reading.
Stokes, Dr C.	University of Bristol.
Stott, Dr A. W.	Scottish Agricultural College, Aberdeen.
Studsholm, Dr F.	Danish Cattle Commission, Aarhus, Denmark.
Symonds, Dr M.	University of Reading.
Taylor, Dr S.	Volac Ltd, Royston.
Thacker, Dr P.	University of Saskatchewan, Canada.
Tibble, Mr S. J.	A-ONE Feeds, Thirsk.
Tomkins, Dr T.	Milk Specialties Co., USA.
Toplis, Mr P.	SC Associates Ltd, Thirsk.
Varley, Dr M. A.	University of Leeds.
Walkland, Mr C.	Pig Farming, Ipswich.
Waterhouse, Dr A.	Scottish Agricultural College, Auchincruive.
Webster, Prof. A. J. F.	University of Bristol.
Widebeck, Ms L.	Swedish Assoc. for Livestock Breeding and Production.
Williams, Dr P. E. V.	Colborn Dawes Nutrition Ltd, Heanor.
Wynands, Dr W. H.	Central Soya Overseas BV, Rotterdam, Holland.

Contents

Varley, M. A. Neonatal survival: an overview	1
Stokes, C. R., Vega-Lopez, M. A., Bailey, M., Telemo, E. and Miller, B. G. Immune development in the gastrointestinal tract of the pig	9
Rowan, T. G. Thermoregulation in neonatal ruminants	13
Close, W. H. Thermoregulation in piglets: environmental and metabolic consequences	25
Lawrence, A. B. and O'Connor, C. E. Behavioural aspects of neonate survival	35
Bassett, J. M. The endocrine regulation of growth during early life: a nutritional perspective	47
Kelly, D., Begbie, R. and King, T. P. Postnatal intestinal development	63
Fletcher, J. M. Patterns of substrate utilization from birth to weaning	81
Taylor, S. J. Milk products and substitutes	93
Hardy, B. Diets for young pigs	99
Williams, P. E. V. and Frost, A. I. Feeding the young ruminant	109
Andrews, A. H. Probiotics and other prophylactic agents	119
Stott, A. W. An information system to manage hypothermia in newborn lambs	139
Spedding, A. W. Calf rearing practice at the National Agricultural Centre Beef and Calf Unit	145
Hughes, P. E. Postnatal care in pigs	149
Abstracts of posters	
Hodgson, J. C., Moon, G. M., Hay, L. A. and Quirie, M. Effectiveness of substitute colostrum in preventing disease in newborn lambs	163
Pattinson, S., Davies, D. A. R. and Winter, A. Colostrum and lamb production of prolific ewes	166
Fisher, G. E. J. and MacPherson, A. Effects of cobalt deficiency in the pregnant ewe on neonatal lamb survival	169
Darby, C. J., Waal, S. van de, Lomax, M. A. and Symonds, M. E. Effect of environmental temperature on brown adipose tissue development in the neonatal lamb	172

Clarke, L., Waal, S. van de, Lomax, M. A. and Symonds, M. E. Brown adipose tissue development in the ovine foetus during the final month of gestation	174
Waterhouse, A., Logue, D. N. and Roger, L. C. The effects of increased prolificacy on lamb and ewe mortality in an intensive hill sheep system	176
Waterhouse, A., Roger, L. C. and Ashworth, S. W. Reducing lamb mortality in hill sheep	179
Rydhmer, L. Relations between piglet weights and survival	183
Sangild, P. T. and Foltmann, B. Glucocorticoids influence the development of gastric proteases in the neonatal pig	185
Needham, D. and Fletcher, J. M. Development of the small intestine and pancreas of the pig weaned at 21 days of age and the effects of exogenous glucocorticoids before weaning	186
Oben, J., Morgan, L., Fletcher, J. M. and Marks, V. The control of porcine adipose tissue metabolism by gut hormones before weaning	189
Batley, I. and Fletcher, J. M. The effects of sow's milk on growth of intestinal epithelial cells <i>in vitro</i>	192
Neil, M. Piglet mortality as affected by a two-food system and <i>ad libitum</i> feeding of the sow	194
Herpin, P., Os, M. van and Le Dividich, J. Adaptation of fat metabolism to environmental temperature in the newborn pig	197