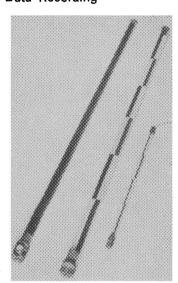
## DELTA-T DEVICES

Specialised Scientific Instruments Micrometeorology – Plant Physiology – Data Recording

	Approx. Price
Stomatal Resistance*	£ Stg.
AUTOMATIC POROMETER Mk II	490
Mk I UPDATE TO Mk II	150
Solar and Net Radiation*	
TUBE NET RADIOMETERS	40
TUBE SOLARIMETERS	50
Relative Humidity	
MINIATURE VENTILATED THERMISTOR	
PSYCHROMETER UNIT	58
Data Collection	
DC MILLIVOLTMETER	57
9-POINT mV CHART RECORDER	240
CS5 CHART STEPPER	375



\* These instruments are manufactured in collaboration with Professor J. L. Monteith Nottingham University School of Agriculture, England.

Please mention this journal when asking for further information.

128 Low Road, Burwell, Cambridge CB5 0EJ, England Telephone: Newmarket (0638) 741584

(i)

# THE JOURNAL OF AGRICULTURAL SCIENCE

#### EDITED BY

- PROF. J. W. L. BEAMENT, SC.D., F.R.S., Department of Applied Biology, Cambridge
- G. D. H. BELL, C.B.E., PH.D., F.R.S. Plant Breeding Institute, Cambridge
- K. L. BLAXTER, PH.D., N.D.A. (HONS.), D.SC., F.R.S.E., F.R.S., Rowett Research Institute, Bucksburn, Aberdeen
- G. W. COOKE, PH.D., F.R.I.C., F.R.S., Agricultural Research Council, 160 Great Portland Street, London W1N 6DT
- S. K. ELTRINGHAM, PH.D., Department of Applied Biology, Cambridge
- PROF. SIR J. B. HUTCHINSON, C.M.G., SC.D., F.R.S., Emeritus Professor of Agriculture, Department of Applied Biology, Cambridge
- PROF. J. B. OWEN, B.SC., PH.D., M.A., School of Agriculture, Aberdeen
- H. L. PENMAN, O.B.E., PH.D., F.R.S., Rothamsted Experimental Station, Harpenden
- PROF A. T. PHILLIPSON, PH.D., M.R.C.V.S.,, F.R.S.E., Department of Clinical Veterinary Medicine, Cambridge
- W. J. RIDGMAN, M.A., Department of Applied Biology, Cambridge
- H. H. ROGERS, B.SC., DIP.AG.SCI., Plant Breeding Institute, Cambridge
- L. E. A. ROWSON, O.B.E., M.R.C.V.S., F.R.S., Agricultural Research Council, Unit of Reproductive Physiology and Biochemistry, Animal Research Station, Cambridge
- PROF. E. W. RUSSELL, C.M.G., PH.D., F.INST.P., Department of Soil Science, University of Reading
- F. YATES, C.B.E., SC.D., F.R.S., Rothamsted Experimental Station, Harpenden

#### **VOLUME 86**

## CAMBRIDGE UNIVERSITY PRESS CAMBRIDGE · LONDON · NEW YORK 1976

#### PUBLISHED BY

#### THE SYNDICS OF THE CAMBRIDGE UNIVERSITY PRESS

The Pitt Building, Trumpington Street, Cambridge CB2 1RP Bentley House, 200 Euston Road, London, NW1 2DB 32 East 57th Street, New York, N.Y.10022

© Cambridge University Press 1976

Printed in Great Britain at the University Printing House, Cambridge

## Contents

## PART 1 (FEBRUARY 1976)

	PAGE
ZAFRA, MARÍA and GARCÍA-PEREGRÍN, E. Seasonal variations in the composition of <i>Pinus</i> halepensis and <i>Pinus sylvestris</i> twigs and needles essential oil	1
FULLER, M. F., ENGLISH, P. R., LIVINGSTONE, R. M. and CROFTS, R. M. J. Effects of simul- taneous reductions of food intake and dietary protein concentration on the growth and carcass quality of bacon pigs	7
WORKER, G. F. JR. Effect of urea and ammonium sulphate applied before sowing on sudan- grass seedlings	17
KEMPSTER, A. J., AVIS, P. R. D., CUTHBERTSON, A. and HARRINGTON, G. Prediction of the lean content of lamb carcasses of different breed types	23
MISSON, B. H. The effects of temperature and relative humidity on the thermoregulatory responses of grouped and isolated neonate chicks	35
MEHRA, USHA R., NATH, K., RANJHAN, S. K. and CHETAL URMILA. A note on the difference between blood urea of buffalo and cow calves	45
HAMID, A. and TALIBUDEEN, O. Effect of sodium on the growth and ion uptake by barley, sugar beet and broad beans	49
RHODES, A. P. and JENKINS, G. Nitrogen and dry-matter accumulation in high lysine and normal varieties of barley	57
SCARISBRICK, D. H., CARR, M. K. V. and WILKES, J. M. The effect of sowing date and season on the development and yield of Navy beans ( <i>Phaseolus vulgaris</i> ) in south-east England	65
PEARCE, J. and WALKER, N. A study of the effects of diet composition, within the bounds of normal diversity, on the characteristics of backfat lipid in pigs	77
SCAIFE, M. A. and JONES, D. The relationship between crop yield (or mean plant weight) of lettuce and plant density, length of growing period, and initial plant weight	83
ALLOWAY, B. J. Field studies on the magnesium, copper and zinc nutrition of maize	93
CONNOLLY, J. Some comments on the shape of the gain-stocking rate curve	103
GUADA, J. A., ROBINSON, J. J. and FRASER, C. The effect of a reduction in food intake during late pregnancy on nitrogen metabolism in ewes	111
JONES, M. J. The significance of crop residues to the maintenance of fertility under continuous cultivation at Samaru, Nigeria	117
McGOVERN, P. T. and LAING, J. A. Ovulation rate in ewes treated with pregnant mares' serum gonadotrophin and luteinizing hormone releasing factor	127
MORAN, J. B. The grazing feed intake of Hereford and Brahman cross cattle in a cool temperate environment .	131
BYFORD, W. J. and PRINCE, J. Experiments on the effect of hormone weedkillers on sugar beet.	135

## Contents

	PAGE
BARRY, T. N. Effects of intraperitoneal injections of DL-methionine on the voluntary intake and wool growth of sheep fed sole diets of hay, silage and pasture differing in digestibility	141
GREGORY, P. and GROGAN, C. O. Influence of cytoplasms on the fatty acid composition of two maize inbred lines	151
HADJICHRISTODOULOU, A. Effect of harvesting stage on cereal and legume forage production in low rainfall regions	155
BARRY, T. N. and JOHNSTONE, P. D. A comparison of supplementary sources of nitrogen and energy for increasing the voluntary intake and utilization of barley straw by sheep .	163
KITCHENHAM, BARBARA A. and ROWLANDS, G. J. Differences in the concentrations of certain blood constitutents among cows in a dairy herd	171
DRAYCOTT, A. P. and DURRANT, M. J. Response by sugar beet to superphosphate, particularly in relation to soils containing little available phosphorus	181
WILMAN, D., DROUSHIOTIS, D., KOOCHEKI, A., LWOGA, A. B. and SHIM, J. S. The effect of interval between harvests and nitrogen application on the proportion and yield of crop fractions in four ryegrass varieties in the first harvest year	189
ELFAWAL, M. A., BISHR, M. A. and HASSOUB, E. K. Natural cross pollination in Egyptian cotton (Gossypium barbadense L.)	205
HAMMERTON, J. L. Effects of B-9 (N-dimethyl-aminosuccinamic acid) on growth and yield of peanuts (Arachis hypogaea L.)	211
SHORT NOTES	
KAUL, J. N., SINGH, K. B. and SEKHON, H. S. The amount of flower shedding in some <i>kharif</i> pulses	219
WURR, D. C. E. and ALLEN, E. J. Effects of cold treatments on the sprout growth of three potato varieties	221

## PART 2 (APRIL 1976)

BARNES, A., GREENWOOD, D. J. and CLEAVER, T. J. A dynamic model for the effects of potassium and nitrogen fertilizers on the growth and nutrient uptake of crops	225
LAURENCE, R. C. N. and GIBBONS, R. W. Changes in yield, protein, oil and maturity of groundnut cultivars with the application of sulphur fertilizers and fungicides	245
WURR, D. C. E. The effects of the growth-regulating compounds methyl decanoate and 2,3,5,-triiodobenzoic acid on potato tuber size	251
HEARN, A. B. Response of cotton to nitrogen and water in a tropical environment. III. Fibre quality	257
WIDDOWSON, F. V., JENKYN, J. F. and PENNY, A. Results from two barley experiments at Saxmundham, Suffolk, measuring effects of the fungicide benodanil on three varieties,	
given three amounts of nitrogen at two times 1973-4	271

v

	PAGE
BHATT, J. G., SHAH, R. C. and SHARMA, A. N. Net assimilation rate of cotton in relation to spacing	281
ENGLAND, F. Genetic relationships between winter survival in Italian ryegrass (Lolium multi- florum Lam) and yield in the previous season	287
LODHI, G. N., SINGH, DAULAT and ICHHPONANI, J. S. Variation in nutrient content of feeding- stuffs rich in protein and reassessment of the chemical method for metabolizable energy estimation for poultry	293
BURNS, I. G. Equations to predict the leaching of nitrate uniformly incorporated to a known depth or uniformly distributed throughout a soil profile	305
LAWRENCE, T. J. L. High moisture maize grain for growing pigs: some effects on accepti- bility, digestibility, nitrogen retention and performance of physical form and tocopherol supplementation	315
FRAPE, D. L., TUCK, M. G. and BOXALL, R. C. A proposed experimental method for the determination of digestible energy of ingredients in pig feeds	325
ATTIYA, H. S. and WILLIAMS, WATKIN. Genetic control of the nuda character complex in the genus Avena .	329
MARSH, R., GORDON, F. J., MURDOCH, J. C. and STEVENSON, W. E. G. Effect of season and pre- vious seasonal fertilizer N application rates on the response of an S.24 perennial rye- grass/white clover sward to fertilizer N	335
HEBBLETHWAITE, P. D. and BURBIDGE, A. The effect of maleic hydrazide and chlorocholine on the growth, seed yield components and seed yield of S. 23 ryegrass.	343
GIBB, M. J. and TREACHER, T. T. The effect of herbage allowance on herbage intake and per- formance of lambs grazing perennial ryegrass and red clover swards	355
PLAYNE, M. J. and KENNEDY, P. M. Ruminal volatile fatty acids and ammonia in cattle grazing dry tropical pastures	367
HOLMES, M. R. J., DEVINE, J. R. and DUNNETT, F. W. Nitrogen requirements of sugar beet in relation to harvesting date	373
BARRY, T. N. Evaluation of formaldehyde-treated lucerne hay for protecting protein from ruminal degradation, and for increasing nitrogen retention, wool growth, live-weight gain and voluntary intake when fed to young sheep	379
WILMAN, D., DROUSHIOTIS, D., KOOCHEKI, A., LWOGA, A. B. and SHIM, J. S. The effect of interval between harvests and nitrogen application on the digestibility and digestible yield and nitrogen content and yield of four ryegrass varieties in the first harvest year.	393
OBIGBESAN, G. O. and FAYEMI, A. A. A. Investigations on Nigerian root and tuber crops: Influence of nitrogen fertilizer on the yield and chemical composition of two casava cultivars ( <i>Manihot esculenta</i> )	401
WHITTEMORE, C. T. and MOFFAT, I. W. The digestibility of dried microbial cells grown on methanol in diets for growing pigs	407
ØRSKOV, E. R., MCDONALD, I., GRUBB, D. A. and PENNIE, K. The nutrition of the early weaned lamb. IV. Effects on growth rate, food utilization and body composition of changing from a low to a high protein diet	411

## Contents

	PAGE
MEELU, O. P., BISHNOI, S. R., RANDHAWA, N. S. and SHARMA, K. N. Response of wheat	
( <i>Triticum aestivum</i> L.) to graded doses of P and N on soils of different P and organic carbon fertility under rainfed conditions	425
Short Notes	
O'KELLY, J. C. and REICH, H. P. The fatty-acid composition of tropical pastures	427
SINGH, N. P., MORE, T. and SAHNI, K. L. Effect of water deprivation on feed intake, nutrient	
digestibility and nitrogen retention in sheep	431

#### Part 3 (June 1976) . . .

CHARLES, D. D. and JOHNSON, E. R. Muscle weight distribution in four breeds of cattle with reference to individual muscles, anatomical groups and wholesale cuts	435
BEEVER, D. E., THOMSON, D. J. and CAMMELL, S. B. The digestion of frozen and dried grass by sheep	443
MCMANUS, W. R., and CHOUNG, C. C. Studies on forage cell walls. 2. Conditions for alkali treatment of rice straw and rice hulls	453
KAMPEN, M. VAN. Activity and energy expenditure in laying hens. I. The energy cost of nesting activity and oviposition	471
REIS, P. J. and TUNKS, D. A. The influence of abosomal supplements of zein and some amino acids on wool growth rate and plasma amino acids	475
SEARLE, T. W. and GRIFFITHS, D. A. The body composition of growing sheep during milk feeding and the effect on composition of weaning at various body weights	483
JONES, W. T. and MANGAN, J. L. Large-scale isolation of fraction 1 leaf protein (18S) from lucerne ( <i>Medicago sativa</i> L).	495
ALLEN, E. J. and WURB, D. C. E. The relationships between tuber size and tuber concentra- tions of nitrogen, phosphorus and potassium.	503
SYKES, A. R. and COOP, R. L. Intake and utilization of food by growing lambs with parasitic damage to the small intestine caused by daily dosing with <i>Trichostrongylus colubriformis</i> larvae	507
CHOUNG, C. C. and McMANUS, W. R. Studies on forage cell walls. 3. Effects of feeding alkali- treated rice hulls to sheep	517
HARRIS, C. E. and MAY-BROWN, R. The effect of tri- <i>n</i> -butyl phosphate on the drying rate and respiration rate of grass leaves measured in the laboratory	531
NASR, H. G. and KHAYRALLAH, W. Heterosis, inbreeding depression and combining abilities in a five-parent diallel of six-row barley	537
DURRANT, M. J. and DRAYCOTT, A. P. Improvements in calcined magnesite as a magnesium fertilizer	543
HABISH, H. A. and MAHDI, A. A. Effect of soil moisture on nodulation of cowpea and hyacinth bean	553
BOND, D. A. In vitro digestibility of the testa in tannin-free field beans (Vicia faba L.)	561

Contents	vii
	PAGE
GOODERHAM, P. T. The effect of soil conditions on mechanized cultivation at high moisture content and of loosening by hand digging	567
CARTWRIGHT, G. A. and THWAITES, C. J. Foetal stunting in sheep. 1 The influence of mater- nal nutrition and high ambient temperature on the growth and proportions of Merino foetuses	573
CARTWRIGHT, G. A. and THWAITES, C. J. Foetal stunting in sheep. 2. The effects of high ambient temperature during gestation on wool follicle development in the foetal lamb.	581
SYKES, A. R. and DINGWALL, R. A. The phosphorus requirement of pregnant sheep	587
COGGINS, C. R. E. and FIELD, A. C. Diurnal variation in the chemical composition of plasma from lactating beef cows on three dietary intakes .	595
RIGGS, T. J. and GOTHARD, P. G. The development of barley grain: comparisons between cultivars for growth rate and $\alpha$ -amylase activity	603
TROUNSON, A. O., WILLADSEN, S. M. and MOOR, R. M. Effect of prostaglandin analogue Cloprostenol on oestrus, ovulation and embryonic viability in sheep	609
VERCOE, J. E. Urinary allantoin excretion and digestible dry-matter intake in cattle and buffalo	613
NAIR, K. P. P. and SINGH, R. P. Plant density studies in maize in India	617
AMIR, J. and LIFSHITZ, N. Weed control of irrigated peanuts in an arid zone	623
DUFFUS, CAROL M. and ROSIE, ROBERTA. Changes in major element composition of developing barley grain	627
ENSER, M. B., WOOD, J. D., RESTALL, D. J. and McFIE, H. J. H. The cellularity of adipose tissue from pigs of different weights	633
SHORT NOTE	
MCALLEN, A. B. and SMITH, R. H. Interrelationships between different chemical components in mixed rumen bacteria	639

	PAGE
CARTWRIGHT, G. A. and THWAITES, C. J. Foetal stunting in sheep. 2. The effects of high ambient temperature during gestation on wool follicle development in the foetal lamb.	581
SYKES, A. R. and DINGWALL, R. A. The phosphorus requirement of pregnant sheep	587
COGGINS, C. R. E. and FIELD, A. C. Diurnal variation in the chemical composition of plasma from lactating beef cows on three dietary energy intakes	595
RIGGS, T. J. and GOTHARD, P. G. The development of barley grain: comparisons between cultivars for growth rate and $\alpha$ -amylase activity	603
TROUNSON, A. O., WILLADSEN, S. M. and MOOR, R. M. Effect of prostaglandin analogue Cloprostenol on oestrus, ovulation and embryonic viability in sheep	609
VERCOE, J. E. Urinary allantoin excretion and digestible dry-matter intake in cattle and buffalo	613
NAIR, K. P. P. and SINGH, R. P. Plant density studies in maize in India	617
AMIR, J. and LIFSHITZ, N. Weed control of irrigated peanuts in an arid zone	623
DUFFUS, CAROL M. and ROSIE, ROBERTA. Changes in major element composition of developing barley grain	627
ENSER, M. B., WOOD, J. D., RESTALL, D. J. and MACFIE, H. J. H. The cellularity of adipose tissue from pigs of different weights	633
Short Note	
MCALLEN, A. B. and SMITH, R. H. Interrelationships between different chemical components in mixed rumen bacteria .	639

## THE JOURNAL OF AGRICULTURAL SCIENCE

### CONTENTS

#### Vol. 86 Part 3 June 1976

Crupter D. D. and Jammers, F. B. Muscle switch distribution in four last haft with with	PAGE
CHARLES, D. D. and JOHNSON, E. R. Muscle weight distribution in four breeds of cattle with reference to individual muscles, anatomical groups and wholesale cuts	435
BEEVER, D. E., THOMSON, D. J. and CAMMELL, S. B. The digestion of frozen and dried grass by sheep	443
McMANUS, W. R. and CHOUNG, C. C. Studies on forage cell walls. 2. Conditions for alkali treatment of rice straw and rice hulls	453
KAMPEN, M. VAN. Activity and energy expenditure in laying hens. 1. The energy cost of nesting activity and oviposition	471
REIS, P. J. and TUNKS, D. A. The influence of abomasal supplements of zein and some amino acids on wool growth rate and plasma amino acids	475
SEARLE, T. W. and GRIFFITHS, D. A. The body composition of growing sheep during milk feeding and the effect on composition of weaning at various body weights	483
JONES, W. T. and MANGAN, J. L. Large-scale isolation of fraction 1 leaf protein (18S) from lucerne (Medicago sativa L.)	495
ALLEN, E. J. and WURR, D. C. E. The relationships between tuber size and tuber concentra- tions of nitrogen, phosphorus and potassium	503
SYKES, A. R. and COOP, R. L. Intake and utilization of food by growing lambs with parasitic damage to the small intestine caused by daily dosing with <i>Trichostrongylus colubriformis</i> larvae	507
CHOUNG, C. C. and MCMANUS, W. R. Studies on forage cell walls. 3. Effects of feeding alkali- treated rice hulls to sheep	517
HARRIS, C. E. and MAY-BROWN, R. The effect of tri- <i>n</i> -butyl phosphate on the drying rate and respiration rate of grass leaves measured in the laboratory.	531
NASR, H. G. and KHAYRALLAH, W. Heterosis, inbreeding depression and combining abilities in a five-parent diallel of six-row barley	537
DURRANT, M. J. and DRAYCOTT, A. P. Improvements in calcined magnesite as a magnesium fertilizer	543
HABISH, H. A. and MAHDI, A. A. Effect of soil moisture on nodulation of cowpea and hyacinth bean	553
BOND, D. A. In vitro digestibility of the testa in tannin-free field beans (Vicia faba L.).	561
GOODERHAM, P. T. The effect on soil conditions of mechanized cultivation at high moisture content and of loosening by hand digging	567
CARTWRIGHT, G. A. and THWAITES, C. J. Foetal stunting in sheep. 1. The influence of maternal nutrition and high ambient temperature on the growth and proportions of Merino foetuses	573

Continued on inside back cover

#### Cambridge University Press 1976

SUBSCRIPTIONS. Two volumes of three parts are published annually. The subscription price of volumes 86 and 87, 1976, is £17.50 net (U.S.A. and Canada US \$47.50) per volume (post free); single parts are available at £7.00 net (U.S.A. and Canada US \$18.50) plus postage. Orders or enquiries may be sent to any bookseller or subscription agent, or to Cambridge University Press, P.O. Box 92, London NW1 2DB (U.S.A. and Canada, Cambridge University Press, 32 East 57th Street, New York, N.Y. 10022, U.S.A.).

Printed in Great Britain at the University Printing House, Cambridge