The Journal of Agricultural Science

SENIOR EDITOR W. J. Whittington

EDITORIAL ASSISTANT
N. M. Boston

Journal of Agricultural Science, University of Nottingham, Faculty of Agricultural and Food Sciences, Sutton Bonington Campus, Loughborough, Leicestershire LE12 5RD, UK

EDITORIAL BOARD

E. J. Allen University of Cambridge, UK

B. W. Bache University of Cambridge, UK

W. Day Silsoe Research Institute, UK

M. F. Fuller Rowett Research Institute, Aberdeen, UK

M. D. Gale

Cambridge Laboratory,

JI Centre, Norwich, UK

K. E. Giller
Wye College, UK

J. C. Gower
Wheathampstead, UK

J. F. D. Greenhalgh Conwy, UK

A. E. Johnston
AFRC Institute of Arable
Crops Research,
Rothamsted, UK

R. A. Kempton

Scottish Agricultural Statistics Service, University of Edinburgh, UK

T. Lewis

AFRC Institute of Arable Crop Research, Rothamsted, UK

D. B. Lindsay Cambridge, UK

J. S. Macfarlane

Centre for Tropical Veterinary Medicine, University of Edinburgh, UK

T. R. Morris
University of Reading, UK

J. B. Owen
University College of
North Wales, Bangor, UK

C. J. Pollock

AFRC Institute of Grassland
and Environmental Research,

Welsh Plant Breeding Station,

D. A. Preece

University of Kent, Canterbury, UK

T. J. Riggs

Horticulture Research International, Wellesbourne, UK

P. E. Russell
Chesterford Park
Research Station

Research Station, Saffron Walden, UK R. K. Scott

University of Nottingham, Sutton Bonington, UK

R. Thompson

AFRC Institute of Animal,

Physiology and Genetics

Research, Edinburgh Research

Station. UK

D. Wilman
University College of Wales,
Aberystwyth, UK

INTERNATIONAL CONSULTANTS

G. M. O. Maloiy University of Nairobi, Kenya

P. Day Rutgers University of

New Jersey, New Brunswick, USA

Aberystwyth, UK

S. K. Sinha

Indian Agricultural Research Institute, New Delhi, India W. Erskine
ICARDA,
Aleppo, Syria
J. H. Topps

University of Zimbabwe, Harare, Zimbabwe

VOLUME 122

CAMBRIDGE UNIVERSITY PRESS

Cambridge

New York Port Chester Melbourne Sydney

1994

CAMBRIDGE UNIVERSITY PRESS

PUBLISHED BY THE PRESS SYNDICATE OF THE UNIVERSITY OF CAMBRIDGE

The Pitt Building, Trumpington Street, Cambridge CB2 1RP 40 West 20th Street, New York, NY 10011-4211, USA 10 Stamford Road, Oakleigh, Melbourne 3166, Australia

© Cambridge University Press 1994

Printed in Great Britain by the University Press, Cambridge

CONTENTS

PART 1 (FEBRUARY 1994)

Instructions to Authors	PAGE
REVIEW	
GRANT, S. A. AND MARRIOTT, C. A. Detailed studies of grazed swards – techniques and conclusions	1
CROPS AND SOILS	
DONG SHUTING. Canopy apparent photosynthesis, respiration and yield in wheat	7
BENBI, D. K. Prediction of leaf area indices and yields of wheat	13
KIRBY, E. J. M., APPLEYARD, M. AND SIMPSON, N. A. Co-ordination of stem elongation and Zadoks	
growth stages with leaf emergence in wheat and barley	21
ADU-DAPAAH, H. K., COBBINA, J. AND ASARE, E. O. Effect of cocoa pod ash on the growth of maize	31
SHARMA, A. R. AND DE, R. N. Effect of foliage cutting on growth and yield of different rice cultivars	
under semi-deepwater conditions (0-80 cm)	35
GHOSH, B. C., GHOSH, R., MITTRA, B. N., MITRA, A. AND JANA, M. K. Influence of organic and	
inorganic fertilization on the growth and nutrition of rice and fish in a dual culture system	41
JACOBSEN, SE., JØRGENSEN, I. AND STØLEN, O. Cultivation of quinoa (Chenopodium quinoa) under	
temperate climatic conditions in Denmark	47
DE FIGUEIREDO, M. AND MARAIS, J. P. The effect of bacterial inoculants on kikuyu silage quality	53
OKEKE, J. E. Productivity and yield stability in cassava (Manihot esculenta) as affected by stake weight	61
XIA, M. Z. Effects of soil drought during the generative development phase of faba bean (Vicia faba)	
on photosynthetic characters and biomass production	67
JOHNSTON, A. E., MCEWEN, J., LANE, P. W., HEWITT, M. V., POULTON, P. R. AND YEOMAN, D. P.	
Effects of one to six year old ryegrass-clover leys on soil nitrogen and on the subsequent yields and	
fertilizer nitrogen requirements of the arable sequence winter wheat, potatoes, winter wheat, winter beans (<i>Vicia faba</i>) grown on a sandy loam soil	7.2
· · · · · · · · · · · · · · · · · · ·	73
NGUYEN, M. L. AND GOH, K. M. Distribution, transformations and recovery of urinary sulphur and sources of plant-available soil sulphur in irrigated pasture soil-plant systems treated with	
35sulphur-labelled urine	91
JOSHI, R. C., HAOKIP, D. D. AND SINGH, K. N. Effect of green manuring on the physical properties	91
of soil under a rice-wheat cropping system	107
or son under a rice wheat eropping system	10,
ANIMALS	
FREUDENBERGER, D. O., BURNS, C. J., TOYOKAWA, K. AND BARRY, T. N. Digestion and rumen	
metabolism of red clover and perennial ryegrass/white clover forages by red deer	115
BARLOW, R., HEARNSHAW, H., ARTHUR, P. F. AND DARNELL, R. E. Evaluation of Hereford and	
first-cross cows on three pasture systems. I. Calf growth and reproductive performance of young	
cows	121
HEARNSHAW, H., ARTHUR, P. F., KOHUN, P. J. AND BARLOW, R. Evaluation of Hereford and first-	
cross cows on three pasture systems. II. Growth of Hereford and Brahman sired calves out of	
mature cows	131
CAFE, L. M. AND POPPI, D. P. The fate and behaviour of imbibed water in the rumen of cattle	139
MARTIN, P. A., CHAMBERLAIN, D. G., ROBERTSON, S. AND HIRST, D. Rumen fermentation patterns	
in sheep receiving silages of different chemical composition supplemented with concentrates rich	
in starch or in digestible fibre	145
GOODCHILD, A. V. AND MCMENIMAN, N. P. Intake and digestibility of low quality roughages when	
supplemented with leguminous browse	151
ABSTRACTS	
AFRC MODELLERS' GROUP. Proceedings of the Twenty-Fourth Meeting of the AFRC Modellers'	
Group	161
BOOK BENIEWS	
BOOK REVIEWS	

PART 2 (APRIL 1994)

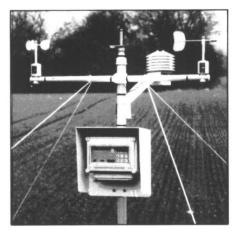
Instructions to Authors	PAGE
REVIEW WILSON, J. R. Cell wall characteristics in relation to forage digestion by ruminants	173
CROPS AND SOILS	
FLAGELLA, Z., PASTORE, D., CAMPANILE, R. G. AND DI FONZO, N. Photochemical quenching of	
chlorophyll fluorescence and drought tolerance in different durum wheat (Triticum durum) cultivars	183
CHOWDHURY, M. K. AND ROSARIO, E. L. Comparison of nitrogen, phosphorus and potassium utilization efficiency in maize/mungbean intercropping	193
SHARMA, A. R. Effect of seed rate and row spacing on the performance of early and late maturing rice cultivars in mixed crop systems under intermediate deepwater conditions (15–50 cm)	20
VOLAIRE, F. Effects of summer drought and spring defoliation on carbohydrate reserves, persistence and recovery of two populations of cocksfoot (<i>Dactylis glomerata</i>) in a Mediterranean environment WILMAN, D. AND DERRICK, R. W. Concentration and availability to sheep of N, P, K, Ca, Mg and	20′
Na in chickweed, dandelion, dock, ribwort and spurrey, compared with perennial ryegrass	21
WHITEHEAD, A. G. Effect of cultivar, carbofuran and row spacing on the incidence of stem and leaf nematodes (Ditylenchus dipsaci and Aphelenchoides ritzema-bosi) in lucerne (Medicago sativa) and	
on lucerne herbage yield	22:
SOLOMON-BLACKBURN, R. M., MACKAY, G. R. AND BROWN, J. An evaluation of seedling progeny tests for resistance to potato leafroll virus in potato	23
PRABHJEET SINGH AND BHARGAVA, S. C. Changes in growth and yield components of Brassica	2.4
napus in response to Azotobacter inoculation at different rates of nitrogen application METZ, P. L. J., BUIEL, A. A. M., VAN NOREL, A. AND HELSPER, J. P. F. G. Genetic factors controlling	24
outcrossing in faba bean (<i>Vicia faba</i>): effects of pollen donor and receptor genotypes and estimates of inter-receptor cross-fertilization	249
STÜTZEL, H., AUFHAMMER, W. AND LÖBER, A. Effects of sowing technique on yield formation of	27.
Vicia faba as affected by population density, sowing date and plant type	25
WHITE, J. W., OCHOA M., R., IBARRA P., F. AND SINGH, S. P. Inheritance of seed yield, maturity and seed weight of common bean (<i>Phaseolus vulgaris</i>) under semi-arid rainfed conditions	26:
WHITE, J. W., CASTILLO, J. A., EHLERINGER, J. R., GARCIA-C., J. A. AND SINGH, S. P. Relations of carbon isotope discrimination and other physiological traits to yield in common bean (<i>Phaseolus vulgaris</i>) under rainfed conditions	27:
ANIMALS	
HAUSTEIN, A. T., GILMAN, R. H., SKILLICORN, P. W., HANNAN, H., DÍAZ, F., GUEVARA, V., VERGARA, V., GASTAÑADUY, A. AND GILMAN, J. B. Performance of broiler chickens fed diets	204
containing duckweed (<i>Lemna gibba</i>) COBON, D. H. AND CARTER, J. O. Effect of herbage in <i>Astrebla</i> spp. pastures in north-west Queensland on lamb survival	285 291
ORTIGUES, I., DURAND, D. AND LEFAIVRE, J. Use of para-amino hippuric acid to measure blood flows through portal-drained-viscera, liver and hindquarters in sheep	299
NEUTZE, S. A., ODDY, V. H. AND GOODEN, J. M. A cranial mesenteric vein preparation for measurement of amino acid uptake by lambs	309
EL-BELELY, M. S. Endocrine changes, with emphasis on 13,14-dihydro-15-keto-prostaglandin $F_{2\alpha}$ and	
corticosteroids, before and during parturition in dromedary camels (Camelus dromedarius)	315
BOOK REVIEWS	325

PART 3 (JUNE 1994)

Instructions to Authors	PAGE
REVIEW LEMON, R. W. Insecticide resistance	329
CROPS AND SOILS KEMPTON, R.A., SERAPHIN, J. C. AND SWORD, A. M. Statistical analysis of two-dimensional variation in variety yield trials CONRY, M. J. Comparative effect of six cultivars at four rates of nitrogen on the grain yield and grain quality of spring-sown malting barley in Ireland DUBEY, S. K. AND MONDAL, R. C. Effect of amendments and saline irrigation water on soil properties and yields of rice and wheat in a highly sodic soil SHARMA, A. R. AND DAS, K. C. Effect of green manuring with dhaincha (Sesbania aculeata) on growth and yield of direct-sown and transplanted rice under intermediate deepwater conditions (0-50 cm) JENKINSON, D. S., POTTS, J. M., PERRY, J. N., BARNETT, V., COLEMAN, K. AND JOHNSTON, A. E. Trends in herbage yields over the last century on the Rothamsted Long-term Continuous Hay Experiment WILMAN, D., GAO, Y. AND MICHAUD, P. J. Morphology and position of the shoot apex in some temperate grasses NG KEE KWONG, K. F. AND DEVILLE, J. The course of fertilizer nitrogen uptake by rainfed sugarcane in Mauritius DARBY, R. J. AND YEOMAN, D. P. Effects of methods of cereal straw disposal, seedbed preparation and sowing method on the establishment, yield and oil content of winter oilseed rape (Brassica napus) LEACH, J. E., DARBY, R. J., WILLIAMS, I. H., FITT, B. D. L. AND RAWLINSON, C. J. Factors affecting growth and yield of winter oilseed rape (Brassica napus), 1985–89 RAO, L. J. AND MITTRA, B. N. Planting pattern of two pigeonpea (Cajanus cajan) cultivars when intercropped with groundnut (Arachis hypogaea) HINDS, M. J. AND SINGH, B. Evaluation of fatty acids in oil as reaping indices for Caribbean-grown groundnut (Arachis hypogaea) HINDS, M. J. AND SINGH, B. Evaluation of fatty acids in oil as reaping indices for Caribbean-grown groundnut (Arachis hypogaea) HINDS, M. J. AND SINGH, B. Evaluation of fatty acids in oil as reaping indices for Caribbean-grown groundnut (Arachis hypogaea) HINDS, M. J. AND SINGH, B. Evaluation of fatty acids in oil as reaping indices for Caribbean-grown groun	335 343 351 359 365 375 385 393 405 415 423 429 435
after a grazed grass ley and on the response of the following cereal crops to fertilizer nitrogen	445
ANIMALS KHOMBE, C. T., HAYES, J. F., TAWONEZVI, H. P. R. AND KHOMBE, M. Estimation of genetic differences between Mashona bulls from different production systems using an animal model MORROW, A. T. S. AND WALKER, N. Effects of number and siting of single-space feeders on performance and feeding behaviour of growing pigs MORRIS, S. T., MCCUTCHEON, S. N., PARKER, W. J. AND BLAIR, H. T. Effect of sward surface height on herbage intake and performance of lactating ewes lambed in winter and continuously stocked on pasture	459 465 471
BOOK REVIEWS	483
INDEX	487

DELTA-T WEATHER STATION

A complete system of instrumentation for automatically measuring and recording the weather at remote sites.



Standard sensors

- air temperature
- rainfall
- relative humidity
- soil temperature
- solar radiation
- wind direction
- wind speed
- barometric pressure
- * User-defined recording
- * Typically 12 months battery life
- * Solar power option
- * On-site checks using LCD on control panel
- * Remote interrogation via RS232 link

Description All sensors are mounted on a 2m mast, except for the soil temperature probe and the raingauge. An environmental data logger (the Delta-T logger) initiates readings, controls the sensors and stores data. The Logger memory is expandable from 16K to 128K readings.

Data collection Stored readings can be collected with a portable computer or printer without interrupting logging.

Programmable The user has independent control over each sensor to define: sampling interval, valid reading range, engineering units (eg mm of rainfall), and data compression. These are specified using a personal computer.

Special requirements We are able to supply part-systems and non-standard combinations of sensors, (the Logger is expandable up to 60 analogue/counter inputs). Further information, advice or a quotation will be provided on request.



DELTA-T DEVICES LTD.

128 Low Road, Burwell, Cambridge CB5 0EJ Telephone: 0638 742922 Fax: 0638 743155 Telex: 817670 ASABSE G "ATTN DELTA-T" New Graphing Software Now Available Copying. No contents may be reproduced by any means without the permission of Cambridge University Press. This journal is registered with the Copyright Clearance Center, 222 Rosewood Drive, Danvers, MA 01923. Organizations in the USA who are also registered with the C.C.C. may therefore copy material (beyond the limits permitted by sections 107 and 108 of US copyright law) subject to payment to C.C.C. of the per-copy fee of \$5.00. This consent does not extend to multiple copying for promotional or commercial purposes. Code 0021–8596/94 \$5.00+0.00. *ISI Tear Sheet Service*, 3501 Market Street, Philadelphia, PA 19106, USA, is authorized to supply single copies of separate articles for private use only. Organizations authorized by the Copyright Licensing Agency may also copy material subject to the usual conditions. *For all other use*, permission should be sought from Cambridge or the American Branch of Cambridge University Press.

Continued from back cover

MORROW, A. T. S. and WALKER, N. Effects of number and siting of single-space feeders on performance and feeding behaviour of growing pigs	465
MORRIS, S. T., McCUTCHEON, S. N., PARKER, W. J. and BLAIR, H. T. Effect of sward surface height on herbage intake and performance of lactating ewes lambed in	
winter and continuously stocked on pasture	471
BOOK REVIEWS	483
INDEX	487

CAMBRIDGE UNIVERSITY PRESS

The Pitt Building, Trumpington Street, Cambridge CB2 1RP 40 West 20th Street, New York, NY 10011–4211, USA 10 Stamford Road, Oakleigh, Melbourne 3166, Australia

Printed in Great Britain by the University Press, Cambridge

The Journal of Agricultural Science

VOLUME 122 PART 3 JUNE 1994

CONTENTS

Instructions to Authors	
REVIEW LEMON, R. W. Insecticide resistance	329
CROPS AND SOILS KEMPTON, R. A., SERAPHIN, J. C. and SWORD, A. M. Statistical analysis of two-	
dimensional variation in variety yield trials CONRY, M. J. Comparative effect of six cultivars at four rates of nitrogen on the grain	335
yield and grain quality of spring-sown malting barley in Ireland DUBEY, S. K. and MONDAL, R. C. Effect of amendments and saline irrigation water on	343
soil properties and yields of rice and wheat in a highly sodic soil	351
SHARMA, A. R. and DAS, K. C. Effect of green manuring with dhaincha (Sesbania aculeata) on growth and yield of direct-sown and transplanted rice under inter-	
mediate deepwater conditions (0-50 cm) JENKINSON, D. S., POTTS, J. M., PERRY, J. N., BARNETT, V., COLEMAN, K. and	359
JOHNSTON, A. E. Trends in herbage yields over the last century on the Rothamsted Long-term Continuous Hay Experiment	365
WILMAN, D., GAO, Y. and MICHAUD, P. J. Morphology and position of the shoot apex	
in some temperate grasses NG KEE KWONG, K. F. and DEVILLE, J. The course of fertilizer nitrogen uptake by	375
rainfed sugarcane in Mauritius DARBY, R. J. and YEOMAN, D. P. Effects of methods of cereal straw disposal, seedbed	385
preparation and sowing method on the establishment, yield and oil content of winter oilseed rape (<i>Brassica napus</i>)	393
LEACH, J. E., DARBY, R. J., WILLIAMS, I. H., FITT, B. D. L. and RAWLINSON, C. J.	
Factors affecting growth and yield of winter oilseed rape (<i>Brassica napus</i>), 1985–89 RAO, L. J. and MITTRA, B. N. Planting pattern of two pigeonpea (<i>Cajanus cajan</i>)	405
cultivars when intercropped with groundnut (<i>Arachis hypogaea</i>) HINDS, M. J. and SINGH, B. Evaluation of fatty acids in oil as reaping indices for	415
Caribbean-grown groundnut (<i>Arachis hypogaea</i>) HEBBAR, K. B., SASHIDHAR, V. R., UDAYAKUMAR, M., DEVENDRA, R. and	423
NAGESWARA RAO, R. C. A comparative assessment of water use efficiency in	
groundnut (Arachis hypogaea) grown in containers and in the field under water- limited conditions	429
HULUGALLE, N. R. and NDI, J. N. Changes in soil properties of a newly-cleared Ultisol due to establishment of hedgerow species in alley cropping systems	435
WEBB, J. and SYLVESTER-BRADLEY, R. Effects of fertilizer nitrogen on soil nitrogen availability after a grazed grass ley and on the response of the following cereal crops	
to fertilizer nitrogen	445
ANIMALS	
KHOMBE, C. T., HAYES, J. F., TAWONEZVI, H. P. R. and KHOMBE, M. Estimation of genetic differences between Mashona bulls from different production systems using an animal model	459

Continued on inside back cover

PAGE





0021-8596(199406)122:3;1-8