The 2011 Society for Engineering in Agriculture Conference

‘Diverse Challenges Innovative Solutions’
The 2011 SEAg Conference
‘Engineering in Agriculture – Diverse Challenges Innovative Solutions’

‘Book of Abstracts (Volume 1 of 1)
Published by the Australian Society for Engineering in Agriculture
Editors: T. Banhazi and C. Saunders
Surfers Paradise, September 2011
ISBN: 978-0-85825-990-4
CONFERENCE COMMITTEE

Chair of Scientific Committee:
A/Prof Thomas Banhazi, National Centre for Engineering in Agriculture (NCEA)

Members of the Scientific Committee acting as sub-editors and reviewers:

- Dr Alexander Kist
- Dr Alison McCarthy
- Dr. Amots Hetzroni
- Dr Andre Aarnink
- Prof. Andres Aland
- Dr Andrew Maxwell
- Dr. Avraham Arbel
- Prof. Baoming Li
- Dr Bernadette McCabe
- Dr Chris Saunders
- Dr Heiner Lehr
- Prof. In-Bok Lee
- Prof. Jeff Smithers
- Prof. Joerg Hartung
- Prof. John Feddes
- Assoc. Prof. John Fielke
- Dr Les Bowtell
- Prof. Manuela Zude
- A/Prof Nigel Hancock
- Prof. Richard S. Gates
- Prof. Rod Smith
- Dr. Samuel Gan-Mor
- A/Prof. Thomas Banhazi
- Dr Tobias Low
- Dr Troy Jensen
- Prof. Victoria Blanes-Vidal
- Prof. Daniel Berckmans
- Dr Avraham Arbel
- Craig Baillie
- Jochen Eberhard
- Dr John Bennett

Although some basic refereeing or ‘light reviews’ have been undertaken, the scientific content of the papers is the sole responsibility of the authors.

Chair of Organising Committee:
Erik Schmidt, Director, National Centre for Engineering in Agriculture, University of Southern Queensland

Members of Organising Committee:

- A/Prof Thomas Banhazi, Chair – Scientific Committee
- Dr Chris Saunders
- Glen Riethmüller
- Paul Harris
- Dr Troy Jensen
- Dr Mark Trotter
- Rhiannon Hegarty
- Catriona McAuliffe

‘Book of Abstracts’ of the Biennial Conference of the Australian Society for Engineering in Agriculture (SEAg), published by SEAg Editors: T. Banhazi and C. Saunders, 26 -30 September 2011, Surfers Paradise, QLD
SEAG NATIONAL COMMITTEE MEMBER POSITIONS

**Chair:** A/Prof Thomas Banhazi,  
National Centre for Engineering in Agriculture (NCEA)  
Faculty of Engineering and Surveying  
University of Southern Queensland (USQ),  
Email: thomas.banhazi@usq.edu.au

**Deputy Chair:** Dr Chris Saunders  
School of Advanced Manufacturing and Mechanical Engineering  
University of South Australia  
Email: Chris.saunders@unisa.edu.au

**Secretary:** Troy Jensen  
National Centre for Engineering in Agriculture (NCEA)  
University of Southern Queensland (USQ),  
Email: troy.jensen@usq.edu.au

**Treasurer:** Glen Riethmuller  
Development Officer  
Department of Agriculture and Food, WA  
Email: glen.riethmuller@agric.wa.gov.au

**Education:** Erik Schmidt  
Director  
National Centre for Engineering in Agriculture (NCEA)  
University of Southern Queensland  
Email: Erik.Schmidt@usq.edu.au

**Communication:** Dr Guangnan Chen  
Faculty of Engineering & Surveying  
University of Southern Queensland  
Email: Guangnan.Chen@usq.edu.au
CONFERENCE SPONSORS AND SUPPORT

Gold Sponsor:

Australian Government
Sugar Research and Development Corporation

In Kind support:

NCEA
NATIONAL CENTRE FOR ENGINEERING IN AGRICULTURE

USQ UNIVERSITY OF SOUTHERN QUEENSLAND
fulfilling lives
FOREWORD

Australia is a country of great diversity with extreme agricultural challenges. Innovation has been a prerequisite for the agricultural sector. Currently, the agricultural sector faces intense challenges related to a range of economic, environmental and social factors. Research, development and adoption of new agricultural technologies provide real opportunities to deliver innovative solutions for a variety of agricultural production systems. The 2011 Australian Society for Engineering in Agriculture conference ‘Engineering in Agriculture - Diverse Challenges Innovative Solutions’ provides a unique forum for local and international delegates to come together, share ideas and thus foster the development of innovative solutions for the benefit of different agricultural industries.

The 2011 SEAg conference offers presentations on wide ranging topics, including sensor development, machine vision applications, post harvest technologies, machinery design, tillage optimisation, irrigation, water, livestock and environmental management, making the conference a truly informative event. Internationally recognised, this conference has received paper submissions from 14 different countries. In particular our South East Asian neighbours are well represented with a very large Chinese delegation visiting us to forge collaborative links with Australian agricultural engineering organisations. Other regions such as Europe and North America are also well represented.

All keynote speakers of the 2011 conference are focusing on commercialisation, arguing that commercialisation should be seen as one of the main venues for technology transfer from research organisations to the private sector.

The organisation of such event on an international scale would not happen without the hard work of the conference organising team. We also would like to thank the contributions of many individuals who have assisted the conference organisers with venue arrangements, paper reviews, editing, and various other tasks. The invaluable assistance of the conference organising section of Engineers Australia is especially acknowledged. We also would like to acknowledge the financial assistance of the main sponsors, including the Sugar Research and Development Corporation (SRDC), Grains Research and Development Corporation (GRDC) and Engineers Australia.

The conference is held at the Hotel Grand Chancellor, Surfers Paradise in the beautiful Gold Coast south of Brisbane. With this in mind we would like to encourage you to full-heartedly participate in the conference, but equally enjoy the Gold Coast and all the region can offer. On behalf of the SEAg and the conference organising committee we would like to wish you a productive and enjoyable time during the 2011 SEAg conference.

Dr. Thomas Banhazi
Chair of SEAg and the Scientific Committee

Mr. Eric Schmidt
Chair of Organising Committee
TABLE OF CONTENTS

GINGHAM WETLANDS FLOODPLAIN PLANNING – FOCUS ON WETLANDS AND THE ENVIRONMENT ................................................................................................................................. 12
N. ALBERT, A. FALKENMIRE .............................................................................................................. 12

A PRELIMINARY REVIEW OF IRRIGATION CONTROL FOR SITE-SPECIFIC MICROIRRIGATION ................................................................................................................ 24
A.C.S ALMEIDA¹, M.F.PINTO¹, T.A.BOTREL¹, S.R.RAINE² ...................................................................................... 24

RELATING FLOCK ACTIVITY LEVELS TO ODOUR VARIATIONS IN TUNNEL VENTILATED BROILER SHEDS – PRELIMINARY RESULTS ............................................................
MICHAEL ATZENI ¹*, JAE-HO SOHN ², NIGEL HANCOCK ³ AND THOMAS BANHAZI ³ ...................................................................................................................................................... 31

DEVELOPMENT AND IMPLEMENTATION OF EFFECTIVE CHEMICAL SPRAY EQUIPMENT FOR HORTICULTURAL INDUSTRIES .............................................................. 41
B. BAEK ...................................................................................................................................... 41

ENERGY, GREENHOUSE GAS EMISSIONS AND IRRIGATED AGRICULTURE.....................
C.P. BAILLIE AND G. CHEN .................................................................................................... 48

REVIEW OF DYNAMIC WATER ALLOCATION SYSTEMS .........................................................
J BAILLIE & I BRODIE ............................................................................................................. 58

SPATIAL, DIURNAL AND SEASONAL VARIATIONS IN THE LEVELS OF ENVIRONMENTAL PARAMETERS IN AUSTRALIAN LIVESTOCK BUILDINGS ...................................................................................................................................................... 69
T.M. BANHAZI ........................................................................................................................... 69

ENGINEERING, MANAGEMENT AND STRUCTURAL CHARACTERISTICS OF PIGGERY BUILDINGS IN AUSTRALIA: THE RESULTS OF A LARGE SURVEY............
T.M. BANHAZI ........................................................................................................................... 79

DETERMINATION OF CRITICAL IMPACT ENERGY TO DEVITALISE WIMMERA RYEGRASS (LOLIUM RIGIDUM) SEEDS ....................................................................................
N.K. BERRY, J.M. FIELKE, C. SAUNDERS ................................................................................... 89

AIR EMISSIONS FROM A PIG BREEDER FACILITY IN THE OKLAHOMA PANHANDLE ...................................................................................................................................................... 100
K.D. CASEY¹, E.L. CORTUS², A.P. CARAMANICA¹, AND A.J. HEBER³ .................
ENERGY USE AND DEVELOPMENT OF ONLINE ENERGY CALCULATORS FOR
THE NURSERY INDUSTRY ........................................................................................................ 108
G. CHEN, E. SCHMIDT, T, SYMES, B. ZHAO, R. CAMERON ................................................ 108
THE SIMULATION OF THE PLANTING MOVEMENT FOR THE DIBLE-TYPE
TRANSPLANTER ........................................................................................................................ 117
YONGCHENG CHEN1,A, XINYAN QIN2,B, LEI LIU3,C, SHUANGJI HU3,D, KE WU3,E .... 117
DEVELOPMENT OF A WIRELESS INTER-ROBOT COMMUNICATION SYSTEM FOR
GREENHOUSE OPERATIONS .................................................................................................. 122
YI-CHICH CHIU, PEN-YUAN YANG, TONY E. GRIFT ...................................................... 122
A LOW COST PORTABLE ENVIRONMENTAL MONITORING SYSTEM FOR
LIVESTOCK BUILDINGS ......................................................................................................... 141
M.S. CLEMENTS1, A.C. WATT 1, A.P. DEBONO1, S.M. AZIZ 1, T.M. BANHAZÌ2 ............... 141
AUTOMATIC DETECTION OF EVAPORATION REDUCING MONOLAYERS........................ 159
P.A. COOP1,3, D.W. LAMB1,3, C.M. FELLOWS2,3 AND R. BRADBURY1,3 ......................... 159
PERFORMANCE EVALUATION OF COMMERCIAL CP&LM MACHINES ......................... 169
J.P. FOLEY AND R.J. SMITH ................................................................................................ 169
ADOPTING SUSTAINABLE INNOVATIONS AND PRACTICES IN AN AUSTRALIAN
ABATTOIR ............................................................................................................................... 179
STEVEN GOH, MIKE SPENCE, TALAL YUSAF, IAN CRAIG ............................................. 179
PRESSURE AND FLOW PATTERN PREDICTIONS IN A 3D SILO MODEL - DE
ANALYSIS ............................................................................................................................... 184
C. GONZÁLEZ-MONTELLANO, Á. RAMÍREZ, F. AYUGA .................................................. 184
LATERAL MOVE IRRIGATORS – AN INNOVATIVE ENGINEERING SOLUTION
FOR IMPROVED WATER USE EFFICIENCY – AND RISK FOR ROOT ZONE
SALT ACCUMULATION? .............................................................................................................. 196
T.A. GUNAWARDENA AND D. MCGARRY ........................................................................ 196
APPRAISAL OF SOIL FERTILITY FOR SITESPECIFIC FERTILIZER MANAGEMENT
IN IRRIGATED RICE DOMAIN BY GIS AND MULTIVARIATE ANALYSIS .................... 201
A. A. M. HAQUE 1, H. A. AZIZ 1 AND H. M. THWE 2 .................................................... 201
A METHOD FOR DETERMINING THE SIZE OF ANAEROBIC DIGESTERS ................ 213
P. HARRIS ................................................................................................................................. 213
EXPOSURE OF MAINTENANCE PERSONAL TO AIRBORNE BACTERIA IN
BIOSCRUBBER/BIOFILTER SYSTEMS ..................................................................................
J. HARTUNG, J. SCHULZ, H.F.A. VAN DEN WEGHE, J. HANEKE ................................. 221

EFFICIENCY OF A BIOSCRUBBER/BIOFILTER COMBINATION TO REDUCE AIR
POLLUTANTS FROM EXHAUST AIR OF A PIGGERY – TECHNIQUES,
EFFICIENCY, COSTS .......................................................................................................................... 226

J. HARTUNG, J. STRATMANN-SELKE AND M. CLAUß ......................................................... 226

EXPERIMENTS TO REDUCE AIRBORNE BACTERIA AND MRSA WITH A
WASHER/UV COMBINATION IN A PIG FATTENING UNIT .................................................. 236

J. HARTUNG, R. HOELSCHER, E. BAO AND J. SCHULZ ................................. 236

EFFECT OF ELECTRO-OSMOSIS ON SOIL-WATER POTENTIAL AND WATER
CHEMISTRY IN SAND ......................................................................................................................... 238

A. F. S. HUWEG, F. KAMEL, S. RAINE ................................................................................. 238

ASSESSING VARIOUS TECHNIQUES TO MONITOR YIELD IN SUGARCANE ............ 248

T.A. JENSEN, B. FOKKEMA, & C. BAILEY ................................. 248

OPPORTUNITIES FOR IMPROVING THE PERFORMANCE OF SINGLE DISC
SEEDERS IN STICKY SOIL CONDITIONS ................................................................................. 256

A. KHOSRAVANI, J. DESBIOLLES AND J. FIELKE ......................................................... 256

AGRICULTURAL MECHANIZATION: SOME KEY EQUIPMENT AND POLICY
ISSUES ............................................................................................................................................... 265

J. KIENZLE, M. A. BHATI AND J. E. ASHBURNER............................................................... 265

TRENDS IN THE SURFACE IRRIGATION SYSTEMS IN THE AUSTRALIAN
IRRIGATED AGRICULTURE ...................................................................................................... 277

KOECH, R. K., SMITH, R. J. AND GILLIES, M. H ............................................................... 277

DESIGN OF AN AUTOMATIC FURROW IRRIGATION SYSTEM UTILISING
ADAPTIVE REAL-TIME CONTROL .............................................................................................. 278

KOECH, R. K., SMITH, R. J. AND GILLIES, M. H ............................................................... 278

A COMPARISON OF TWO RANGING APPROACHES TO AN INTEGRATED ACTIVE,
OPTICAL, REFLECTANCE AND RANGING SENSOR ...................................................... 298

M.T. SCHAEFER, D.W. LAMB AND R. BRADBURY .......................................................... 298

QUAD BIKES - REDESIGN AND MODIFICATION TO REDUCE DEATHS AND
TRAUMA ......................................................................................................................................... 307

JOHN M LAMBERT AND DAVID ROBERTSON ......................................................................... 307

DESIGN AND EVALUATION OF AN AUTOMATED SHORT FURROW IRRIGATION
SYSTEM .......................................................................................................................................... 307
‘Diverse Challenges, Innovative Solutions’

N.L. LECLER1, D.D. MILLS2 AND J.C. SMITHERS2 ............................................................ 330

TRYING TO DEFINE PRACTICAL AND ACCEPTABLE PRECISION LIVESTOCK FARMING: RESULTS FROM BRIGHTANIMAL ................................................................. 337

H. LEHR ........................................................................................................................... 337

TRANSFERRING TECHNOLOGY OF MEASURING SUGARCANE QUALITY FROM THE LABORATORY TO THE FIELD: WHAT IS POSSIBLE? ................................................. 350

NAZMI MAT NAWI1, GUANGNAN CHEN1, TROY JENSEN1,2 AND CRAIG BAILLIE2

THE APPLICATION OF SPECTROSCOPIC METHODS TO PREDICT SUGARCANE QUALITY BASED ON STALK CROSS-SECTIONAL SCANNING ........................................ 359

NAZMI MAT NAWI1, TROY JENSEN1,2, GUANGNAN CHEN1 AND CRAIG BAILLIE2

MEASURING FURROW PROPERTIES IN ROTARY STRIP-TILLAGE SYSTEMS ............... 366

M A MATIN, J M A DESBIOLLES AND J M FIELKE .......................................................... 366

MONITORING THE PERFORMANCE OF COVERED ANAEROBIC PONDS IN THE TREATMENT OF ABATTOIR WASTEWATER ................................................................. 379

B. K. MCCABE, P. PITAWAY, C. BAILLIE AND P. HARRIS .............................................. 379

SENSOR BASED SYSTEM TO DETERMINE THE HEIGHT OF TRITICALE IN FIELD TRIALS ......................................................................................................................... 389

KIM MÖLLER, RALPH KLOSE, ERIK WUNDER, LUCAS BUSEMeyer AND ARNO RUCKELSHAUSEN .................................................................................................................. 389

OPTIMIZING PRODUCTION PROCESS OF FUEL PELLET FROM SWINE DUNG ............ 398

I.H. OH1*, S.K. BAE1, Y.J. LEE1, J.H. LEE1, E.Y. CHO1 .................................................. 398

PHYSICAL WEED CONTROL IN WIDE ROW LUPINS ....................................................... 407

G.P. RIETHMULLER1, A. HASHEM2 AND C. BORGER1 ...................................................... 407

SWATHING OR DIRECT HARVESTING CANOLA WITH DESICCATION CAN REDUCE RYEGRASS SEED SET ......................................................................................... 416

G.P. RIETHMULLER1, A. HASHEM2 AND C. BORGER1 ...................................................... 416

IMPROVING THE CHAFF TRANSFER SYSTEM OF THE HARRINGTON SEED DESTRUCTOR (HSD) ........................................................................................................ 423

C. SAUNDERS, N.K. BERRY, J.M. FIELKE ......................................................................... 423

EFFECT OF RAKE ANGLE ON SOIL MOVEMENT INDUCED BY NARROW POINT OPENERS ......................................................................................................................... 433

A. A. SOLHJOU, J. FIELKE AND J. DESBIOLLES ............................................................... 433
EFFICIENT MANAGEMENT OF DEEP LITTER TO REDUCE AMMONIA AND GHG
EMISSIONS AND PROVIDE CLEAN ENERGY AND FERTILIZER .............................. 446
S.G. SOMMER¹, J. WEBB² AND T. MISSELBROOK³ .................................................. 446
GROWTH RECORDED AUTOMATICALLY AND CONTINUOUSLY BY A MACHINE
VISION SYSTEM FOR FINISHER PIGS ................................................................. 454
M.J. TSCHARKE¹ AND T.M. BANHAZI¹ ................................................................. 454
REVIEW OF METHODS TO DETERMINE WEIGHT, SIZE AND COMPOSITION OF
LIVESTOCK FROM IMAGES ........................................................................................ 465
M. TSCHARKE AND T. M. BANHAZI ...................................................................... 465
MODELLING AND EVALUATION OF THE SOLAR STILL INTEGRATED
GREENHOUSE DESALINATION SYSTEMS* ........................................................... 484
M. UCGUL¹, W.Y. SAMAN², AND J.M. FIELKE¹ .................................................... 484
3D DISCRETE ELEMENT MODEL SIMULATION OF A SINKAGE TEST ....................
M. UCGUL, J.M. FIELKE, AND C. SAUNDERS ....................................................... 497
EDDY COVARIANCE MEASUREMENTS OF THE TOTAL EVAPORATION DURING
SPRINKLER IRRIGATION – PRELIMINARY RESULTS ............................................. 506
J. UDDIN, R.J. SMITH, N.H. HANCOCK AND J. FOLEY ........................................ 506
EVALUATION OF SAP FLOW SENSORS TO MEASURE THE TRANSPIRATION
RATE OF PLANTS DURING SPRINKLER IRRIGATION ........................................... 516
J. UDDIN, R.J. SMITH, N.H. HANCOCK AND J. FOLEY ........................................ 516
THE POSSIBILITY OF USING POLYMERS IN AGRICULTURE MILLING
EQUIPMENT ............................................................................................................ 526
J.M. AL-SANDOOQ, B.F. YOUSIF, T.A. JENSEN ...................................................... 526
EFFECTS OF SPRAY DISINFECTION WITH SLIGHTLY ACIDIC ELECTROLYZED
WATER IN A LAYING HEN HOUSE ...................................................................... 534
WEICHAO ZHENG¹, BAOMING LI¹, RUNMIN KANG², HONGNING WANG², WEI
CAO¹, SHUANG WANG¹...................................................................................... 534
EFFECT PLASTIC MULCH AND TILLAGE METHOD ON YIELD AND YIELD COMPONENTS OF TOMATO (LYCOPERSICON ESCULENTUM)………………
MAJID RASHIDI AND BORZOO GHAREEI KHABBAZ

EFFECT OF RELATIVE HUMIDITY, COATING METHODS AND STORAGE PERIODS ON SOME QUALITY CHARACTERISTICS OF CARROT DURING COLD STORAGE………………………………………………………………………………
MAJID RASHIDI, BORZOO GHAREEI KHABBAZ AND MAHDI HOSSEINI BAHRI