1 The University of Queensland, Queensland, Australia

Monitoring of large on-farm agronomic experimentation is usually constrained by lack of time in labour intensive data collection activities. Currently the determination of crop characteristics, e.g. above ground biomass, leaf area, and nitrogen contents involves taking and managing large samples of vegetal material that require processing and costly analyses. Due to these constraints only small areas, of each plot in field trials that are considered representative, are usually evaluated at any point in time. The accuracy of this methodology can be reduced due to the spatial variability within a plot, sample size, and assessment frequency. These factors also constrain the number of large multifactorial agronomic experiments that can be performed in any one season. Here we present results from the use of multispectral crop canopy sensors to derive vegetation indices in the red, near infrared and red edge sections of the light spectra that could be used to predict crop characteristics of interest, and treatments effects. Destructively harvested biomass samples were taken concurrently with crop reflectance in agronomic trials. Treatments included low and high input systems. Relationships between proximal sensed indices and crop characteristics were developed and are presented.

[P046] Sugarbush - A break-crop for sustaining sugarcane productivity in the tropics

Theme: 2. Solutions through Integrated Farming Systems

Stephen Ockerby*, Chris Gardiner, Aholiab Aoetpah, Iain Hannah, Nick Kempe

1 AgSight Pty Ltd, Queensland, Australia
2 James Cook University, Queensland, Australia
3 James Cook University, Queensland, Australia
4 Agrimix Pty Ltd, Queensland, Australia

Many crops fail to achieve the biological maximum yield despite ideal growing conditions and surplus agronomic inputs. It is an ongoing issue in sugarcane in Queensland, for which break crops are recommended to improve yield and correct poor soil condition. In recent years, we have grown seed crops of Sugarbush, selected genotypes of the legume Desmanthus spp., during the plough-out period between sugarcane crops in the Burdekin River and Mareeba regions. Demanthus is well-adapted to Queensland's extensive grazing regions where it benefits animal production and the edaphic environment. Our observations suggest that a break-crop of Sugarbush with crop residues returned to the soil will increase both sugarcane yield and crop nitrogen use, and may lessen off-site nitrate pollution from sugarcane farming. We submit our technical rationale:

1.The vegetative growing-periods of the selected Desmanthus genotypes are well-suited to summer break-crop conditions
2.Desmanthus is a legume so will fix atmospheric N
3.The plant has a large, woody and deep tap root which may: recover N that has leached below the roots of the sugarcane crop; form resilient root pathways and improve soil structure; and contribute to soil C
4.The crop produces a large above-ground biomass (more than 12 tonnes DW per hectare) and residues will contribute labile C to the soil

5.The residues of Desmanthus are a preferred mix of low C:N leaf (similar to soybean and rapidly mineralized) and high C:N stem that will slow the rate of C and N mineralization in the soil.

[P047] Stocking strategies for sustainable and profitable beef production in a variable and unpredictable climate

Theme: 2. Solutions through Integrated Farming Systems

Peter O'Reagain[1]*, John Bushell[1], Joe Scanlan[1]

1 Department of Agriculture and Fisheries, Queensland, Australia

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Whatever technological advances occur, beef production in northern Australia will remain dependent upon native rangelands to sustain production. Sustainable management of these rangelands is thus critical to avoid loss of productive capacity and improve efficiency. Extreme rainfall variability is however a major challenge to sustainable management and may increase with climate change. To assist in developing guidelines to manage for rainfall variability, five stocking strategies were tested over 18 years in a large, replicated grazing trial. Results showed that aside from initial wet years, heavy stocking rates were unprofitable and resulted in pasture degradation; this in turn reduced resilience to drought. In the longer term, moderate stocking was far more profitable due to lower costs and increased product quality and also maintained land condition. Varying stocking rates between years with forage availability (with or without the use of climate forecasts) was also far more profitable than heavy stocking but caused some pasture degradation when droughts abruptly followed good years. Bio-economic modelling was used to extrapolate results upwards to the enterprise level with breeding animals over a range of climate windows. Modelling confirmed that profitability and pasture condition were maximised at moderate stocking rates under either constant or low flexibility strategies. However the optimum stocking rate varied with the climate window used emphasising the need to adjust stocking rates as rainfall changes. These results indicate that profitability will be maximised and land condition maintained by adjusting stocking rates as rainfall varies in a risk averse fashion around long term carrying capacity.

[P048] Achieving reliable yields of legume break crops is the key for sustainable integrated farming systems

Theme: 2. Solutions through Integrated Farming Systems

Rao (RCN) Rachaputi[1]*, Kerry Mechenzie[2], Nikki Seymour[2], Rebecca Raymond[2], Doug Sands[2], Yashvir Chauhan[2]

1 QAAFI- The University of Queensland, Queensland, Australia
2 Department of Agriculture and Fisheries, Queensland, Australia

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The global challenge of meeting future food demand and protecting environmental quality will largely depend on sustainability of cereal-based cropping systems. Given cereal mono-cropping tend to cause economic and environmental problems associated with increased costs of energy-based inputs, decreased soil health and farm incomes. Increasingly research suggests that the health of cropping systems is largely dependent on the level of legume rotations present.