Bioenergy Cropping Solutions Ltd

The New Zealand Institute for Plant & Food Research Limited

Plant & Food RESEARCH
RANGAHAU AHUMĀRA KAI

Bioenergy Cropping, Nutrient Cycling

Rocky Renquist, Bioenergy Cropping Solutions Ltd
Huub Kerckhoffs, Massey University
Stephan Heubeck, NIWA

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Why biogas transport fuel?

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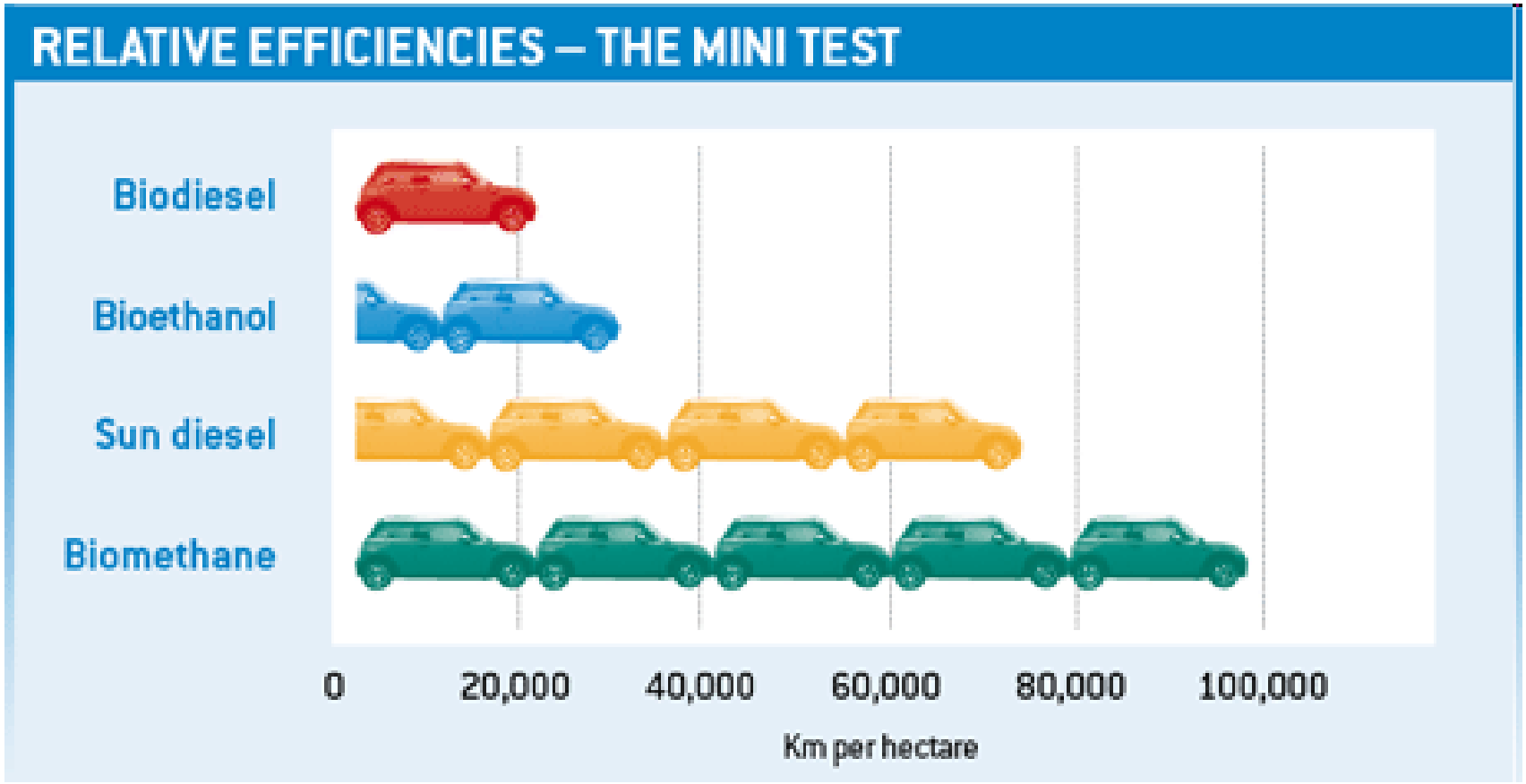
Km travel per hectare – Land efficiency



Source: www.biodieselnow.com/forums/t/19315.aspx

Biomass Cropping Aims

- Produce biofuels that can be made with local scale technology and have a high fuel yield per ha: biogas.

- Demonstrate a cropping system in which bioenergy crops are fertilised with *recycled crop nutrients*:

  the Closed-Loop N system (CLN).

- Identify the best species...

Selection criteria for biomass crops

- Ability to produce moderate to high DM in marginal conditions and with minimal tillage (perennials).
- Very high DM yield in years when rainfall is adequate; annual crops ok with winter legume & CLN cycling.
- General traits:
  - high biogas yield per kg DM;
  - minimal pest control requirements;
  - easy to establish and harvest;
  - able to be stored or ensiled; and
  - don’t make viable seed.

Rural benefits

- Substitution of fossil fuels used on the farm and by rural trucking with local, reliable *biofuels*.
- Little need for purchased fertilisers: Use N-efficient crops plus legumes and recycle nutrients.
- New land use opportunity: to supply crops to biofuel producers. Use ‘marginal’ sites where crops are susceptible to moderate drought stress.

Forage sorghum (‘Jumbo’)

‘Jumbo’
Sorghum

Kerikeri
2010

3m tall
at leaf top

30 tDM/ha

Forage sorghum (‘Jumbo’)

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‘Jumbo’ Sorghum

Hastings 2011

2.7m tall leaftop

27 tDM/ha

Jerusalem artichoke, tubers

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Jerusalem artichoke (JA)

JA as an annual crop (first year plantings) in Hastings

Shoot biomass
200 days after planting:

<u>2012</u>
31 tDM/ha

<u>2013 (no rain)</u>
16 tDM/ha

Jerusalem artichoke (JA)

JA as a perennial crop;
(second year)

Shoot biomass
190 days after emergence
in Hastings:

<u>2012</u>
26 tDM/ha

<u>2013 (no rain)</u>
17 tDM/ha

Giant Miscanthus

Parallel project: other biofuel options

Mxg is a perennial, highest DM of all biomass crops tested in NZ

<u>2013 (dry year!)</u>
Hastings:
36 tDM/ha at late March peak
(DM% = 47)

Cropping Conclusions

- The most promising combinations of new biomass species and legumes to maximise biomass production for biogas on ‘summer-dry’ marginal land:

  (1) forage sorghum in combination with tickbean or crimson clover (H. Bay north)

  (2) Jerusalem artichoke and/or lucerne (H. Bay south)

- Our biomass crop yields in good sites:

  forage sorghum 20-25tDM/ha + 10tDM/ha for legume

  Jerusalem artichoke 16-25tDM/ha

  Lucerne 16-22 tDM/ha (3-4 cuttings)

  (all are well adapted to the CLN system)

Rural NZ Biofuel potential

- Biofuel yield from <u>only</u> 5% of 'summer dry' land:
  - 3.9 million tDM
  - 900 million m^3 methane (630 million m^3 net)
  - (= energy equivalent to 595 million litres of diesel)

- Lake Taupo District scenario:
  - 220ha biomass crops = 5045 tDM/yr
    - -->1.27 million m^3 methane per year
  - CAPEX 1.9 million NZ$
    - Payback: 9.2 years (diesel $1.00/litre)
    - 2.8 years (diesel $1.50/litre)

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Closed-Loop Nutrients & Bioenergy

Rocky Renquist & Huub Kerckhoffs
Bioenergy Cropping Solutions Ltd
E: bioenergycropping@inspire.net.nz

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