The potential Bio-energy crops in the Renewable Energy thrust for the Caribbean

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Bio – energy power

Bio-energy crops
renewable source of bio-diesel

- bio-degradable and non-toxic
- low emission profiles,
- environmentally beneficial,
- Substitute petro-diesel
- high calorific value
- improved lubricity

Bio-energy crops
renewable source of bio-diesel

- lack of sulphur
- CO_2 – photosynthesis
- oxygenated fuel
- complete firing,
- reduced engine emission
- Low threat to global warming

Bio - energy Crops

- Minimum input in vegetative phase,
- No competition – [food production or food grade oils]
- cultivable on marginal lands
- Zero soil fertility demands
- prevents desertification and erosion
- no toxicity problem

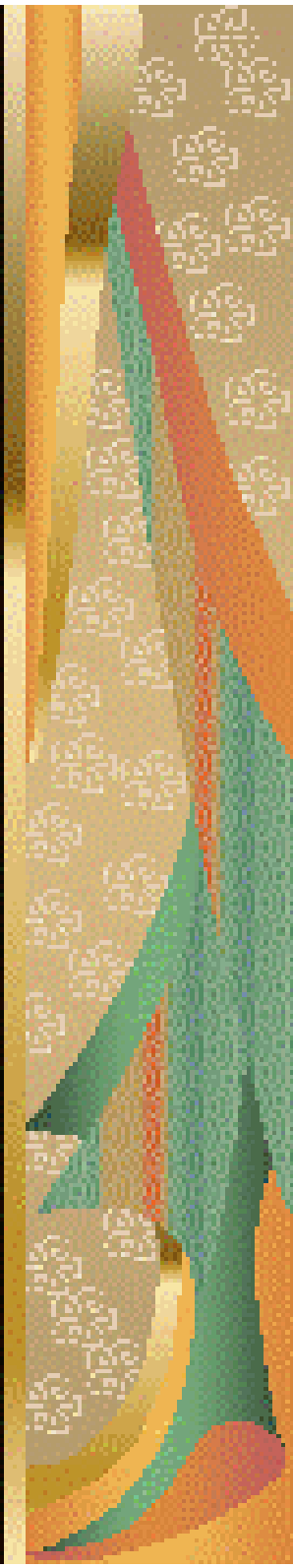
Rationale

- cost of fossil fuel
- negative environmental issues
- forces non- sugar producing Caribbean Small Island States (SIDS),
- Need to seek alternative sources
  - ethanol production
  - Solar ng
  - Wind
  - Thermal
  - co-generation
  - Bio-diesel

Objective

An agro-energy evaluation of three (3) bio-energy crops in the Caribbean, *viz* .

- drumstick vegetable *(moringa oliefera),*
- physics nut *(jatropha curcas),and*
- castor oil (*rincinus communis*).



Experimental

- moringa, jatropha, and castor oil density of 2,500plants.ha^{-1} on cambered beds.
- rain-fed and no chemical inputs [fertilizer, insecticides or herbicides]
- All operations manually.
- Crop agronomic, morphological and phenology

Extraction Method

- hydraulic press at 2500*psi*.
  [Fred Carver Inc. Hydraulic Equipment, Wisconsin]
- Screw Press
- Electrolux

Analyses

- Proximate
  - AOAC for DM, ash, CP, crude fibre (CF) and ether extract (AOAC, 1984),
  - NDF (Goering and van Soest, 1970),
  - ADF (Van Soest *et al.*, 1991).

- statistical
  - transformation if required, and data analysis conducted using the MINITAB 15 statistical package (2007)

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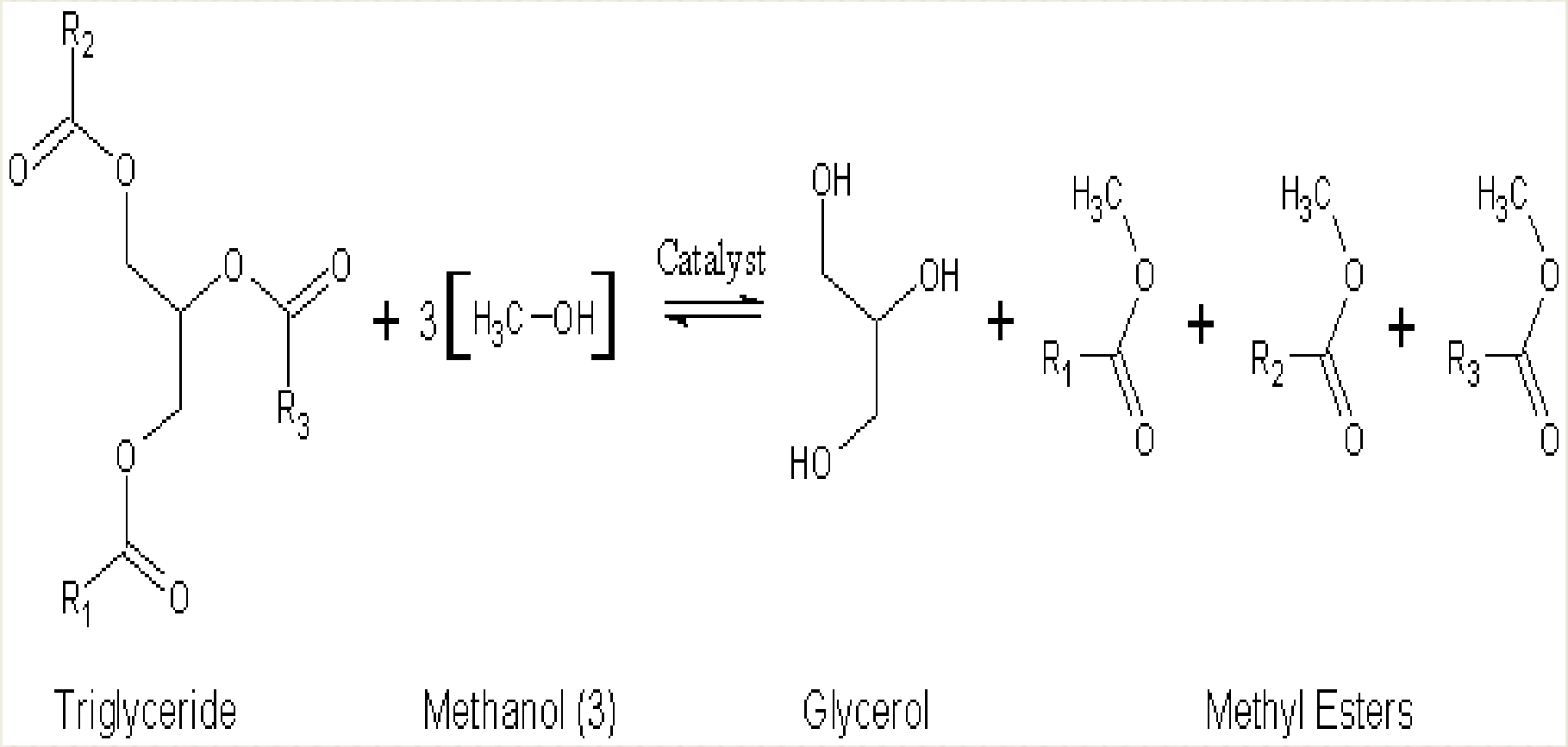
Transesterifcation



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Bio-energy Crops

- *Rincus communis*

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Bio-energy Crops

- *Moringa oliefera*

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Bio-energy Crops

- *Jatropha Carcus*

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Preparation for oil extraction

- Grinding all 3 seeds

With hand mill

Preparation for oil extraction

- freezing
- Crushing
- Heating
- Pressing
- Settling / filtration
- purification

Oil cake and virgin oil extraction Equipment screw press

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Oil cake and virgin oil extraction Equipment hydraulic press

Oil cake and virgin oil extraction Equipment manual press

Agronomic and Phenological Characteristics

Crop Phenology	*m.oliefera*	*j.carcus*	*r.comunis*
Days to germination	7	9	4
Days from sowing to pod	180	90	140
Nos. of flowering flushes/ year	10	3	3
Nos. of flower [poll] per cluster	21	19.0 [2.83]	19 [1.14]
Nos. of flower cluster per tree	25 to 36	34 [1.27]	23.2 [7.89]
Nos. of fertilized pod/ cluster	2 to 4	28 [2.02]	16.96 [4.89]
Nos. new pod/tree/month	24 to 27	30 [3.01]	29 [6.34]
Length of flowering harvest[DAS]	45	82	120
Nos. harvest per year	9 to 10	3 to 4	2 to 3
Nos harvestable fruit pods / tree/ flush	30 [4.78]	646 [12.25]	408

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Yield Characteristics *m.oliefera*

Yield Characteristics	*m.oliefra*
Pod Yield . tree^{-1}. yr $^{-1}$	750
Nos. seeds . pod^{-1}	20
Weight 100 seed [g]	35
Seed yield kg.tree^{-1}.yr $^{-1}$	5.25
Seed yield t.ha^{-1}.yr^{-1}	**13.12**
Oil yield [38%CF] t.ha^{-1}.	**5.01**

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Yield Characteristics *r.comunis*

Yield Characteristics	*r.comunis*
Pod Yield . tree^{-1}. yr $^{-1}$	1020
Nos. seeds . pod^{-1}	4
Weight 100 seed [g]	11.36
Seed yield kg.tree^{-1}.yr $^{-1}$	4.364
Seed yield t.ha^{-1}.yr^{-1}	**1.5**
Oil yield [40%CF] t.ha^{-1}.	**2.52.**

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Yield Characteristics *j.carcus*

Yield Characteristics	*j.carcus*
Pod Yield . tree^{-1}. yr $^{-1}$	2584
Nos. seeds . pod^{-1}	4
Weight 100 seed [g]	3.64
Seed yield kg.tree^{-1}.yr $^{-1}$	0.376
Seed yield t.ha^{-1}.yr^{-1}	**0.96**
Oil yield [50% CF] t.ha^{-1}.	**0.68**

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Yield Characteristics	*m.oliefra*	*j.carcus*	*r.comunis*
Pod Yield . tree^{-1}. yr $^{-1}$	750	2584	1020
Nos. seeds . pod^{-1}	20	4	4
Weight 100 seed [g]	35	3.64	11.36
Seed yield kg.tree^{-1}.yr $^{-1}$	5.25	0.376	4.364
Seed yield t.ha^{-1}.yr^{-1}	13.12	0.96	13.90
Oil yield	5.01	.54 to.68	2.52

Fatty Acid	m.oliefra [1]	j.carcus[2]	r.comunis[3]
Palmitic	1.1	15.6	1.2
Stearic	5.9	6.2	4.8
Oleic	72.9	40.2.	3.87
Linoleic	0.6	36.3	4.4
Behenic	7.3	-	-
Myristic	-	-	90.25
ricinoleic	0.1	-	-

[1] After Lalas and Tsaknis, 2002

[2] After [anon. 2008 - NRI 973]

Castor oil and waste product

First Expressed bio-fuel

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First Expressed Moringa oil

- Cakes and oil

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CONCLUSION

- **moringa oliefera** – 5.01 Oil yield [38%CF] $t.ha^{-1}$.
  - Bio-diesel
- **Crude protein – 42.8%**
  - **Animal feed**
- **LISA – no agricultural input demand**
- **Potential source of organic lubricant and fuel additive**


Sugar cane
#1
renewable
Co-generation Power
Thank you
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