Biofuels – Promise/Prospects

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Introduction

- Total demand for liquid and gaseous fuels in India in 2011-12 will be 200 MTOE.
- Includes transport and household fuels.
- 90% of this demand will be imported. Will create serious balance of payment problems. Presently we import Rs. 1,30,000 crores worth of oil.
- Serious problem of cooking and lighting energy for rural households. Costly kerosene and polluting biomass cook stoves.
- Liquid fuels superior to other fuels because of high energy density, ease of transportation and storage.

Biofuels

- Ethanol, biodiesel and pyrolysis oil can be excellent substitutes for fossil liquid fuels.
- Ethanol can be mixed with or substituted for petrol. Low concentration ethanol is an excellent fuel for rural households.
- Biodiesel and pyrolysis oil as good substitutes for diesel. Pyrolysis oil is produced by rapid combustion of agricultural residues. Biodiesel is produced from vegetable oils.
- Biodiesel fuel for cooking and lighting in rural households is not yet suitable.

Cooking and lighting with ethanol

- Ethanol stove runs on 50%(w/w) ethanol.
- 50% mixture very safe as household fuel and easy to distill.
- Stove capacity 0.9 to 3 kW.
- Lantern also runs on 50% ethanol. R&D needed in materials.
- Produces light equal to that from a100W electric bulb.
- Both units very environment friendly and easy to use.

Resource availability

- India produces ~ 600 MT/yr of agricultural residues.
- Theoretically it can produce 156 billion liters of ethanol/yr via lignocellulosic conversion. 42% of India's oil demand.
- Or it can produce 402 billion kg of pyrolysis oil. Can take care of 81% of India's oil demands for 2011-12.
- Or it can produce ~ 80,000 MW of electricity.
- Competition among electricity, biogas and liquid fuel production. Market forces locally will dictate the stream path. R&D needed in cellulose-ethanol and pyrolysis oil.
- Industrial use of agriculture for fuel may effect food production.
- Need to develop strategies for producing food and fuel from the same piece of land.

Strategy for biofuels

- Land should be utilized year round for food and fuel production.
- For farmers important thing is maximization of profit (net returns).
- For planners need for maximization of energy/ha (bioenergy).
- Need to maximize bioenergy (BE) X net returns (NR) or maximizing BENR.
- Various crop combinations evaluated for this strategy.
- Whole plant approach used. All parts of plants utilized for food and liquid fuel production.

Fig. 1. Bioenergy from sweet sorghum and oilseed-based cropping system under rainfed and irrigated conditions

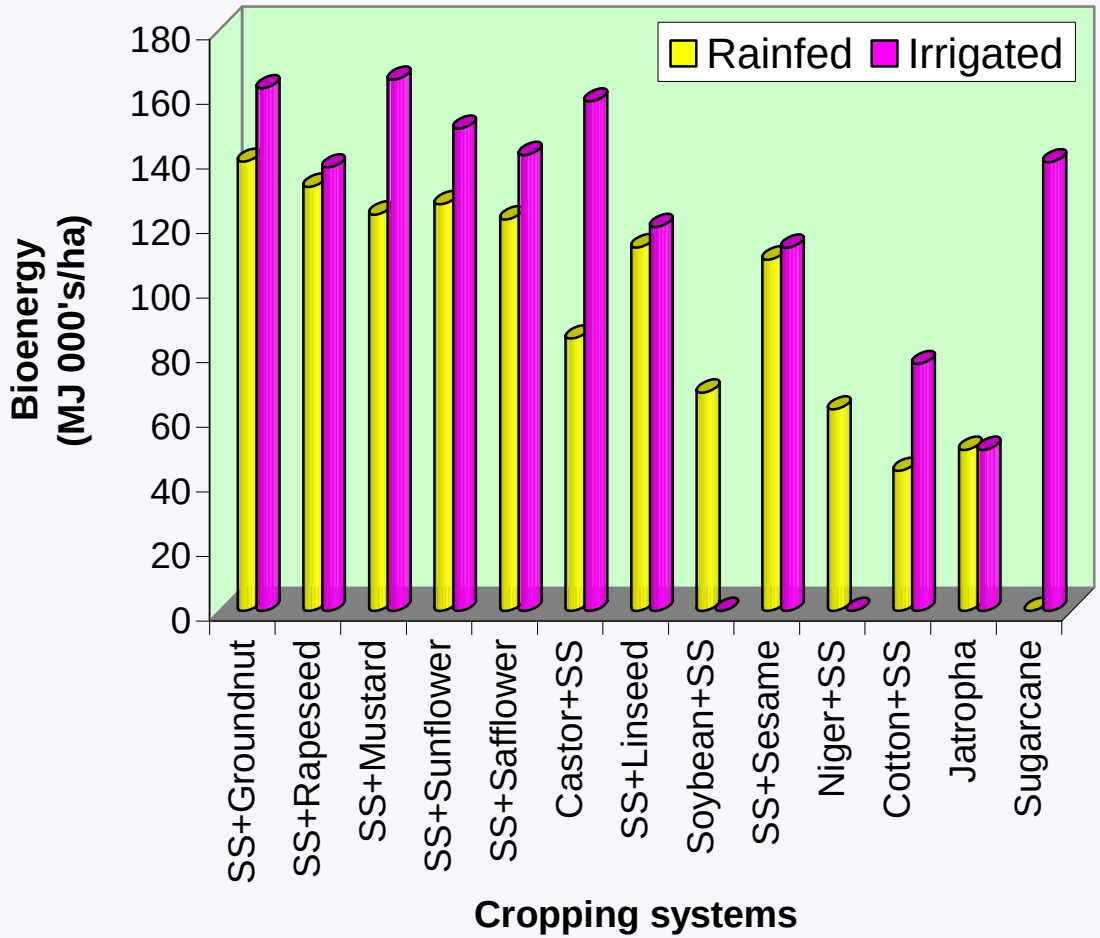


Fig. 2. Net returns from sweet sorghum and oilseed-based cropping system under rainfed and irrigated conditions.

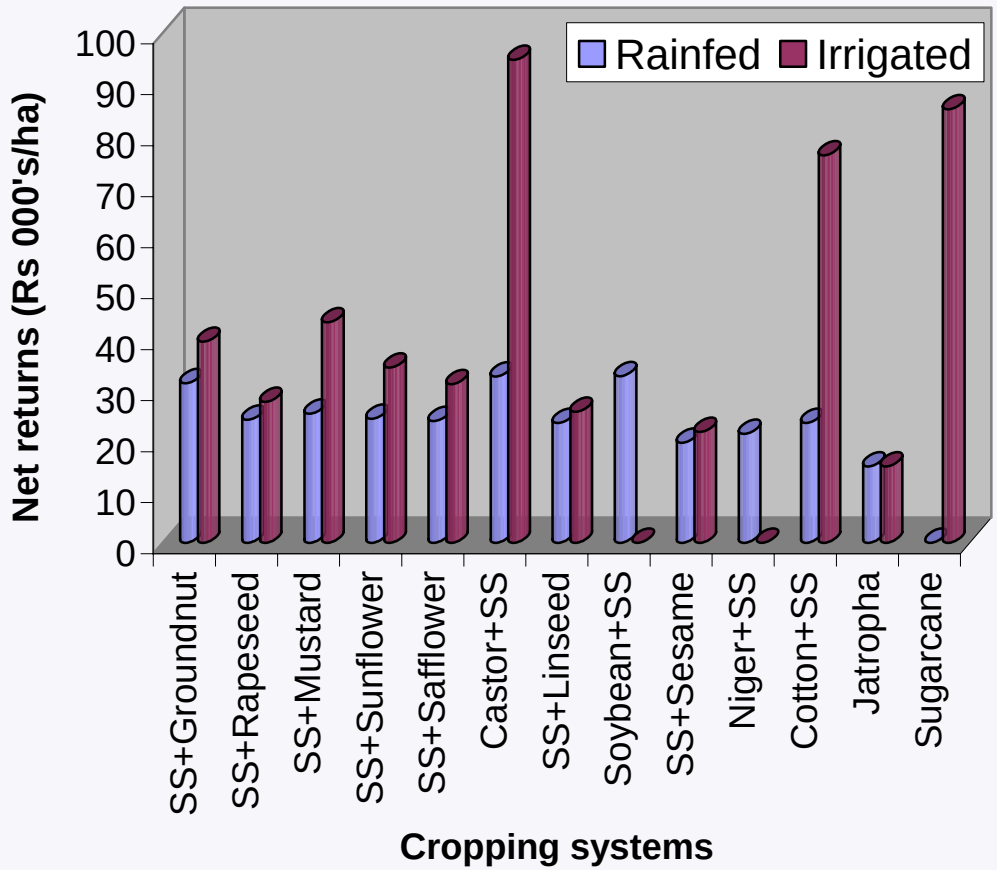
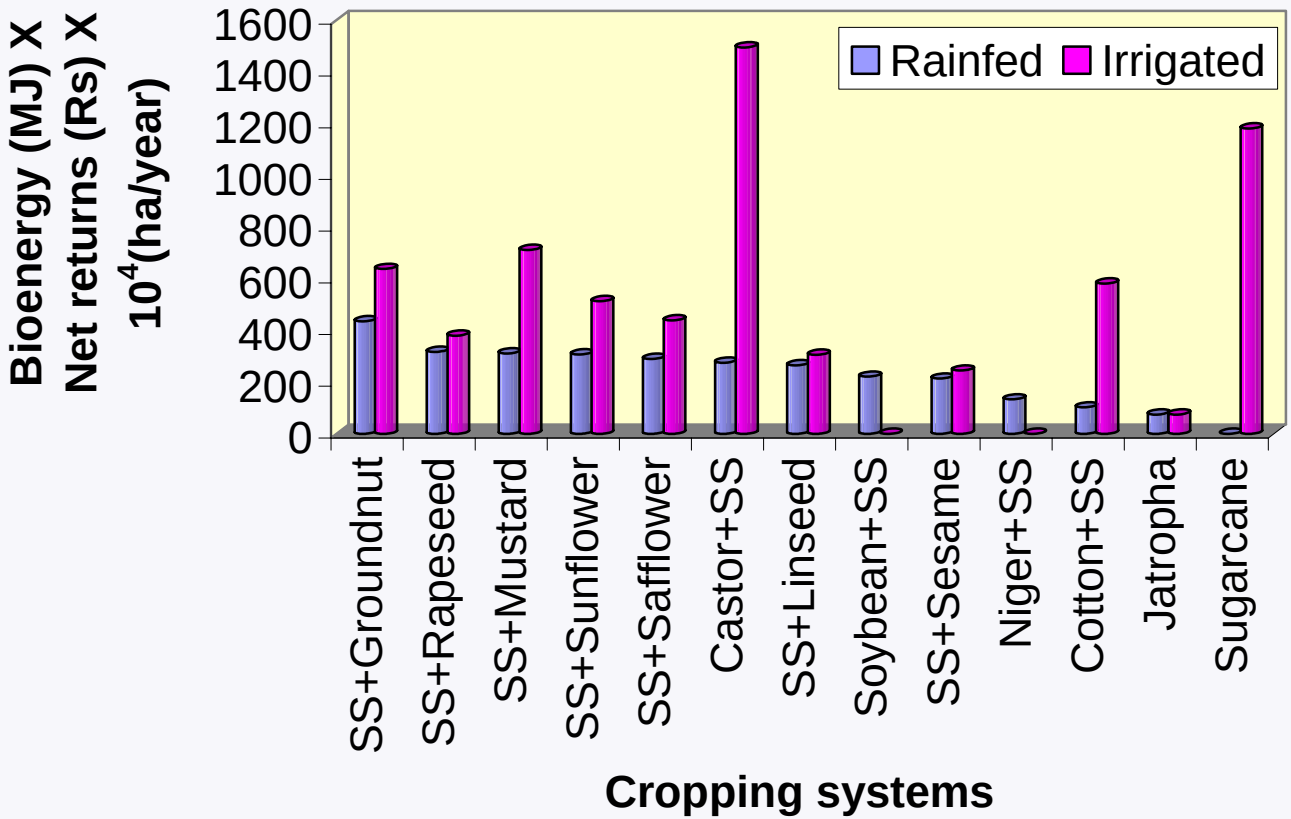


Fig. 3. Bioenergy X net returns from sweet sorghum and oilseed-based cropping system under rainfed and irrigated conditions.



Optimum biofuels strategy

- Best strategy appears to be castor planted in monsoon followed by winter sweet sorghum.
- Ethanol from sweet sorghum planted in existing sorghum area can take care of 5% of total oil requirements for 2011-12.
- Same area planted under castor in monsoon will further take care of 5% oil requirements.
- Total of 10% of liquid and gaseous fossil fuel requirements can be met by this strategy.
- Substantial energy gain for India without any food sacrifice.

Conclusions

- Combination of sweet sorghum for ethanol and castor for biodiesel appears to be the best strategy for biofuels.
- Need to spread this technology on large scale.
- Biodiesel production from Jatropha is still economically unproven.
- Production of liquid fuels through agriculture will bring in substantial wealth and employment to rural areas.

Thank you

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