Fact Sheet

Jatropha curcas Linn: A potential Biofuel Crop

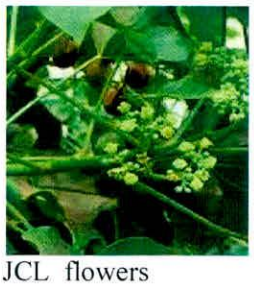
Turinayo Yonah, Kalanzi Fred & Mwanja Christine

About *Jatropha Curcas* Linn

Jatropha curcas Linn (Latin name), often referred to as 'jatropha', is a perennial tropical tree species, drought resistant, pest tolerant, well adapted to degraded, arid and semi-arid lands. *Jatropha curcas* Linn (JCL) survives at an annual rainfall of about 300mm. The plant is believed to have originated from Mexico and Central America. It has been traditionally used as "living fences" and for production of soap, medicine, biodiesel and lamp fuels etc.



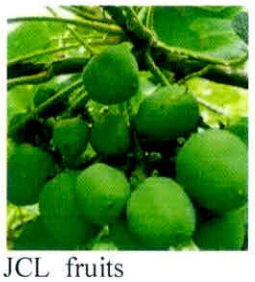
Jatropha curcas Linn (JCL) Plant



JCL flowers

Environmental Aspect

From the standpoint of green house gases reduction and concerns for long term energy security, it is important to develop alternative fuels with properties comparable to petroleum based fuel. Use of biodiesel as an alternative has emerged as a solution for this problem. Globally, great attention has been put on use of biodiesel fuels due to their nature of being renewable, non-toxic and safe to store. Furthermore, because of their oxygen content, the combustion is more complete and consequently less polluting. On this note, JCL oil has been identified as one of the potential sources of biodiesel fuels.



JCL fruits



JCL seeds



JCL kernel



JCL oil

Facts on *Jatropha curcas* Linn attributes

JCL plant		JCL-Oil and fossil diesel (F-Diesel)		
Parameter	**Range**	**Parameter**	**JC-Oil**	**F-Diesel**
First flowering (days)	90 to 120	Oil content per kernel (%w/w)	55 to 60	
Seeds per fruit (number)	1 to 4	Oil content per seed (%w/w)	28 to 38	
Seeds/tree after 5 years (Kg)	0.25 to 5	Biodiesel yield (litre/ha)	300 to 2,200	
Seed yield (Kg/ha/yr)	1,000 to 7,000	Ester content (%)	96 to 98	
Seed yield, hedges(Kg/ha/yr)	2,800 (max)	Viscosity at 40 °C (mm^2/sec)	30 to 45	2 to 4
Fruit yield (Kg/ha/yr)	1,500 to 10,000	Cetane number	36 to 40	40 to 55
Dry seeds per kg (number)	1,200 to1,400	Energy content of oil (MJ/kg)	36 to 41	42 to 44
Oil yield (litre/ha)	350 to 2,500	Chemical structure	C_{12} to C_{22} Methyl esters of fatty acids	C_8 to C_{25}

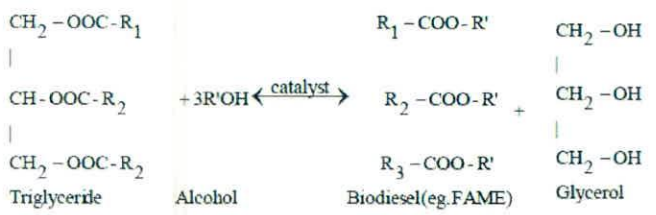
Fact Sheet

Biofuel production chain



Biodiesel production Process

The major components (over 90%) of JCL oil, a vegetable oil, are triglycerides which are transformed into biodiesel by transesterification process using a strong base or acid as a catalyst (*see* equation bellow).



At the industrial scale however, sodium or potassium methanolate is mostly used. When using methanol, glycerol can easily be separated simultaneously during transesterification process, unlike ethanol which needs to be free of water as well as low water content in the oil. The glycerol can be used in cosmetic and oleochemical industries and as a substrate for biogas generation.

Ongoing Research on JCL at NaFORRI

National Forestry Resources Research Institute (NaFORRI) is conducting research on sustainable development of biofuel utilisation in Uganda. *Jatropha curcas* Linn (JCL) and *Ricinus cummunis* have been considered as potential biofuel crops for the study. So far, physicochemical characterization of JCL oil for bodiesel production in West-Nile and Lake Victoria Crescent agro-ecological zones of Uganda has been done. JCL seed kernel contained 51%w/w and 48%/w/w of oil with high levels of Free Fatty Acids (1.52 and 1.93%) and acid values (35 and 36mg KOH/g) for West-Nile and L. Victoria Crescent, respectively. Generally, the quality and quantity of the oil from west-Nile was better than that of L. Victoria Crescent, basing on the biodiesel standard values. However, the oil from both regions would require adequate treatment by degumming, etherification and transesterification before use in a diesel engine for better performance.

Bibliography

Jongh J. and van der Putten E. (2010) *The Jatropha Handbook: From Cultivation to Application*: FACT Foundation.

Wright L., Boundy B., Perlack B., Davis S. and Saulsbury B. (2006) Biomass Energy Data Book, Volume 1.

NREL (2009) *Biodiesel Handling and Use Guide*, 4th ed. USA: National Renewable Energy Laboratory.

Barabás I. and Todoruţ I.-A. (2011) Biodiesel quality, standards and properties, *Biodiesel-Quality, Emissions and By-Products*, pp. 3-28.

Ab van Peer (2010) Growing Jatropha. Accessed on 27th June 2015 from www.jatropha.pro

For more information, contact

The Director
National Forestry Resources Research Institute (NaFORRI)/NARO
P.O. Box 1752 Kampala
Tel: 256 414 712 161 161
Fax: +256 414 383 028
E-mail: naforridir@infocom.co.ug
www.naforri.org.ug

NARO

NaFORRI

© NaFORRI/NARO 2015