FACT Foundation

FACT promotes the development and use of
bio-fuels in developing countries for local people

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Note on Jatropha pressing for FACT pilot projects

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FACT

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1 Overview of available pressing technology

Based on a literature review an overview of small and medium scale presses has been made with capacities ranging from 10kg/hr (hand press) to 500 kg/hr (engine driven screw press). The overview is visible in Annex 1. Based on this overview specific quotation request were made and of four the information is shown in Annex 2. The FACT pilot project in Mozambique, where about 250 hectares of Jatropha are being planted can be viewed as a practical case study for the selection of pressing technology. For the selection of the best suited technology the following selection criteria have been introduced:

- Ease, speed and reliability of the supply chain;
- Drive train of the press, either with diesel engines (on PPO/diesel) or electrical driven
- Power Take Off with pulleys and belts or with gears
- Required maintenance and spare parts;
- Training of operators;
- Measuring temperature of pressing (too high temperature causes amount of Phosphor to increase in the oil)

Further exploring and testing of these variables will provide a more solid ground for technology selection.

2 Results from practical experiments

Research institutes, small & medium enterprises and private parties have gained experience in mechanical pressing of Jatropha Curcas seeds over the last years. A short overview of the findings from some activities is presented below:

Denmark: Niels AnsØ
Niels AnsØ has been involved in biofuel activities for many years. Niels did some experiments with Jatropha seeds in a BT50 screw press. His main findings were that the press operates better when seeds are crushed before they are entered into the press. Furthermore he reported large quantities of sediments in the oil that came from the press making further treatment of the oil more difficult.

Netherlands: Peter Beerens
In 2007 Peter did his thesis on screw pressing of Jatropha Curcas for application in developing countries. From practical tests at Eindhoven University of Technology and at Diligent Energy Tanzania he gained some significant insights in this process. Jatropha tests were conducted with the following presses:

- BT Bio Press Type 50 (cylinder hole press), with a capacity of 12 kg Jatropha/hr
- Sayari expeller (strainer press), with a capacity of 70 kg Jatropha/hr
- KEK Keller P0101 (strainer press), with a capacity of 70 kg Jatropha/hr
- Reinartz AP08 (strainer press), with a capacity of 300 kg Jatropha/hr

Test most important findings of the press tests where:

- The strainer press is preferable from an operational point of view. The big size of the Jatropha seeds and the relatively high amount of hull cause the cylinder hole press to yam easily. In case of jamming the strainer press is also more easily cleaned then the cylinder hole press.
- With proper press settings an oil recovery factor of around 85% can be achieved. This means that 85 % of the oil present in the seeds is removed, which comes down to 25

liters of oil from 100 kg of Jatropha seeds. This number is equal for both strainer presses and cylinder hole presses.

- All tests revealed a high amount of sediments varying between 20-60%. This sediment contains approximately 50% of oil. Either reduction in the amount of sediment after pressing or a filtering method suited to such high amounts of solid material would in potential increase the amount of clean oil by 10-15 percent points.
- Best efficiencies were achieved at low revolutions (30-40 RPM for the BT50). Of course this means lower throughput in kg/hr. Optimizing the nozzle size leads to an increase in oil recovery of around 10% for a cylinder hole press and up to 6% for a strainer press. In addition to the press settings seed conditioning will also affect the oil recovery. Oil recovery appeared highest for low seed moisture level (2-4%) and whole seeds without dehulling.
- No consistent results were found on the effect of moisture level and pressing temperature on oil quality. It is expected that oil temperatures above 70℃ increase the amount of phosphor in the oil and further tests are needed to confirm this.

Netherlands: Wageningen University and Research centre (WUR)
The WUR has started a research program for Jatropha pressing at the end of 2007. Their choice to use a strainer press from De Smet Rosedowns (MINI 200) supports the suggestion by Peter Beerens that a strainer press is preferred for pressing Jatropha Curcas seeds. Currently WUR commenced practical testing with the MINI 200 and aims to make an improved Jatropha press design.

Germany: Maschinenfabrik Reinartz GmbH & Co. KG
In June 2006 Maschinenfabrik Reinartz GmbH & Co. KG conducted test runs on Jatropha together with Peter Beerens. Results showed an oil recovery of 90% under improved settings.

Germany: Egon Keller GMBH CO KG
In June 2006 Egon Keller GMBH CO KG conducted test runs on Jatropha together with Peter Beerens. Results showed an oil recovery of 80% under normal settings. Tests showing higher oil yield were also done, however Keller advised not to use these settings as machine wear would drastically increase due to the high pressures and friction.

Honduras: FACT pilot project Gota Verde
In April 2008, a press was constructed locally in Honduras, all based on drawings provided by Joost Fokkink (www.biofuels.nl). The design was based on a Taby Type70, cilinder hole press. During the first tests the press ran at 50% rated speed, approximately 25Hz. At that speed the press had a capacity of 8.5 kg Jatropa per hour. At an efficiency of 22.8% clean oil. Using castor a capacity of 13 kg/hr was achieved with an efficiency of 28%.

Mozambique: Private farmer Brendon Evans
Brendon Evans from Chimoio presses cottonseeds with two 6YL-95 presses type DoubleElephants, made in China. One of them was bought via ATA in Zimbabwe and the other one in South Africa. The one from Zimbabwe is performing best. His experience with theses strainer presses is that the oil yield is quite low (no specific number available). Crushing the seeds (e.g. with a hammer mill) appeared to improve the oil recovery. After a short time of operation the bearings were worn out and Brendon replaced the bearings for SKF ones.

3 Recommendation on press selection

It is expected that the annual seed yield from 250 ha of Jatropha will be between 250 to 500 ton after 3 years. For continuous press operation this means a required production capacity of 0.7 to 1.4 ton per day (or 90/180 kg per hour assuming an 8 hour working day). From a practical point of view it would be better to have multiple presses with a joint capacity of the order 150-200 kg. The advantage of using more than one press is that parts can be exchanged and production can still continue at a lower level when one of the machines fails. Furthermore smaller machines are easier to operate and maintain for local artisans. Smaller machines also allow for gradual expansion of the project size.

As the goal of the Jatropha projects is that they are run mostly by local population within a few years from now it seems wise to use technology that is as simple as possible and complies with the requirements. Taking into account the required capacities and project budget for press technology the three best options would be the Sayari expeller or the 6YL-80; the 6YL-95 and 6YL-125 (DoubleElephants). The fact that dealers and users of these presses are in Mozambique or Tanzania contributes positively to the selection.

The best screw presses included in this study are the ones from De Smet Rosedowns, Reinartz and Keller because of their superior performance and durability. Due to budget restriction for many of the projects in developing countries this type of equipment is not seen as a realistic option for small and medium sized projects.

Annex 1: Overview available presses from literature

The tables below show an overview of available presses from literature in the range of 10-500 kg/hr. The press types of interest for small scale Jatropha pressing as is planned for a scale comparable to Mozambique (250 ha) are marked in green.

Company	Bt Maskinfabrik	IBG Monforts Oekotec GmbH & Co.	United Oil Mill Machinery & Spares Private Limited.	
Country	Denmark	Germany	India	
Address	Riskærvej 12, Hørby, DK-9352 Dybvad	An der Waldesruh 23, D-41238, Mönchengladbach	D-133, Okhla Industrial Area Phase-1, 1st Floor, New Delhi - 110020	
Phone number	+ 45 98 46 61 57	+49 (0) 2166-8682-90	+ 91-11-26371201 / 26371202 / 26371203	
Fax number	+ 45 98 46 61 55	+49 (0) 2166-8682-44	+ 91-11-26371200	
Email	btmaskinfabrik@thomsen.mail.dk	oekotec@ibg-monforts.de	umas@vsnl.com	
Website	http://www.bt-maskinfabrik.dk	http://www.oekotec.ibg-monforts.com/en/20.html	http://www.umas-india.com	
Press Type	BT biopress type 100	Komet S120F	UMAS' TIGER MK-I	UMAS' TIGER MK-II
Impression				
Capacity standard oilseeds (kg/hr)	100	70-100	2**	3-4**
Expected capacity Jatropha (kg/hr)*	60-70	50-70	1,4	2-3
Power req. (kW)		7,5	-	-
Weight (kg)	-	440	-	-
Size (mm)				
length	-	1670	-	-
width	-	825	-	-
height	-	1320	-	-
Price (€)	-	-	-	-
Spare parts	-	-	-	-

* expected capacity for Jatropha is based on experience with BT 50 and Sayari expeller and is about 70% of the capacity for standard oilseeds
** ton per day

Company	Tiny Tech	Hybren ApS	De Smet Rosedown		
Country	India	Denmark	United Kingdom		
Address	Tagore Road, Rajkot - 360 002 (India)	Skagensvej 29, Uggerby, 9800 HjØrring	Cannon St Hull, East Yorkshire HU2 0AD		
Phone number	+ 91 - 281 - 2480166	+ 459897 5702	+44 (0)1482 329864		
Fax number	+ 91 - 281 - 2467552	+ 45 9897 5703	+44 (0)1482 325887		
Email	tinytech@tinytechindia.com	hybren@hybren.dk	info@ Rosedowns.co.uk		
Website	http://www.tinytechindia.com	www.hybren.dk	http://www.rosedowns.co.uk		
Press Type	Tiny Tech Tiny Oil Mill	Hybren 60	Mini 100	Mini 200	Mini 500
Impression					
Capacity standard oilseeds (kg/hr)	125	55-65	100	200	300
Expected capacity Jatropha (kg/hr)*	80-90	40-45	70	140	210
Power req. (kW)	9	1,2	7,5	15	22
Weight (kg)	-	100	500	900	900
Size (mm)					
length	-	-	1500	2200	2300
width	-	-	375	680	700
height	-	-	500	840	850
Price (€)	-	-	17,750 (includes motor)	28,150 (includes motor)	32,550 (includes motor)
Spare parts	-	-	-	-	

* expected capacity for Jatropha is based on experience with BT 50 and Sayari expeller and is about 70% of the capacity for standard oilseeds
** ton per day

Company	Täby presses	Goyum screw presses		Egon Keller GMBH CO KG.	
Country	Sweden	India		Germany	
Address	Täby Skeppsta, SE-705 94, Örebro	Plot No. 324/2, Industrial Area A, Ludhiana -141 003, (Punjab)		Anton-Kuppers-Weg, P.O. box: 140350 D-42824 Remscheid	
Phone number	+46 **(0)19 228005**	+(91)-(161)-4629180		+49 (0) 21 91 - 8 41 00	
Fax number	+46 **(0)19 228005**	+(91)-(161)-2543442/2230380		49 (0) 21 91 - 86 28	
Email	sales@oilpress.com	goyumjain@yahoo.com / jaingoyum@rediffmail.com		info@keller-kek.de	
Website	www.oilpress.com	http://www.oilmillmachinery.com		www.keller-kek.de	
Contact				Markus Keller	
Press Type	type 90	Goyum 60	Goyum 100	KEK-p0101	KEK-p0500
Impression					
Capacity standard oilseeds (kg/hr)	80-110	210-250	330-420	100	500
Expected capacity Jatropha (kg/hr)*	60-80	140-175	230-300	70	350
Power req. (kW)	4	14	15	7,5	22
Weight (kg)	160			950	3950
Size (mm)					
length	1420	2900	2175	2240	4060
width	400	960	1100	1500	2030
height	370	2150	2200	1100	1590
Price (€)	10.500				
Material		Cast Iron Bodies, Steel Fabricated Chamber, Case Hardened Screw	Steel Fabricated Base & Bodies, Case hardened worm assembly with hard faced discharge ring and compression ring.		
Spare parts	-	-	-	18,500 (includes motor)	63,500 (includes motor)

* expected capacity for Jatropha is based on experience with BT 50 and Sayari expeller and is about 70% of the capacity for standard oilseeds

Company	Maschinenfabrik Reinartz GmbH & Co. KG			Henan Doubleelephants Machinery Co, LTD	
Country	Germany			China	
Address	Industriestrasse 14, 41460, Neuss			No.68 Xinhua road Henan province Shenqiu county seat,China	
Phone number	+49 2131 9761-0			0394-5183368 5235093	
Fax number	+49 2131 9761-12			0394-5235093	
Email	g.strupat@reinartz.de			sales@dbph.com	
Website	www.Reinartz.de			http://www.oilpress.com.cn	
Contact	Gabrielle Strupad				
Press Type	AP 10/06	Ap 12	AP 14/30	6YL-120	ZX-105A
Impression					
Capacity standard oilseeds (kg/hr)	100	200	500	200	250
Expected capacity Jatropha (kg/hr)*	70	140	350	140	160
Power req. (kW)	7,5	15	30	11	11
Weight (kg)	900	2000	3000	680	980
Size (mm)					
length	1900	2700	3630	1650	2300
width	600	700	760	630	1760
height	1100	1200	1200	2360	1950
Price (€)	20,000 (includes motor)	-	53,000 (includes motor)		
Spare parts					

* expected capacity for Jatropha is based on experience with BT 50 and Sayari expeller and is about 70% of the capacity for standard oilseeds

Company	Vyahumu thrust	Universal Equipment Industries	New Dawn Engineering	CAMARTEC	KickStart Tanzania
Country	Tanzania	India	Southern Africa	Tanzania	Tanzania
Address	P.O. Box 189, Morogoro	Post box 30, Bahumukhi Path, Jyotinagar	P.O. Box 3223 Manzini, MZ200, Swaziland	P.O. Box 764, Arusha	P.O. Box 33605, 83 Old Bagamoyo Road, Dar es Salaam
Phone number	+ 255784895534	+977 (71) 545056	(+268) 518-5016 or 518-4194		+ 255-22-278-1061
Fax number	+ 255232604196	-			
Email	clshila@yahoo.com / vyahumu@hotmail.com	ueibtl@yahoo.com	info@newdawnengineering.com		kickstart.tz@kickstart.org
Website	-	www.universal-equipment.com	http://www.newdawnengineering.com		http://kickstart.org
Contact	Lehada Cyprian Shila				
Press Type	Sayari expeller	Sundhara expeller	Cooking Oil Press	Bielenberg ram press	Mafuta Mali
Impression					
Capacity standard oilseeds (kg/hr)	100	100	12	10	10
Expected capacity Jatropha (kg/hr)*	70	70	8-9	7	7
Power req. (kW)	7,5	7,5	-	-	
Weight (kg)	322	322	-	-	
Size (mm)					
length	1182	1182	-	-	
width	1430	1430	-	-	
height	904	904	-	-	
Price (€)	2200 (includes engine)	1100 (without engine)	700	200	
Spare parts	-	-	-	-	

* expected capacity for Jatropha is based on experience with BT 50 and Sayari expeller and is about 70% of the capacity for standard oilseeds

Company	Brendon Evans	Pro Campo (supplier agro equipment)	
Country	Mozambique	Mozambique	
Address	Chimoio	Maputo	
Phone number			
Fax number			
Email			
Website			
Contact			
Press Type	6YL-95 (Double Elephants)	6YL-80 (Double Elephants)	Filter unit
Impression	 		
Capacity standard oilseeds (kg/hr)	2**	75-80	
Expected capacity Jatropha (kg/hr)*	1.4**	52-56	
Power req. (kW)	7.5-11	5 (380V)	
Weight (kg)	650	140-160	
RPM	28-38		
Size (mm)			
length		880	
width		420	
height		660	
Price (€)	3250 (2005)	1100 (without diesel engine) + extra 700 for filter	
Spare parts	only to replace the bearings by SKF (fit) once and replace parts of the worm, about 2 to 3 times/year (cost $ 20-30 for 1 time) especially the middle part of the worm wears quickly.		

* expected capacity for Jatropha is based on experience with BT 50 and Sayari expeller and is about 70% of the capacity for standard oilseeds
** ton per day

Annex 2: information from quotation requests

Tiny Tech India

125 kg/hr
They claim "cylinder hole", although picture on website clearly shows "strainer"
Adjustable, however company settings are optimal
Fixed 45 RPM. Can only be changed by changing pully
Assume that screw consists of 7 sections
Hardened steel, not certified
Electric (10HP) **or diesel** (12HP) are optional
7.5 kW
press + engine **$3400**, cooking kettle + pipes **$1000**
7 days
2.5 tons
$1100
Parts for first three years included with press
Jatropha 30%, Cottonseed 16%, Castor 40%

GOPAL DESAI

Destek

300 kg/hr sunflower, Cold press with adjustable seed inflow, adjustable backpressure and if required adjustable worm speed
Strainer type
The cage bars are adjustable by insering shims
50 RPM fixed, assume adjustability with pully
One piece with removable endshafts
Tool steel through hardened, certified by Bohler Uddeholm
Any means of drive ± 18,5 kW @ 1450 RPM
18,5 kW hour @ 300 kg/hour sunflower cold pressing
press + electric power source= €15722, filter and pump= €2930
6 weeks
1 ton
€ 762
Barrel complete: **€ 3555** (reconditionable @ Euro 300.00 ex works) 2 x screws complete **€ 6000**
Jatropha 25-29%, Cottonseed 24%, Castor 12-15%

Gert Lubbe

United Oil Mill Machinery & Spares Pvt. Ltd.

100 kg/hr
Strainer
Spacing of cage bars **can be adjusted** with spacers having different thickness
Fixed 18 RPM. Can only be changed by changing pully
Screw consists of multiple replacable pieces
Screws and press cage are made up of heat treated mild steel. Conforms to **I.S.2062 norm**
Electric or diesel (16kVA) driven. Kettle electric only.
Press= 7.5kW, Kettle= 1.1kW
€ 9500, which includes the Oil Expeller complete with cooker and electric motor, with V Belts, V Pulleys, foundation bolts etc.
Shipment can be effected within 6-8 weeks from date of receipt of L/Credit.
2.2 tons
Delivery to Beira port for **€400**
5 sets of cage bars and knife bars, one set bearing and 5 sets worm assembly (**costs=€2200**)

L. K. Gandhi,

Hybren

90 kg/hr
Cylinder hole press
Restriction size and bar spacing are adjustable
79 RPM (30-120 with inverter)
one piece Ø70 mm, 285mm length
according to the german “werkstoff nummer”, we use 1.2312, 1.2344, 1.2379
standard only electric, Lenze geared motor, 5,5 kW, integrated construction, gear cast iron, motor aluminium.
rapeseed = 150Wh/l ~ 550kJ/l
€ 8.800
6 weeks
approx 150 kg
?
screw: € 400, geared motor: €1200, wear sleeves: €400, booster housing: €670, booster nozzle: €125, pellet nozzle:€135
yield and sediment for Jatropha not yet known, sediment for first tests around 20%

Thomas Norgaard