Oilseeds & Small-scale Oil Extraction

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Common Oilseeds

Seeds & Beans	Nuts	Fruits
Canola	Almond	Avocado
Castor	Coconut/Copra	Oil palm
Corn	Groundnut	Olive
Cotton	Palm kernels	
Mustard	Shea nut	
Safflower	Walnut	
Sesame		
Soybean (solvents)		
Sunflower		

More Oilseeds

Seeds & Beans	Nuts	Fruits
Coffee	Cashew	Apricot
Grape	Hazelnut	Orange peel
Linseed		
Moringa		
Neem		
Pumpkin/Cucurbits		
Sesame		

Potential Uses

- Culinary (cooking oils, flavor, in recipes)
- Making Soaps
- Fuel (oil lamps, candles, biofuels)
- Cosmetics
- Lubricants
- Medicines
- Animal feeds
- Health spas
- Waterproofing / Protectants

Basic Steps

- Prepare raw materials
- Extract oil
- Clarify oil
- Package and store oil
- By-products

Prepare Raw Materials

- Harvest fruits when fully mature
- Sort seeds and remove any that are bad, moldy or rotten
- Dry seeds- moisture content should be no higher than 10%
- Remove husks or seed coats
  - For groundnuts, moringa, etc only dehull 50%
- Separate the seeds from the chaff
- Crush or grind and mix with water (depends on material)
- Heat material; this can increase yields by 50%

Solar Dehydrator

Mortar & Pestle

Universal Nut Sheller

Grinder for Dehulling

Winnow

Oil Extraction

- Small-scale extraction efficiency is about 40%
- For presses, increase pressure slowly to allow time for oil to escape
- For expellers feeding rate and choke tightness determine oil yield as well as clogging potential and difficulty of operating

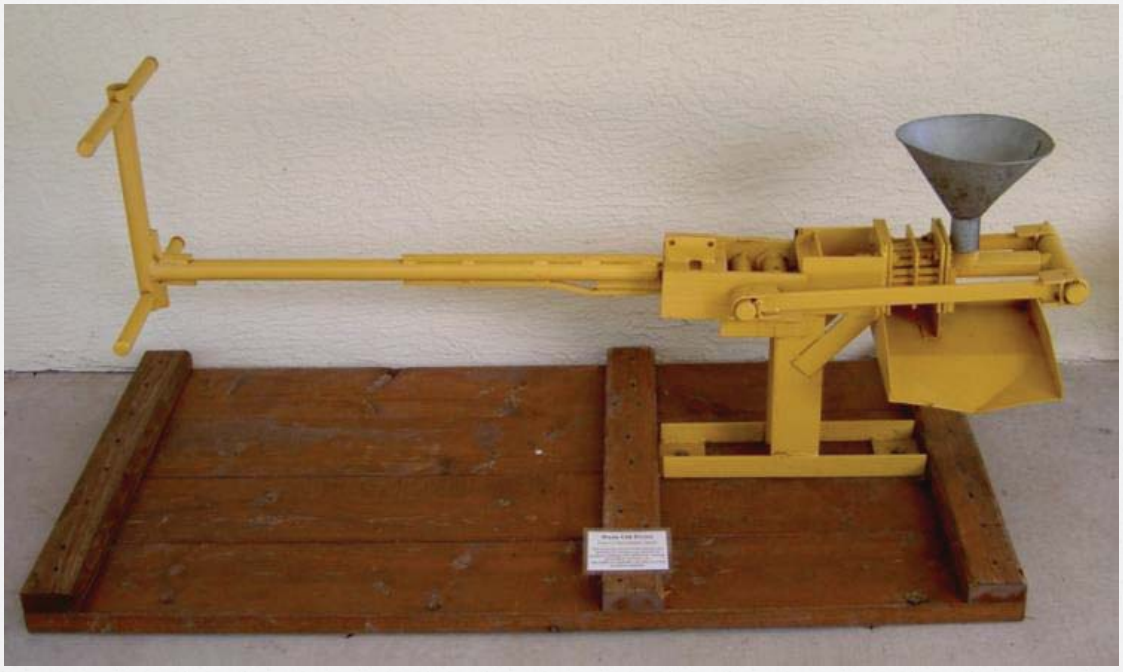
Oil Extraction Methods

- Boiling
- Mortar & Pestle and Ghanis
- Oil presses
  - Lever and screw presses are generally more reliable but slower and produce less pressure/oil
  - Hydraulic presses are generally more expensive, need more maintenance, and can be dangerous
- Oil expellers
- Solvents (efficient but also complex, dangerous and typically used for large quantities- 200 tons per day)

Hydraulic Jack Press

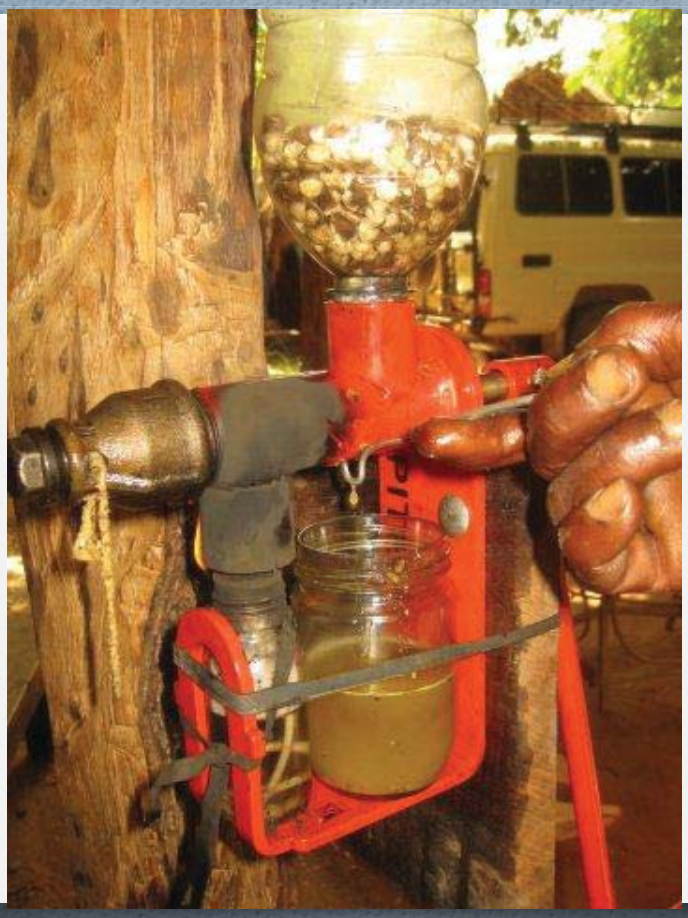
Screw Press w/ Hydraulic Jack

Ram Press



Ram Press

Oil Expellers grind and press raw material in a barrel with a helical screw; pressure and yield controlled by choke ring at outlet.



Auger Bit Oil Press

Auger Bit Oil Press

- Homemade version of the Piteba Press
- Made using a 1” single fluted auger bit, 1” water pipe, angle iron, bolts, and a few other odds and ends
- Tools needed are welder, angle grinder, drill and bits, round file, hacksaw, vice/clamps

Auger Bit Oil Press

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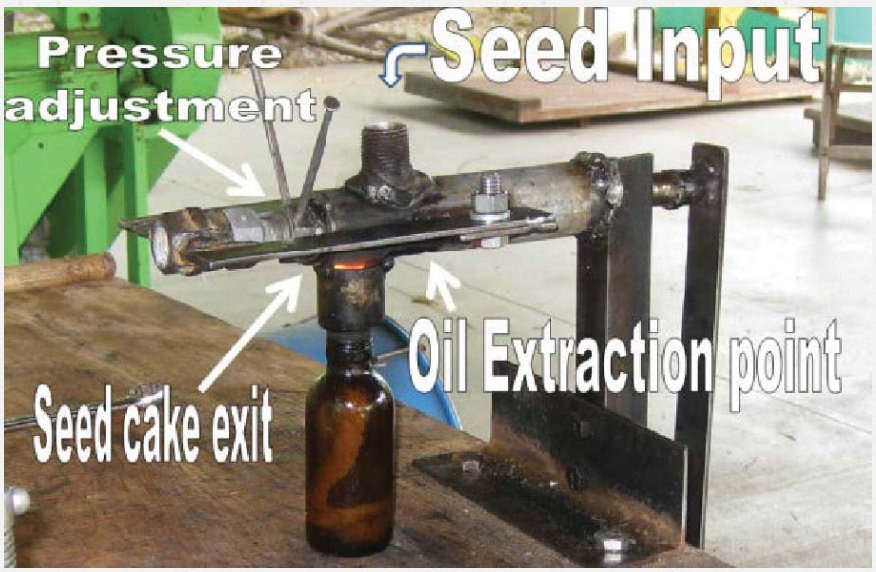


Clarify Oil

Remove contaminants such as fine pulp, water and resins:

- Allow oil to stand undisturbed for a few days so solids settle to bottom
- Filter through a fine cloth
- Heat oil to drive off traces of water and destroy bacteria

Package & Store Oil

- Package in clean dry containers
  - glass, plastic, glazed pottery, stainless steel, galvanised iron, enamel, aluminum, no copper
- Seal against moisture, air and light to protect oil from going rancid
- Colored containers in a dark box help increase shelf life
- Shelf life usually 6-12 months
- Unrefined food grade oils can be stored in a refrigerator and should be used within a month

By-Products

- Husks/Coir/Shells
- Seed cake can be used as human food or animal food
- Water purification
- Keep seed cake stored well (can be frozen), it can mold or rot and harm animals which contaminates animal products (meat, milk, eggs, etc); most contaminants end up in seed cake not oil

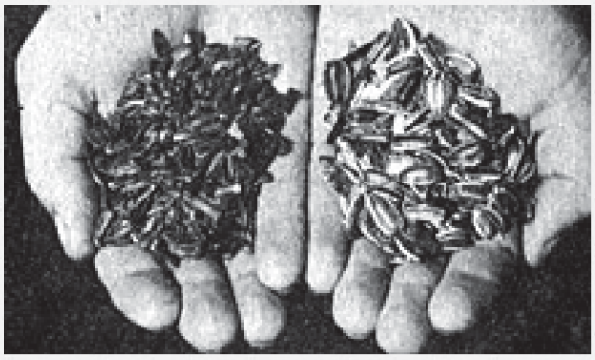
Moringa Seed Cake

Oilseeds

Seed	Oil Content (%)	Uses
Almond	50	Food, salad oil, soap
Castor	50	Medicine, lubricant
Cotton seed	30	Food, paint, resin
Hemp seed	35	Paint, varnish, soap
Linseed	40	Paint, soap, varnish, linoleum
Olive	40	Salad oil, cooking oil
Peanuts (groundnuts)	50	Salad oil, cooking oil
Perilla seed	50	Drying oil for paint, resin
Poppy seed	50	Salad oil, cooking oil
Rape seed (colza)	40	Salad oil, cooking oil
Sesame seed	50	Salad oil, cooking oil
Sunflower seed	35	Salad oil, cooking oil, soap
Tung nuts	20	Paint

Source: Small-scale Oilseed Processing, ATTRA

Sunflower Oil



Sunflower Oil

- 2500 square feet of sunflowers can produce food for 4 people
  - 1280 oilseed sunflowers to produce 3 gallons of oil (2240 sq ft)
  - 140 confectionary sunflowers to produce 20 pounds of dehulled seed (260 sq ft)
  - Bonus: broken seed and seedcake for animal feed

Source: Sunflower Seed Huller & Oil Press, Organic Gardening

Sunflower Oil

- To process confectionary sunflowers
  - Grade using screens
  - Dehull using burr or stone grinder, grain-mill
  - Winnow using shop vac or vacum cleaner or traditional methods
  - Crush seeds
  - Heat
  - Extract oil
- One pound of confectionary seeds produces 1.5 ounces of oil

Sunflower Oil

- To process oilseeds
  - Put whole seeds into a blender and blend until it forms a fine meal
  - Heat in an oven for 20 minutes at 300F, stirring every 5 minutes
  - Extract oil
- One pound of oilseeds produces 3 ounces of oil
- 1280 oil type sunflowers should provide 3 gallons of oil

Moringa Oil

Moringa Oil

- Moringa seeds are 30-40% oil by weight
- Ram press provided 13% oil extraction
- Hand crank Piteba expeller provided 13% oil extraction
- Spindle press provided 14% oil extraction
- Home made Auger Bit Expeller provided 15% oil extraction
- Solvents provided 38% oil extraction

Sources: Bunda College in Malawi and Tim Tanner in Tanzania and at ECHO

Moringa Oil

- One hectare could produce 3000 kg of Moringa seed, equivalent to 900 kg oil/hectare (using solvents); average soybean yield also 3000 kg seeds/hectare but with only 20% oil yield
- The oil lasts for a long time without becoming rancid and is good for soap making (saponification value of 164)

Sources: *Moringa oleifera*, Potentially a New Source of Oleic Acid-type Oil for Malaysia

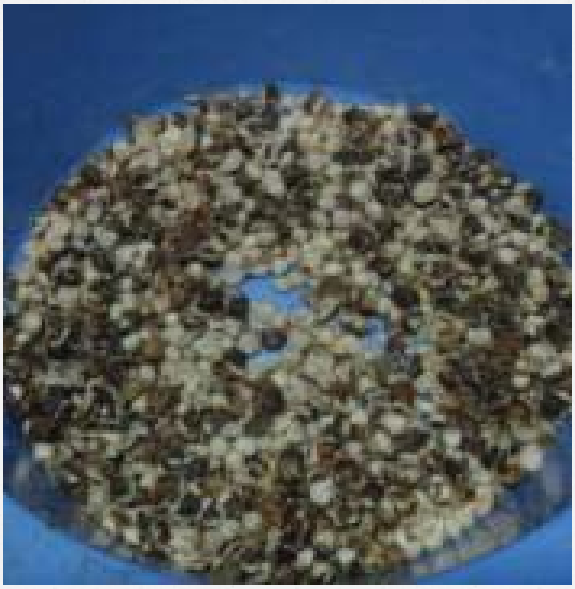
Moringa Oil

- Moringa oil is highly unsaturated containing 80.4% polyunsaturates and 5.3% monounsaturates
- High oleic acid content (67.9%); other high-oleic acid oils are: olive oil (80%), high-oleic canola oil (75%), high-oleic sunflower oil (>80%) and high-oleic safflower oil (77%)
- Oils rich in monounsaturated fatty acids (e.g. oleic acid) are generally more stable to oxidative rancidity, stable as deep frying oils and are usually more healthy (lower risk of coronary heart disease)
- Based on an analysis by electronic nose, it was shown to have a mild and pleasant nutty flavor similar to that of peanut oil

Sources: *Moringa oleifera*, Potentially a New Source of Oleic Acid-type Oil for Malaysia

Prepare Moringa Seeds

1. Sieve and pick though your seed to make sure stones and sticks and stems are out.
2. Weigh out your seed, so you can measure your resulting oil. Start with ¼ kg batches, as you get used to it you can do larger batches; do not prepare more seed than you will press in one day, seed keeps better in the hull.
3. Using a mortar and pestle pound the seed lightly to just crack the hulls.
4. Winnow the seed to remove about 50% of the hulls; don't try to count the hulled and unhulled just estimate.



Assemble Auger Bit Press

1. With your machine completely dismantled, lubricate all the moving parts with some sort of oil, including washers and inside of press cage and auger bit.
2. Assemble the press: bolt the press cage to the stand, put the washers on the bit, insert the auger bit in the press cage so the shaft extends out the back side, thread the spear point's bolt into holder, bolt the spear point frame to the press cage, attach the crank handle.

Auger Bit Press

Add Seeds

3. Light the burner/candle and put in place under the flame protector so it can warm the press cage
4. Close the spear point to almost fully closed.
5. When the press cage is hot (when you cannot keep your hand on it), put on funnel and add some seeds (a protector should be added to protect flame from wind, catch any seed that falls, and protect funnel from melting).

Auger Bit Oil Press

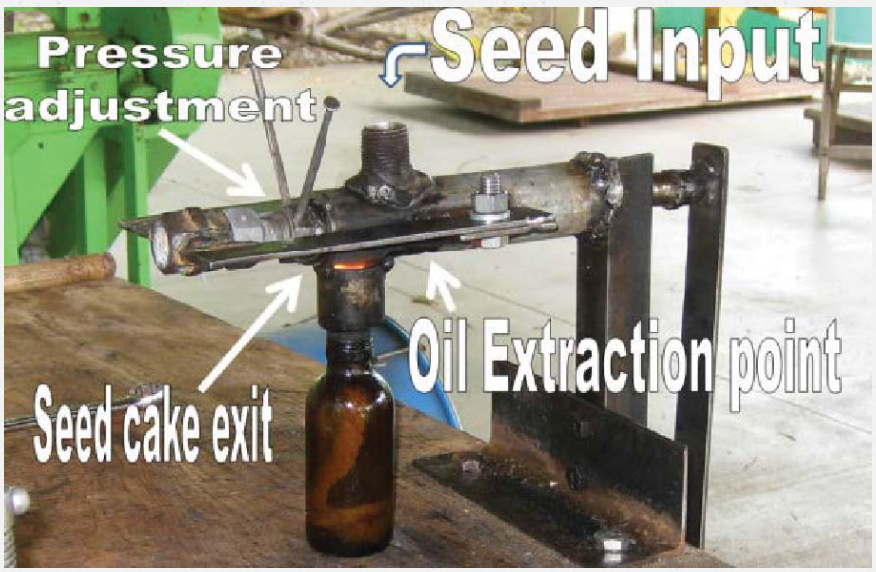
Prime Oil Press

6. Push & guide seeds into the press cage, while turning the crank. **Remember to turn the crank counter clock wise,** the auger bit was made to pull wood from a hole but we are using it to push seed into a hole, so turn it backwards.
7. As you turn the crank and push seeds in, seed cake will slowly pack up in the end of the pipe, once enough pressure is reached the seed cake in the very end (at the spear point) will give up its oil; as soon as you see oil appearing at the mostly closed spear point, stop cranking and release the pressure by turning the spear point bolt in to its holder (away from the press cage) slightly. Continue cranking and repeat adjustments until the seed cake is coming out the opening like thick goo (like plastic that has been warmed to the point of just starting to melt).

Moringa Oil

8. Keep cranking and pushing in seeds and eventually oil will drip out the oil slit.
9. Once this happens just keep it up. You can adjust the spear point some; the basic principle is you want it as closed (more pressure) as possible without slowing your work down too much.

Auger Bit Oil Press



Potential?

What oilseeds are available in your areas?

Which extraction methods are you most interested in?

What areas would this be most applicable for?

Reference Documents

- Auger Bit Oil Press, Tim Tanner, 2012
- *Moringa oleifera*, Potentially a New Source of Oleic Acid-type Oil for Malaysia, University Putra Malaysia
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- Small-Scale Oilseed Processing, Janet Bachmann, ATTRA, 2001 and Oilseed Processing for Small-Scale Producers, Janet Bachmann, ATTRA, 2004
- Sunflower Seed Huller and Oil Press, Jeff Cox, Organic Gardening, 1979