



# OPERATION AND PROCESSING MANUAL PRESSURE-PUFFING MACHINE (YOSHIMURA-MODEL)

This manual explains the operation and maintenance of your pressure-puffing machine (Yoshimura-Model). Please read it thoroughly and follow the instructions carefully. Doing so will help you enjoy many years of safe and trouble-free operation. Sample of processing puffed cereals also described at the end.



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Pressure-puff cereal machine in Kitui County, Kenya

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<u>Photo:</u> Local children in Bomet County enjoying the kashata.



The machine consisted of three major sections, A: Cylinder, B: Fire place, C: Cereal trap (wire mesh cage)







	Name
1	Iron sheet
2	Lid guide
3	Hitting peg
4	Cylinder holder
5	Funnel
6	Pressure gauge
7	Cylinder lid
8	Center bolt
9	Mesh guide
10	Flame stand
11	Shock absorber pad
12	Safety valve
13	Rotating handle
14	Lowering handle
15	Slider
16	Hooks for cotton bag attachment
17	Hitting peg (same as 3)
18	Peg holding pin
19	Lid guide (Same as 2)
20	Center bold rock bolt
21	Hole for iron rod to tighten the cylinder lead
22	Center bolt (same as 8)
23	Cylinder lid (same as 7)
24	Teflon pressure gasket

#### **Section 2: Operation**

The pressure popping machine or cereal popper is used to produce the healthiest foods and snacks through accumulated high pressure by heating the cylinder. It can puff or pop many different kind of cereals and grains; e.g. Maize, Sorghum, Wheat, Finger millet, Pearl millet, Rice, Beans and Nuts etc. The machine can use variety of locally available heat sources such as gas, charcoal but this model particularly designed for using firewood.

# 2.1. Requirements and accessories for operating the machine



	Name		
1	Eye protection		
2	Pressure gauge		
3	Ear mugs- ear protection		
4	Scooping rod- used to clean the machine and remove remaining popped cereals from the cyl-inder.		
5	Rubber hammer- used to open the cylinder when the cereal is ready to pop.		
6	Skin or woolen gloves		
7	Sealing tape		
8	Spanners; no; 14, 17, and 19		
9	Iron funnel- used to pour the cereals into the cylinder		
	Iron rod- used to tighten the cylinder lead		
	Clean cloth		
	Clean basins and buckets		
	Lighter for setting fire		
	Firewood		
	Serving spoons		

## 2.2. Operating procedure

#### 1. Preparation of the materials

Wash, clean, remove stones and dry materials under the sun (a day before the operation). <u>The recommended moisture content of the grains is between 15 and 18 % for best puffing</u>. The moisture contents of polished rice and wheat grain sold in common markets in Nairobi is between 8 to 13%. Washing grain therefore important not only for cleaning but also adjusting the moisture contents of the grains. Recommended to add about 60-80g of water for every 1kg of grains (Rice) if not sure the original moisture contents. This water adjustment process makes well puffing the grains. However more than 20% of the moisture contents makes grain (Rice) hard and reduces the success ratio of puffing grains. The grain can be packed, sealed in a plastic bag and stayed overnight after the moisture adjustment.

#### Sample calculation formula and answer:

Adjusting 10% moisture Rice grain 1kg (1,000g) into 18%.

- Water content of the Rice grain:
  - $1,000g \ge (10/100) = 100g$
- Making 18% moisture content Rice grain: (100+x)/(1,000+x)=18/100 10,000+100x=18,000+18x 100x-18x=18,000-10,000 82x=8,000 x=97.56
  Adding water: 97.56g



2. Assemble all the requirements e.g. firewood, clean basins, clean cloth, clean cereal, gloves, etc. Cut the firewood into small pieces.



3. Confirm pressure gauge clean and put sealing tape on.



4. Check and tighten all the nuts and bolts.



5. Clean inside the pressure tubes.



6. Put the pressure gauge and make sure it is tight.



7. Put shock absorbing pad (wooden and/or rubber).



8. Light the fire in the fire place.



9. When the fire is ready, carefully place the cylinder on the fire place. NB; the cylinder should be open this time.



10. Wipe the cylinder using the long spoon and a clean wet cloth



11. Wipe the cylinder gasket using a clean wet cloth



12. Rotating the empty cylinder about 7-10 minuets as pre-heating of the cylinder.



13. The cylinder can hold up to 1kg of grains. Weigh 1kg of cereal while the cylinder heats.



14. Lower the cylinder using the lowering bar.



15. Release template inside the cylinder as pour the cereal into the cylinder using the iron funnel



16. Close and lock the lid by hooking the hitting peg. Then tighten the center bolt using the iron rod by holding the peg tightly with the other hand (use the globes).



17. Start rotating the cylinder using the rotating handle (<u>60-70 rotating per minute, or 10-14 rotating per 10 seconds</u>) as continue adding firewood from the side. Rotating too fast or slow makes material burnt. Make sure the fire is well maintained while you operate the machine. Ensure you keep rotating the cylinder.



18. Start preparing the cereal trap, attaching cotton bag and keep it near the machine. Keep checking the pressure gauge. Pressure should start increasing after 2-3 minutes and goes slowly upto around 5 M.pa. It increases rapidly after then. NB. Need special attention requires for monitoring the pressure gauge at this time. Keep the clean basin, rubber hummer.



19. When the pressure reads as per the requirements of the type cereal (See Table 1), stop rotating and set up the cereal trap in its position (hitting peg supposed to be at the top position).



20. Once it reaches at the target pressures, set the position of the trap cage. Advice observers to not stand in front of the direction of releasing pressure. Hand bell can be useful to alert people nearby. Gently but surely hitting the peg with the rubber hummer to release pressure. With large explosion sound, puffed cereal is trapped in the bag.





# 21. Remove the cereal trap quickly and



22. Harvest the cereals from cylinder using the scooping spoon and also from the trap and bag.



23. When the cereals are in the trap, pour then into the clean basin/bucket.



# 24. Clean inside the cylinder.



25. Put another cereal into the cylinder to continue processing.



26. Sieve and separate defective materials And put selected materials into the bag for next processing. Defective materials can be grinded into flour for other uses.



# 2.3: Samples of puffed cereals







Some of the grains the project has puffed (top left to bottom right): Maize (Zea mays); the volume expands more than 10 times of the original grain size, Maize (Zea mays), Rice (Oryza sativa), Broken Rice (Oryza sativa), Pearl millet (Pennisetum glaucum), Finger millet (Eleusine coracana), Red sorghum (Sorghum bicolor), Bambara nuts (Vigna subterranean), Greengram (Vigna radiata), and African Marama bean (Tyloseme fassoglense).

27. Enjoy eating puffed cereal or add preferred flavors.



	Materials	Pressures (kg)	Method
1	Rice	10	Puff
2	Wheat	9	Puff
3	Maize	9	Puff
4	Finger millet	11	Puff
5	Sorghum	11	Puff
6	Pearl millet	10	Puff
7	Greengram	8-10	Puff or Cool down
8	Lablab	8-10	Puff or Cool down
9	Beans	6	Puff or Cool down
10	Soya beans	6-7	Puff or Cool down
11	Grand nuts	5-6	Puff or Cool down
12	Cowpea	7	Puff or Cool down
13	Bambarra nuts	6	Puff or Cool down
14	Marama bean (EA type)	6	Puff or Cool down

Table 1. Recommended puffing pressures and methods for major grains.

# Section 3: Maintenance

The best kind of maintenance is preventative maintenance. Good service and routine checkups can reduced breakdowns and significantly increase the lifespan of your machine as well as contribute to saving time and money.

# Inside toolbox



	Name
1	Toolbox
2	Ear mugs- ear protection Pressure gauge
3	Rubber hammer
4	Sealing tape
5	Eye protection
6	Skin or woolen gloves
7	Tools; spanners, pipe wrench, priers etc
8	Scissors
9	Knife
10	Spare parts; pressure gauge, center bolt, hitting peg, Teflon gasket etc.

Wipe inside cylinder with clean duster.



Apply cooking oil inside the cylinder to prevent rusting. Remove carbons using iron rod.



Make sure pressure hole is clear.



You can clean other parts using water.



Change wooden damper if it is necessary.



Make sure all bolts, nuts and pins are tighten and fixed right.



Check thickness and surface of the Teflon gasket. Requires change if it is <than 2mm thickness (standard size is 5-6 mm). To make gasket surface flat using sandpapers.



# Section 4. Processing and flavoring of puffed cereals.

\* Code of practice of the East African standard, Hygiene in the food and drink manufacturing industry will be applied to all food and drink manufacturing industries irrespective of their size and volume of production.

https://law.resource.org/pub/eac/ibr/eas.39.2001.html



# 4.1: Utensils



	Name
1	Plastic buckets, different sizes
2	Wooden "kashata" flames
3	Plastic basins, different sizes
4	Clean cloth
5	Table
6	Stove / Cooker
7	Saucepans
8	Weight balance
9	Kitchen and serving spoons
10	Kitchen knife
11	Stainless steel or wooden board

Flavoring of puffed cereals depend on the type of consumers being targeted. Some of them preferred flavors include sugar, honey, blue band (bread spread), chili papers, chocolate, cinnamon, and fruit flavors etc. The puffed cereals are flavored to add tastes and preserve them.



# 4.2: Flavoring with sugar (standard)

#### Directions

1) Making a sugar syrup

	Ingredient	Quantity
1	Sugar or/and Molasses	350-500 g
2	Salt	2.5 g (one tea spoon)
3	Water	180 mL

- Step 1: Put sugar and salt into the water and stir and boil continuously for 15-20 minutes over large heat. Be careful not to let the sugar burn and do not let it crystallize in the bottom of the saucepan. Never cover the saucepan with a lid.
- Step 2: Never walk away. Continue star to boil over until the mixture begins to thicken and turns into light brownish in color. It produces a lot of small bubbles where it hardly disappears at this stage.
- Step 3: Stop heat and pour the mixture (syrup) over puffed cereals all at once and stir with large wooden spoon for a few minutes to ensure the syrup is well coated and dried.
- 2) The syrup can be used for most of the products to flavor as follows. Different puffed materials can be mixed.

	Ingredient	Syrup
1	1 L of puffed sorghum	1 and <sup>1</sup> / <sub>2</sub> serving spoon
2	1 L of puffed white corn (maize)	2 serving spoons
3	1 L of puffed wheat	1 serving spoon
4	1 L of puffed rice	1 serving spoon

NB: One serving spoon is approximately 50g of the syrup.





Making sugar syrup (left). Adding syrup to puffed materials (right).



Stir with large wooden spoon and ensure the syrup is well coated and dried (left). Serving for testing (right).

# 4.3: potential seasonings

Various spices can be used as seasonings to create new taste and unique additional values for your original puffed cereals. It is recommended to use natural products which easily available and accessible.

Potential spices for favoring

	Spices and favors	Forms	Quantity (g) for 1L puffed materials
1	Coco, Chocolate drink	Powder	2.5 (one tea spoon)
2	Cinnamon	Powder	2.5
3	Roasted soya bean (soya drink)	Powder	2.5
4	Coffee	Powder	2.5
5	Green tea	Powder	2.5
6	Baobab	Powder	3
7	Chili	Powder	1
8	Black paper	Powder	1
9	Curry	Powder	2
10	Salt	Powder	2
11	Soy sauce	Liquid	Some
12	Honey	Liquid	2.5
13	Dried mango	Small particles	3 to 5
14	Dried grated coconuts	Small particles	3 to 5
15	Dried pineapples	Small particles	3 to 5
16	Roasted ground nuts	Small particles	3 to 5
17	Roasted cashew nuts	Small particles	3 to 5
18	Roasted sesame seeds		Some
19	Roasted amaranth seeds		Some

# Directions

- Put puffed materials and spices in a same paper bag and shake until the spices are well sprinkled and mixed with the cereals.
- For salty flavors such as black paper and curry powder, little quantity of olive oil or palm oil is misted over the cereals and then applied spices.
- Different spices and favors can be mixed and create own unique tastes.



Puffed rice with green tea powder (left) and coco drink powder (right). Recipe and photos: Makiko Naganuma (2017)

## 4.4: Chocolate cube

## Directions



- Engrave cooking chocolate (250g) and melt with a water bath.
- Stir slowly until it melts.



- Put puffed material and adjust the quantities (about 1L). Less material makes it less cube.
- Mix well that chocolate evenly courted around.



- Put it in a mold. This time, a 3cm square ice tray was used.
- Put it in the refrigerator, cool it. It solidifies in about 20 minutes.

Recipe and photos: Yumi Yamane (2017)

#### 4.5: "kashata" (cereal bar / biscuit)

		Ingredient	Quantity
	1	Puffed materials (mixed in different cereals)	4 L (450-500 g)
4	2	Sugar	160 g
	3	Salt	6 g
4	4	Water	100 mL
	5	Glucose syrup	100 g
(	6	Other ingredients such as rasted grund nuts, cashew nuts, makademia nuts, grated coconut, dired fruits etc. can be mixed to add exstra fravours of preference.	Some

A "kashata" is a traditional Swahili confectionaly snack popular in East African coast region.

#### Directions

Step 1: Mix sugar, salt and water then boil in a saucepan until all the sugar is dissolved (2-3 minutes). Step 2: Add melted glucose syrup in the pan.

- Step 3: Continue star to boil over until the mixture begins to thicken and turns into light brownish in color. It produces a lot of small bubbles where it hardly disappears at this stage.
- Step 4: While preparing the syrup, prepare the "*kashata*" board (Stainless steel board) and wooden flames and pour roasted soya powder (also other seasonings) on it.
- Step 5: Stop heat and pour the mixture (syrup) over puffed cereals all at once and stir with large wooden spoon to mix the cereal with the prepared syrup in speedy manner.
- Step 6: Spreading the materials in the "*kashata*" flame and apply pressures to shape it. Pressing from both sides of the "*kashata*".
- Step 7: Cutting the "kashata" into favorable sizes and pieces.
- Step 8: Remove the flame and ready for packing them.
- Note: other additional ingredients such as nuts and dried fruits can be cut into small particles and added in the *kashata*.

"kashta" can be served with strong black coffee or tea with ginger.



Weigh ingredient (sugar, salt and water) then boil in a saucepan (Step 1).



Preparing the kashata processing board and shaping wooden flame (Step 4).



Pour prepared hot syrup over the puffed cereals all at once and mix well with large wooden spoon (Step 5).



Spreading the materials in the "kashata" flame and apply pressures to shape it (Step 6).



Cutting the kashata into pieces using a wooden guide stick and remove the flame (Step 7).



Different sizes and shape of kashata.



