

Buaisou Indigo Workshops
*An exploration of Japanese methods
of indigo farming, processing and dyeing*

MARCH/APRIL 2018



Photo by Paige Green



FIBERSHED

Local Fiber, Local Dye, Local Labor

Table of Contents

Introduction	3
Indigo Vat Preparation	5
Indigo Vat Progress Notes.....	10
Composting Demonstration.....	12
Farming Discussion	14
Dyeing and Business Discussion	15
Katazome Workshop	17



Photo by Paige Green

Introduction

THE BUAISOU INDIGO WORKSHOPS were generously funded by Arkay Foundation and Susan Clark as part of Fibershed's True Blue project. It is one project of many that support Fibershed's larger mission:

Fibershed develops regional and regenerative fiber systems on behalf of independent working producers, by expanding opportunities to implement carbon farming, forming catalytic foundations to rebuild regional manufacturing, and through connecting end-users to farms and ranches through public education.

In 2017, the True Blue project undertook a study of the technical, environmental, and economic factors involved in indigo dye production from *Persicaria tinctoria* (Japanese indigo), with the aim of supporting increased farm-scale indigo production in the Northern California fibershed and beyond. Two main approaches to dye production—the compost method and the water extraction method—were analyzed and presented in a report titled *The Production of Indigo Dye from Plants* by Nicholas Wenner. The report concluded that the compost method appears to be more technically and economically feasible, though it may have a significantly smaller market due to the complexity of its use as a dye.

To further investigate the production and use of composted indigo, Fibershed contacted Buaisou, an indigo farm and dye studio in Tokushima, Japan. This document is a summary of the hands-on instruction and workshops taught by Buaisou co-founder Kakuo Kaji and company manager Kyoko Nishimoto, with translation assistance by Rimiko Berreman, that took place from March 20th through April 1st, 2018, in Woodacre and Nicasio, California.

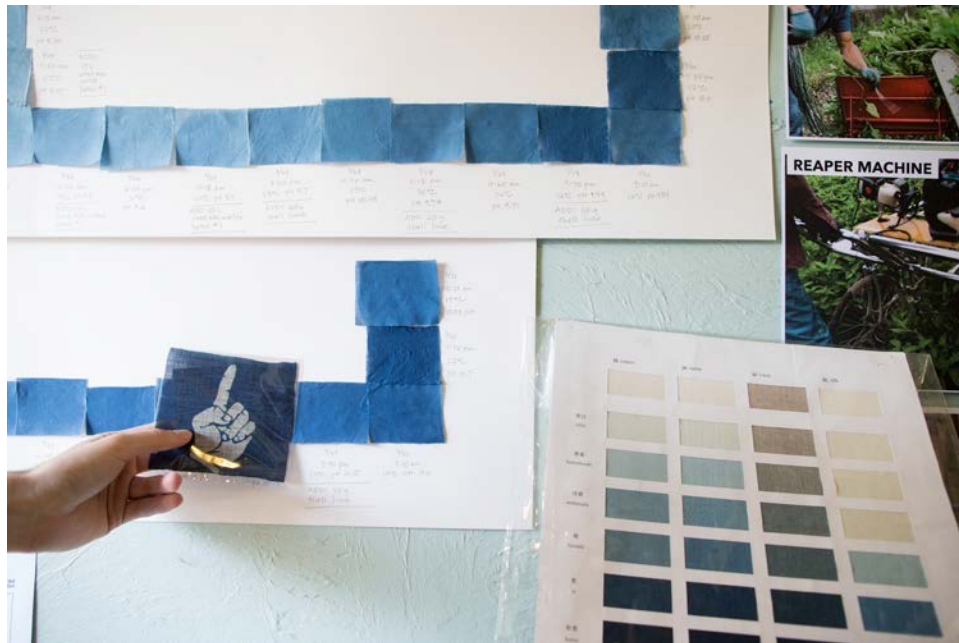


Photo by Paige Green

By practicing both farming and dyeing, Buaisou is reviving two heritage crafts that have traditionally been separate disciplines in Japan.

Indigo production in Tokushima prefecture on the island of Shikoku is believed to have originated in the Muromachi era (1338-1573). Tokushima was the center of Japan's indigo production until the creation of synthetic indigo in the late 1800s. The cultivation area for indigo in Tokushima peaked at around 37,000 acres in 1903, while today there are at most six commercial growers harvesting about 70 acres. Buaisou is one of these growers, and one of their indigo fields is shown below.



As stated in the book *Awa Natural Indigo* by Miyoko Kawahito, in the dyeing process, indigo “only disperses and becomes water soluble through a unique fermentation reduction process for making a dyebath. Fermenting indigo involves the production of redactase by bacilli propagation in a process that continues for a period of time. Slightly different environmental conditions are needed in each stage of the reduction process in order to produce a high quality dyebath.”

The workshops taught by Buaisou touched on all phases of indigo production, from farming and harvesting, to composting the leaves in order to concentrate the indigo, to preparing a fermentation dye vat with composted indigo (plus wood ash lye, powdered lime and rice bran), to dyeing with the resulting dye bath. Notes and photos from those workshops follow.

Indigo Vat Preparation Notes

As Taught by Kakuo Kaji and Kyoko Nishimoto of Buaisou

March 20-30, 2018



March 20: Making wood ash water for two indigo vats

- 15 kilos (33 pounds) of wood ash from Japanese oak (Ubame) is placed in a clean 32-gallon plastic trash can. (We used Rubbermade Brute brand.)
- Heat water to boiling, then pour over the wood ash and stir vigorously to dissolve it.
- Continue adding boiling water until the container is nearly full, stirring with each addition of water.
- Cover and let settle overnight.



March 21: Making wood ash water continues

- Scoop the liquid into a second clean 32-gallon plastic trash can, taking care not to disturb the sediment, and cover. This will be referred to as Batch #1, and is the strongest wood ash water. (Ours tested at pH 12.35.)
- Heat water to boiling and pour over the wet wood ash in the first trash can until the container is nearly full. Stir 10 minutes, cover and let settle. This will be referred to as Batch #2.



March 21: Making the indigo vats

- Rub 20 grams of shell lime on the inside walls and bottom of a clean 32-gallon plastic trash can. This sterilizes the surface. Repeat in a second clean trash can.
- Pour 5 kilos (11 pounds) of sukumo (composted indigo) from Buaisou into one of the sterilized trash cans, and 5 kilos (11 pounds) of sukumo from Fibershed into a second sterilized trash can (referred to as vats going forward)
- Sprinkle 100 grams of shell lime on top of the sukumo in each vat.



PREPARE DILUTED WOOD ASH WATER

- Pour approximately 24 liters (6.3 gallons) of wood ash water from Batch #1 into a clean 32-gallon plastic trash can.

Two additional vats were made for Buaisou's Southern California workshops, and we used a greater quantity of a weaker batch of wood ash water—approximately 40 liters (10.5 gallons) of wood ash water from Batch #2.

Once the wood ash water is diluted, the ideal pH is 11.5.

- Fill the trash can with hot water (at least 45°C or 113°F) and stir.
- Add 1 gallon of the diluted wood ash water to the vats, and mix to get the sukumo dampened.
- Add more diluted wood ash to the two vats until they are approximately half full and stir vigorously

PREPARE WHEAT BRAN

- Place 200 grams of wheat bran, plus 1 liter (1.05 quarts) of wood ash water from Batch #1, in a stainless steel pan (for each vat).
- Place over low heat and stir with a wooden spoon, cooking until the wheat bran turns a dark golden color (approximately 5 minutes).
- Add the 200 grams of cooked wheat bran to each vat, using a spoon to drop it randomly on the surface. Do not stir.
- Buaisou vat: 44°C and pH 11.05
Fibershed vat: 35°C and pH 10.6
- The ideal temp is 45°C when the vats are first made; then 30-35°C until the color develops; then 24-25°C after the color develops
- Place lids on the vats, wrap with electric seed mats due to low air temperature and cover with an electric blanket.





March 22: Testing and stirring the vats

- Starting today, the vats will be tested and stirred twice daily at roughly 10:00 am and 6:00 pm.
- Check the temperature (and rinse thermometer before putting it in another vat). Ideal temperature before the color appears is 30-35°C, and once the color appears it is 24-25°C.
- Check pH if an electronic gauge is available (and rinse pH gauge before putting it in another vat). Ideal pH is 10.5 to 11.5.
- Test the color by dipping a small piece of previously scoured light cotton fabric below the surface of the liquid and massaging it for 35 seconds. (Rinse hands before putting them into another vat to avoid any contamination due to different bacteria.)
- Stir vigorously, in a rowing motion and then in a circular motion, to bring the sukumo up from the bottom of the vat. (Use one stirring stick for the Buaisou vats, and one for the Fibershed vat to avoid any contamination due to different bacteria.)
- See “Indigo Vat Progress Notes” on pages 10 and 11 for charts of daily testing and progress for the vats, including adding more wood ash water and lime to increase alkalinity, until the vat is full.
- Vats are generally ready to use after 10 days, and at that point only need to be stirred once per day.
- After dyeing, we added 300 to 500 cc of wood ash water and stirred.
- After 1 month (if the color drops), add 100 grams cooked wheat bran (dampened with a little wood ash liquid) and 100 grams shell lime and stir well.



Photos by Paige Green



Indigo Vat Progress Notes

Vat Made with Buaisou Sukumo

3/20/2018			Wood ash water prepared (see page 5 for details)
3/21/2018			Vat assembled (see page 6 for details)
	5:00 PM	44°C, pH 11.05	Wrapped with seed mat & old electric blanket
3/22/2018	10:12 AM	33°C, pH 11.19	Wrapped with seed mat & old electric blanket
	6:20 PM	31°C, pH 10.55	Wrapped with seed mat & new electric blanket
3/23/2018	10:45 AM	35.5°C, pH 9.6	Color appears, seed mat removed, electric blanket remains
	6:20 PM	28°C, pH 9.57	After testing color add 60 grams shell lime and stir well
3/24/2018	10:00 AM	28°C, pH 9.9	Add 10 L wood ash water of pH 12.08 from Batch #2
	6:15 PM	22°C, pH 10.08	
3/25/2018	9:50 AM	24°C, pH 9.92	Add 10 L wood ash water of pH 12.49 from Batch #2
	5:45 PM	21°C, pH 10.2	
3/26/2018	10:30 AM	20°C, pH 10.19	Add 10 L wood ash water ½ Batch #1 + ½ Batch #2
	6:20 PM	22°C, pH 10.3	
3/27/2018	10:15 AM	21°C, pH 10.3	Add 10 L wood ash water ½ Batch #1 + ½ Batch #2
	6:20 PM	26°C, pH 10.3	After testing color add 60 grams shell lime and stir well
3/28/2018	10:30 AM	26°C, pH 10.54	
	6:15 PM	23°C, pH 10.74	
3/29/2018	10:20 AM	27°C, pH 10.53	
	9:30 PM	23°C, pH 10.5	After testing color add 30 grams shell lime and stir well
3/30/2018	9:10 AM	24°C, pH 10.6	Add 10 L wood ash water ½ Batch #1 + ½ Batch #2
	9:35 PM	22°C, pH 10.7	
3/31/2018	9:45 AM	19°C, pH 10.83	Workshop: small pieces of hemp fabric dyed by workshop participants
	5:45 PM		After workshop add 500 cc (½ liter) wood ash water and stir
4/1/2018			Workshop: small pieces of hemp fabric dyed by workshop participants. Then yarn and fabric dyeing demonstrated by Kakuo.
	5:00 PM		After workshop add 300 cc wood ash water and stir
For a six week period after the workshops, the vats were only used minimally for fabric samples. Since then, the following items have been dyed, and the vats are still producing good color.			
6/19/2018	11:00 AM	20°C	Dip test shows that color has dropped quite a bit since April. Various fabric samples dyed
6/21/2018	5:00 PM	25°C	Added 100 grams shell lime and 100 grams cooked wheat bran, then stirred well
6/24/2018	2:30 PM	27°C	Color much improved. Jacket made of Huston Textile cotton canvas dipped once
6/26/2018	4:40 PM	23°C	Jacket made of Huston Textile cotton canvas dipped once
7/1/2018	4:00 PM	23°C	Jacket made of Huston Textile cotton canvas dipped once

Indigo Vat Progress Notes

Vat Made with Fibershed Sukumo

3/20/2018			Wood ash water prepared (see page 5 for details)
3/21/2018			Vat assembled (see page 6 for details)
	5:00 PM	35°C, pH 10.6	Wrapped with seed mat & old electric blanket
3/22/2018	10:12 AM	31°C, pH 10.20	Wrapped with seed mat & old electric blanket
	6:20 PM	30°C, pH 9.42	Wrapped with seed mat & new electric blanket
3/23/2018	10:45 AM	36°C, pH 8.6	Color appears, seed mat removed, electric blanket remains
	6:20 PM	28°C, pH 8.75	After testing color add 60 grams shell lime and stir well
3/24/2018	10:00 AM	25°C, pH 9.09	Add 10 L wood ash water of pH 12.08 from Batch #2
	6:15 PM	22°C, pH 9.35	
3/25/2018	9:50 AM	22°C, pH 9.27	Add 10 L wood ash water of pH 12.49 from Batch #2
	5:45 PM	21°C, pH 9.53	
3/26/2018	10:30 AM	19°C, pH 9.5	Add 10 L wood ash water of pH 12.49 from Batch #1
	6:20 PM	21°C, pH 9.6	
3/27/2018	10:15 AM	20°C, pH 9.7	Add 10 L wood ash water of pH 12.49 from Batch #1
	6:20 PM	25°C, pH 9.7	After testing color add 60 grams shell lime and stir well
3/28/2018	10:30 AM	29°C, pH 10.08	
	6:15 PM	30°C, pH 9.74	After testing color add 60 grams shell lime and stir well
3/29/2018	10:20 AM	36°C, pH 9.71	
	9:30 PM	26°C, pH 9.99	After testing color add 60 grams shell lime and stir well
3/30/2018	9:10 AM	26°C, pH 9.89	Add 10-15 L wood ash water ½ Batch #1 + ½ Batch #2
	9:35 PM	22°C, pH 10.0	
3/31/2018	9:45 AM	20°C, pH 10.25	Workshop: small pieces of hemp fabric dyed by workshop participants
	5:45 PM		After workshop add 500 cc (½ liter) wood ash water and stir
4/1/2018			Workshop: small pieces of hemp fabric dyed by workshop participants. Then yarn and fabric dyeing demonstrated by Kakuo.
	5:00 PM		After workshop add 300 cc wood ash water and stir
For a six week period after the workshops, the vats were only used minimally for fabric samples. Since then, the following items have been dyed, and the vats are still producing good color.			
6/19/2018	11:00 AM	20°C	Dip test shows that color has dropped quite a bit since April. Two yards of wool Community Supported Cloth dipped once
6/21/2018	5:00 PM	25°C	Added 100 grams shell lime and 100 grams cooked wheat bran, then stirred well
6/24/2018	2:30 PM	27°C	Color much improved. Community Supported Cloth shirt, previously dyed with oak galls and iron, dipped once
6/26/2018	4:40 PM	23°C	Jacket made of Huston Textile cotton canvas dipped once
7/1/2018	4:00 PM	24°C	Community Supported Cloth shirt, previously dyed with oak galls and iron, dipped once

Composting Demonstration Notes

Taught by Kakuo Kaji of Buaisou • March 30, 2018



Photo at right by @buaisou_i

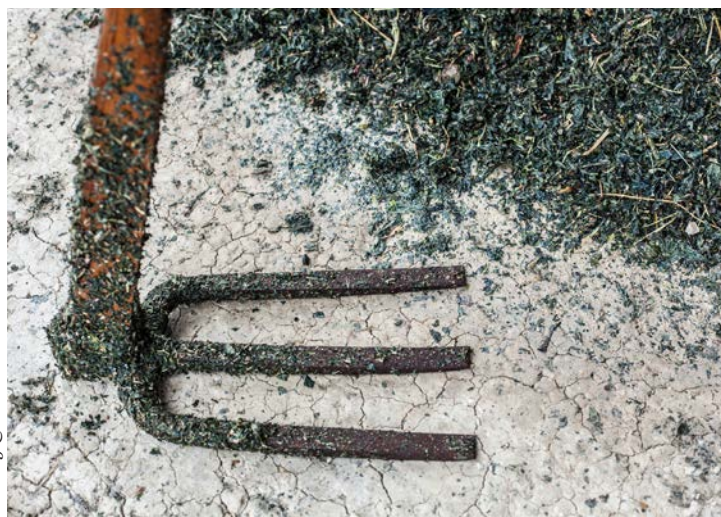


Photo by @buaisou_i

- Generally best to use small leaf size and some powdered leaf.
- Start the compost pile with the largest leaves (we used 435 pounds), holding back about 10 percent (40 pounds).
- Spread a portion of leaves on the floor, dampen by spraying with water, but not so damp that there are drips when a handful of leaves is squeezed.
- Continue to add leaves to the pile and spray to dampen, then mix.
- Shape the pile like a pyramid with a flat top and leave uncovered for the first week.
- The formation of white mold is a good sign.
- One week after starting the pile: Move the pile onto a tarp, add half of remaining leaves, mix, then move the leaves back onto the floor while spraying water to dampen. Cover the sides of the pile with straw mats.
- In another week add the remaining leaves. Cover both sides and top of the pile with straw mats.
- Maintaining humidity is important.
- Compost is turned once per week during a period of about 120 days.
- Test for doneness: Rub some sukumo on paper—brown/black is the desired color. Green/blue color means the composting is not done. There is a specific tradition and process for doing this, and it was used in Japan to assess quality of competing sukumos.
- Smell changes from ammonia to “sweet” when done.



Farming Discussion

with Kakuo Kaji of Buaisou • March 31, 2018

Germination

- March 1 — start the seeds of *Persicaria tinctoria*.
- 5 or 6 seeds are placed in each cell when germinating.
- Round pots work better for Buaisou's planting machine.

Planting

- Amend the soil with pig manure before planting.
- 30,000 plants (or groups of plants) per hectare. Depending on how many seeds germinate, there's an average of 3 plants in one hole.
- Rows are 75 cm (30 inches) from center to center.
- Plants are 10 inches apart
- Buaisou does 4 different plantings, approx. 3 weeks apart, beginning April 1. The final planting is at the end of June. This staggers the harvest to make it manageable.
- Buaisou grows 1 hectare (2.47 acres) total in 4 separate rented fields.



Growing

- As plants grow, dirt is mounded up over the stems to help the plants grow more upright.
- After the first harvest, pig urine is used to fertilize the plants.

Buaisou also uses a chemical fertilizer that contains nitrogen, phosphorus and potassium, which is not recommended by Fibershed, as it will eventually strip the soil of nutrients, destroy critical microbes, and migrate into groundwater.

Harvesting

- Weed carefully before harvesting.
- Cut plants to about 4 inches from the ground.
- 7 or 8 plants are bundled and are stood upright overnight.

- Plants are chopped mechanically and then blown with large fans to separate leaves from stems (as shown in photo above).
- Leaves are spread in the greenhouse to dry, and turned with a rake several times a day for even drying.
- If plants begin to flower, harvest right away.
- If flowering is early, harvest and allow to regrow.

Seeds

- After the first harvest, one area of the field is designated for seeds and the leaves on those plants are not harvested again.

Dyeing & Business Discussion

with Kakuo Kaji of Buaisou • April 1, 2018

Buaisou's sources of income (in order of highest to lowest)

DYE SERVICES

- Customers in Japan and abroad send their products to be dyed (shoes, shirts, pottery, custom work for Blue Bottle coffee, etc.)
- Buaisou dips the fiber 3 or 4 times for a fee of 35 yen per gram (approx. \$9.35 per ounce). This price also includes pre-treatment and post-treatment of the fiber.
- If a customer requires a dark color, they charge 40 yen per gram (approx. \$10.49 per ounce).
- Pricing varies with other dyers in the region—one charges 120 yen per gram (\$31.75 per ounce); another only charges 25 yen per gram (\$6.52 per ounce).

PRODUCT SALES

- Jeans, tote bags, t-shirts, coasters, shoe laces, etc.
- Sukumo: Buaisou will only sell it to customers who have the experience to make a vat successfully, so there is a limited market. (Cost is roughly \$380 for 5 kilos [11 lbs.], which is the amount used for a 30-gallon vat.)

WORKSHOPS

- Buaisou charges \$250 for a 2-hour workshop for up to 15 people in their Tokushima studio.

Customer profile

- Customers tend to be urban.
- Buaisou's largest market is currently Hong Kong.

Vats

- Buaisou has three 900-liter stainless steel vats.
- Vats have heating coils on the outside to keep the temperature at 24°C during the winter. They don't need the heating in the summer.
- Dimension of vats is roughly 3'x6" and 5' deep.
- Buaisou use 50 kilos of sukumo in each vat.

Using other methods of reducing the vat:

- There is no known tradition in Japan of using sugars to reduce an indigo vat. Someone might be doing that, but dye houses tend to be secretive about their methods, so it's difficult to say.
- Using chemicals or sugars to 'dope' the indigo impacts the color fastness and makes the color weaker

Dyeing

- Buaisou dyes a total of 6 kilos (13.25 pounds) of fiber per day in each 900-liter vat. This translates to a total of 1.65 pounds per day in a 30-gallon (113 liter) vat.
- Buaisou dyes for two days, then lets the vat rest for 1 day.
- When the vat is stirred, they wait 2 hours minimum before dyeing.



- The vat is finished when the liquid is muddy with no sheen on the surface and the smell is not good.

Rope dyeing

- Not something that Buaisou offers.
- Challenging because of the number of vats (generally 3 vats) that have to be maintained with consistent color.
- The amount of time the vats need to rest does not fit with the needs of rope dyeing at an industrial scale, because one vat could get off balance, and that might impact the whole rope dyeing line.
- They feel that there are hurdles to overcome with rope dyeing and biologically-reduced sukumo, making it difficult, though not necessarily impossible.



Photo by Paige Green

Preparing Fabric for Dyeing

- Fabric is scoured by simmering in diluted wood ash water for half an hour.

Treatment after dyeing (for fabric or yarn)

- Rinse the fiber 3 times in cold water (3 different buckets).
- Fill a 5-gallon bucket with cold water, add 3 Tbsp. of vinegar, and soak for 15 minutes.
- Rinse in clean, cold water.
- Soak in cold water overnight.
- Rinse in cold water the next day.
- Squeeze, then soak in 70°C water for 30 minutes. 50°C for wool or silk.
- Rinse in cold water 2 times.
- Spin out the water.
- Hang to dry.
- Soak in 70°C water for 30 minutes. 50°C for wool or silk.
- Rinse in cold water 2 times.

SOY WATER SOAK

- To make soy water, mix 35 grams of soy bean powder (not the roasted variety) in 10 liters of water.
- Allow the soy bean powder to settle, pour off the liquid into another container and mix with 40-50 liters of water.
- Soak fabric or yarn for 20 minutes.
- The protein in this soy treatment helps further bond the indigo to the fibers.
- Spin out the water.
- Hang to dry.

Katazome Workshops

Instructed by Kakuo Kaji of Buaisou • March 30 & April 1, 2018



Photos by Paige Green

Katazome, or stencil dyeing, is a Japanese paste-resist surface design technique for cloth and paper. While the process is centuries old, the art was revived in the 20th century by Serizawa Keisuke, an artist of the mingei, or “people’s crafts” movement of 1920s and 1930s Japan.



Photos by Paige Green