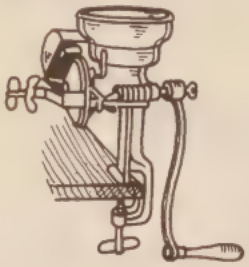
Fig. 29. Miso fermentation crocks

Ingredients

Each of the basic ingredients for homemade miso is now available at reasonable prices in the United States. For a list of sources, see page 258.

Soybeans: Any variety of whole dry soybeans available at natural or health food stores, co-ops, and some supermarkets. Order in bulk for substantial savings. Soy grits (see Variation 4) may be either the coarse or fine varieties now available at better natural food stores. The larger sized and slightly more expensive "vegetable" type soybeans, bred from Japanese stock, are preferred by some to the smaller and more widely available U.S. "field" soybeans.



Corona hand-mill

Ready-made Dried Koji *(Urikoji)*: This koji is prepared by drying fresh koji on large screens in an oven at 104°F. Both ready-made rice and barley koji are now available in the West at most natural food stores and at Japanese food markets (especially at New Years). The main U.S. producer is Miyako Oriental Foods in Los Angeles. In 1983 a 20-ounce tub of their white rice koji retailed for $3.46, or the equivalent of $2.77 a pound. Names of other makers, importers, and distributors are given on page 258. There are two basic types of ready-made dried koji:

Firm Granular Koji is composed of whole separate kernals of rice or barley with very little downy white mycelium visible on the surface of each grain. The beige or milky-white kernels look something like slightly puffed rice. One variety used primarily for making miso and one for salt-pickled vegetables *(tsukemono)*. Miyako makes the miso type.

Soft Mat Koji is sold in sheets about 8 to 10 inches square and ¾ inch thick. It is composed of fluffy grains of steamed rice bound together by a felt-like white mycelium resembling the nap on a brand new tennis ball. This koji is used primarily to prepare homemade *Amazaké* (p. 162) but also works well in the preparation of both miso and salt-pickled vegetables.

Firm granular koji is the traditional form used to make miso and is still considered the best since it has more "strength" (ability to break down proteins and carbohydrates) than the soft mat variety. High-quality granular koji will have a very small percentage of "transparent" grains (those which the mycelium has not penetrated) among the milky-white majority. Individual grains, when broken in half, should show the white mycelium penetrating to the very center and not have a transparent core.

Since dried koji does not, in general, have quite as much "strength" as fresh koji, miso prepared with it takes slightly longer to come to maturity. This explains the difference in aging times between the following homemade varieties and their commercial counterparts as described in Chapter 4.

All koji should be kept well sealed in a cool dry place. For long-term storage, small quantities should be refrigerated (but not frozen). Koji with an olive-green or yellowish tint has probably stood too long in a warm place causing sporulation; it is best used whole or ground as koji starter (p. 178).

Ready-made Fresh Koji: Excellent quality fresh rice koji, produced by Miyako Oriental Foods in Los Angeles, is now widely available in the U.S. In Japan, fresh koji may be purchased directly from a koji or miso shop the day before the soybeans are cooked; it is immediately crumbled and mixed with all of the salt in the miso recipe, placed in a covered container, and stored in a cool, dry place. A given volume of fresh koji weighs about 14 percent more than dried granular koji. In the following recipes, when substituting fresh koji for dried, use only 60 percent of the required mixing liquid.

Salt: Any salt may be used, but to make miso with the best flavor and nutritional value, use sun-dried, unrefined natural sea salt, now available at some natural and health food stores and very rich in minerals (more than 63 varieties). You can prepare your own natural salt by simmering clean sea water in a large kettle until almost all of the moisture has evaporated, placing the moist salt in a cloth-lined colander or strainer, and allowing it to drain for several days; measure homemade salt by volume rather than weight when using it to make miso. (Save the liquid nigari that drips from the salt to use in preparing tofu.)

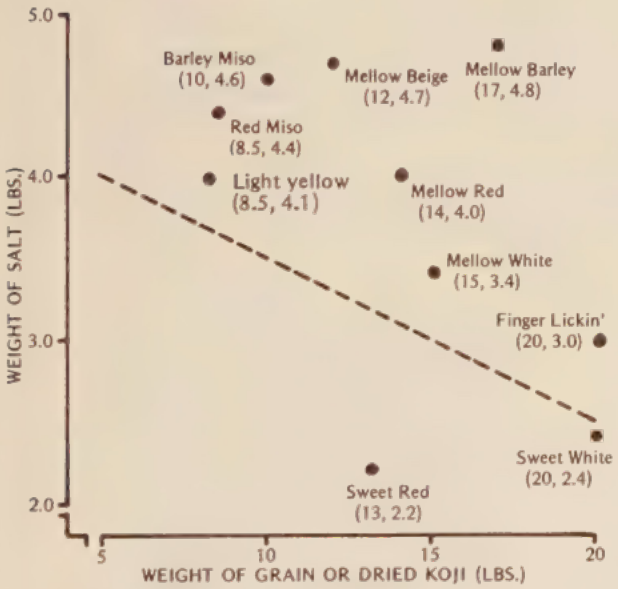
The salt in miso mellows as the fermentation proceeds; thus miso which tastes quite salty after six months may taste just right one year later. To compensate for this phenomenon, some recipes increase the proportion of salt together with the expected fermentation time. Whereas a 1-year red miso might, for example, require 2½ pounds of salt, the same product fermented for 2½ years would require 4 pounds.

People wishing to prepare low-salt misos should make either sweet red or sweet white varieties; do not simply try to reduce the salt in other types or they may spoil. As a general rule, the minimum amount of salt used with a given weight of grain or dried koji should *not fall below* the broken line in figure 30. The equation for this minimum amount is:

$$S = \frac{45 - G}{10}$$

where S is the weight in pounds of salt and G is the weight in pounds of grain or dried koji used with 10 pounds of dry soybeans. Thus a recipe calling for 10 pounds each soybeans and dried rice koji should not contain less than 3.5 pounds salt.

Fig. 30. Basic Proportions of Salt and Grain (or Dried Koji) used with 10 Pounds of Dry Soybeans for Different Miso Varieties



Water: Any water may be used for cooking the soybeans or as mixing liquid (below), but fresh pure water—from a deep well, spring, or distilled—has traditionally been considered to give the best flavor and most trouble-free fermentation. Water containing an abundance of chlorine or other chemicals may somewhat retard the activity of miso's microorganisms, while impure water may introduce contaminating microorganisms.

Seed Miso: Use any good-quality mature miso, either from a previous batch of your own making or commercial miso which has not been pasteurized and contains no preservatives. The use of a small amount of seed miso as an inoculum adds large numbers of yeasts and bacteria to the unfermented ingredients thereby enhancing the aroma and flavor of the finished product and reducing the fermentation time by up to 50 percent. It is best to use seed miso of the same variety as the miso you wish to prepare, but any miso will work.

Mixing Liquid: Either boiled water or the cooking liquid remaining after boiling the soybeans is mixed with the other ingredients to give the miso its proper moisture content. In Japan, this is called "seed water" (*tané mizu*). Fresh water, unless taken from a very pure deep well, is always boiled to assure that no contaminating microorganisms are present. From November until early April, soybean cooking liquid gives excellent results and helps make full use of the soybean nutrients. However, if the miso is prepared during the warm half of the year, water should be used since the soybean cooking liquid may encourage spoilage; in this case, cook the soybeans so that very little liquid remains at the end. If you want to try to use cooking liquid during the warmer part of the year, mix the liquid with 3 tablespoons salt as soon as it has drained from the beans, and reduce the salt added with the other ingredients accordingly.

The proper amount of liquid to be added to any given mixture of ingredients is difficult to specify exactly since it depends upon the moisture level of the koji and the moisture losses through the vat (which are determined by the vat's size and construction). If too much liquid is added, the miso can easily over-ferment and develop a strong alcoholic aroma. The miso's moisture content can be adjusted during fermentation by simply increasing or decreasing the pressing weight.

Alternate Carbohydrate Sources: For rice or barley koji, you may substitute up to 50 percent cornmeal or corn, sweet potatoes, Irish potatoes, or *kabocha;* these foods should be well steamed or boiled (see Variation 5). Wheat koji may be substituted in equal parts. See also page 44.

Alternate Protein Sources: For soybeans, you may substitute up to 100 percent broad, black, *azuki,* lima, or garbanzo beans, or others listed on page 44. Indian pulses (Bengal gram, Thur dhal, green gram, and Field beans) also work well. If 10 to 20 percent soybeans (and peanuts) are used together with these ingredients, the amino acid balance and total usable protein will be considerably enhanced (see p. 21).

Fig. 31. Proportions by Weight of Basic Ingredients for Various Homemade Misos

Type of Miso	Batch Size	Dry Soybeans	Dried Koji			Salt		Mixing Liquid		Seed Miso (Optional)	
				Soft Mat	Firm[1] Granular						
Red Miso	*BASIC RATIO* (WT)	10	8.5			4.4		11.1		0.4	
	Small Batch	13 oz 2c	11.1 oz	3.4c	2.4c	5.7 oz	8.9T	14.4 oz	1.7c	0.5oz	1T
	Medium	3 lb 4 oz 8c	2 lb 12 oz	13.4c	9.7c	22.9 oz	2.2c	3 lb 9 oz	6.9c	2.1oz	4T
	Large	13 lb 32c	11 lb 1 oz	53.5c	39.0c	5 lb 12 oz	9.0c	14 lb 7 oz	27.7c	8.3oz	1c
Barley Miso	*BASIC RATIO* (WT)	10	10			4.6		13.0		0.4	
	Small Batch	13 oz 2c	13 oz	3.9c	2.9c	6.0 oz	9.3T	16.9 oz	2.0c	0.5oz	1T
	Medium	3 lb 4 oz 8c	3 lb 4 oz	15.7c	11.4c	23.9 oz	2.3c	4 lb 4 oz	8.1c	2.1oz	4T
	Large	13 lb 32c	13 lb	62.7c	45.7c	6 lb 0 oz	9.4c	16 lb 14 oz	32.5c	8.3oz	1c
Light-yellow Miso	*BASIC RATIO* (WT)	10	8.5			4.1		11.1		0.4	
	Small Batch	13 oz 2c	11.1 oz	3.4c	2.4c	5.3 oz	8.3T	14.4 oz	1.7c	0.5oz	1T
	Medium	3 lb 4 oz 8c	2 lb 12 oz	13.4c	9.7c	21.3 oz	2.1c	3 lb 9 oz	6.9c	2.1oz	4T
	Large	13 lb 32c	11 lb 1 oz	53.5c	39.0c	5 lb 3 oz	8.4c	14 lb 7 oz	27.7c	8.3oz	1c
Sweet Red Miso	*BASIC RATIO* (WT)	10	13			2.2		12.3		0	
	Small Batch	13 oz 2c	16.9 oz	5.1c	3.7c	2.9 oz	4.5T	16.0 oz	1.9c	—	
	Medium	3 lb 4 oz 8c	4 lb 3 oz	20.4c	14.4c	11.4 oz	1.1c	4 lb 0 oz	7.7c	—	
	Large	13 lb 32c	16 lb 12 oz	81.5c	59.4c	2 lb 14 oz	4.5c	16 lb 0 oz	30.8c	—	
Sweet White Miso	*BASIC RATIO* (WT)	10	20			2.4		19.2		0.4	
	Small Batch	13 oz 2c	1 lb 12 oz	8.4c	6.2c	3.1 oz	4.9T	25.0 oz	3.0c	0.5oz	1T
	Medium	3 lb 4 oz 8c	7 lb	33.7c	24.6c	12.5 oz	1.2c	6 lb 4 oz	12.0c	2.1oz	4T
	Large	13 lb 32c	28 lb	134.9c	98.5c	3 lb 2 oz	4.9c	24 lb 15 oz	48.0c	8.3oz	1C
Mellow Barley Miso	*BASIC RATIO* (WT)	10	17			4.8		16.3		0.4	
	Small Batch	13 oz 2c	1 lb 6 oz	6.6c	4.8c	6.2 oz	9.7T	21.2 oz	2.6c	0.5oz	1T
	Medium	3 lb 4 oz 8c	5 lb 8 oz	26.5c	19.3c	25.0 oz	2.4c	5 lb 5 oz	10.2c	2.1oz	4T
	Large	13 lb 32c	22 lb 2 oz	106.0c	77.3c	6 lb 4 oz	9.8c	21 lb 3 oz	40.9c	8.3oz	1c
Soybean Miso	*BASIC RATIO* (WT)	10				2.0		3.4		0.4	
	Medium Batch	3 lb 4 oz 8c	—			10.4 oz	1.0c	16.6 oz	2c	2.1oz	4T
	Large	13 lb 32c	—			2 lb 10 oz	4.1c	4 lb 2 oz	8c	9.4oz	1c

Notes:
1) The ready-made firm granular dried koji produced in the U.S. by Miyako Oriental Foods weights 175 grams (6.17 ounces) per cup, or 36 percent more per cup than the figures given in this table. Since the basic proportions of the table are based on weight, use either the same weight as shown in the table or 66 percent the required volume. Example: to make a small batch of red miso using Miyako firm granular dried koji, use either 11.1 ounces or 1.58 cups of this koji.
2) If using fresh koji, use 1.14 times as much by weight as the dried koji.
3) If using fresh koji, use only 40 to 60 percent as much mixing liquid; for firm granular koji, only 80 to 90 percent as much.

Homemade Red Miso (*Sendai Miso*)

MAKES 6 CUPS OR 3.6 POUNDS

Basic proportions by weight: soybeans 10, dried rice koji 8.5, salt, 4.4, mixing liquid 11.1 (reduced to 6.7 if using fresh koji), seed miso 0.4.

2 cups (13 ounces) whole dry soybeans
3¼ cups water
9 tablespoons (5.7 ounces) natural salt
1 tablespoon seed miso (optional)
1¾ cups mixing liquid
11.1 ounces (315 grams) ready-made dried rice koji (about 3.4 cups well-crumbled soft mat koji or 2.4 cups homemade or firm granular koji)

PREPARE IN ADVANCE

Carefully remove any split soybeans (their loose hulls easily clog pressure cooker), then wash beans thoroughly in pressure cooker. Add 3¼ cups water, cover pot, and soak for 3 hours, or until beans have swelled to fill hulls tightly. Skim off any hulls floating in water.

To cook beans without pressure, see Variation 1.

If using a wooden vat, fill it with water and allow it to stand overnight to seal leaks.

1) Bring cooker to full pressure over medium-high heat. When steam first begins to jiggle vent cap, turn heat *immediately* to very low (to prevent foaming over); cook for 25 minutes at 15 pounds (30 minutes at 10 pounds, or 75 minutes at 5 pounds). Remove from heat and allow to stand for 10 to 15 minutes as pressure returns to normal. Open cooker and test for doneness; each bean should be soft enough to be easily crushed between your thumb and ring finger. Re-cover cooker.

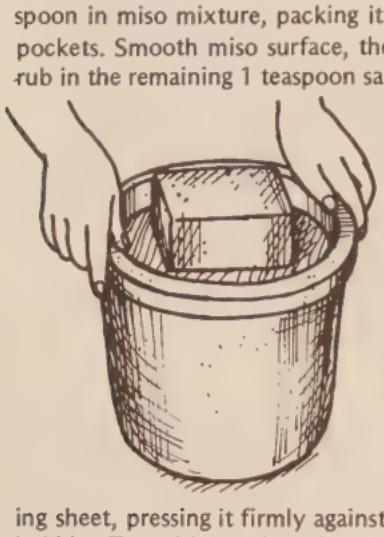
2) See that all utensils are well washed, preferably doused with boiling water. Place colander over (or into) mixing pot, pour in cooked beans, and allow to drain for 3 to 5

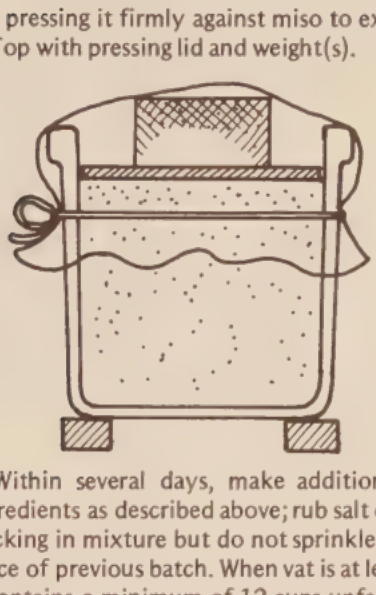
minutes before returning beans to cooker. Using pestle or potato masher, mash beans until only about one-third remain whole. Or run two-thirds of the beans through a grain mill or meat grinder. (For smooth miso, mash or grind all beans.) Allow beans' temperature to cool to 110°F.

3) Remove cooking liquid from mixing pot and measure out 1¾ cups, reserving any excess for use in other cooking; if insufficient liquid remains, add the necessary amount of boiled water. Combine in the mixing pot all but 1½ teaspoons of the salt and, if used, the seed miso. Add ¼ cup liquid, mixing with a wooden spoon until smooth, then stir in the remaining 1½ cups liquid. Wash hands. Using fingertips,

crumble koji into mixing pot, then stir into liquid mixture. Now add soybeans and mix all ingredients thoroughly, using first the wooden spoon, then your hands to squeeze the ingredients together. After mixing, ingredients should have about the same consistency as mature miso.

4) Wash, rinse, and dry vat. Sprinkle ¼ teaspoon salt onto your moistened fingertips and rub salt over walls of vat. Sprinkle additional ¼ teaspoon salt over bottom of vat, then spoon in miso mixture, packing it down firmly to expel air pockets. Smooth miso surface, then sprinkle on and gently rub in the remaining 1 teaspoon salt. Cover surface with sealing sheet, pressing it firmly against miso to expel surface air bubbles. Top with pressing lid and weight(s).





5) Within several days, make additional batches of mixed ingredients as described above; rub salt over vat's walls before packing in mixture but do not sprinkle additional salt over surface of previous batch. When vat is at least 80 percent full and contains a minimum of 12 cups unfermented miso, sprinkle surface with salt and top with sealing sheet, lid, and weight(s).

6) Cover container with a double layer of wrapping paper and tie in place with string. On index card, write type of miso prepared, exact ingredients used, the date, and date at which miso is expected to be ready. Make a note of this latter date on your yearly calendar and tape index card to paper-wrapped vat.

7) For natural fermentation, choose an unheated environment such as a garage, store-room, workshop, or barn for faster (temperature-controlled) fermentation, see Variation 2. Choose a location that receives no direct sunlight and has adequate air circulation. Clean area well and set vat off floor on several blocks. Allow miso to ferment for at least 6 months including 1 full summer. The finest flavor will be attained after 12 months (or 18 to 24 months if seed miso is not used). Do not stir miso during fermentation.

8) As fermentation proceeds, you may wish to check the miso once every few months. However, do not open the vat more than is necessary since contact with the air encourages the growth of surface mold and contaminating organisms, and causes a slight darkening of the color and loss of aroma. If, after one month, no liquid tamari has risen to the miso's surface, increase the pressing weight. If tamari rises to a depth of more than ½ inch during the warm months, reduce the weight. To taste the miso, remove lid and sealing sheet and tilt vat so that tamari runs to one side. Using a clean spoon, open a small hole 3 to 4 inches deep at center of miso surface and retrieve a sample. Compare aroma, flavor, color, and texture with your favorite commercial miso and record your impressions on index card. If flavor is too salty or color too light, increase fermentation time. If texture is too soft, increase pressing weight and remove tamari for use in cookery (pp. 50 or 77). Overly alcoholic, acidic, or sour flavors cannot be remedied and may require that the miso be discarded. After each tasting, record date for next tasting on yearly calendar.

9) When miso is mature, remove all covering; carefully scrape off and discard any surface mold. (Although this mold is not harmful, it causes a slight decline in the miso aroma and flavor). Mix miso in container thoroughly from top to bottom to evenly distribute tamari and saltier surface layer. (Removal of tamari for use in cookery will cause a slight decline in the miso flavor.) Spoon a 1-month supply of miso into a small crock or jar and place in a refrigerator or other cool place for daily use. Smooth surface of miso remaining in container, re-cover, and weight as before. All non-sweet miso may be stored in its vat for 1 to 3 years; sweet miso should be stored in a very cool place and used within 1 to 2 months.

VARIATIONS

1) **Cooking Soybeans Without Pressure:** Wash beans thoroughly in cooking pot and drain well. Add 8 cups water, cover, and allow to stand for 12 to 14 hours at room temperature. (At temperatures below 50°F, increase soaking time to 18 hours.) Bring covered beans to a boil over high heat. Reduce heat to very low, set lid ajar, and simmer for about 2 hours, skimming off any foam and hulls that surface. Add 3 cups (hot) water and simmer for 2½ to 3 hours more, or until beans are soft (see Step 1). If necessary, add water from time to time so that about 2 cups cooking liquid remain when beans are done. Drain and proceed from Step 2.

2) **Temperature-controlled Fermentation:** Place the vat of mixed, unfermented ingredients in a warm dark place such as a water heater- or furnace room, above a stove, or in an insulated attic. During the first 2 months, choose a location

where the temperature is 70°F to 75°F. Then transfer for 2 months to a temperature of about 85°F. Finally, return to the original temperature for 2 months more. Allow the miso to stand in an unheated environment for 1 week before opening (fig. 49, p. 236). (For an even faster fermentation, place at 85°F for 1 week, 90°F for 2 to 3 months, 85°F for 1 week more, then ripen for 1 week in an unheated place.) Flavor will be improved if the miso is stirred thoroughly once or twice during this period. Fermentation time can also be decreased by packing mixed ingredients into vat while they are still hot (90°F to 100°F) and wrapping vat with several layers of thick towelling.

3) **Using Fresh Koji:** Substitute for the 11.1 ounces ready-made dried koji, 12.7 ounces fresh koji. Purchase or prepare this koji before starting to cook the soybeans, as explained on page 177. Use only 1 cup mixing liquid.

4) **Using Soy Grits:** The use of grits reduces the soaking, cooking, and fermentation times, and yields a lighter colored miso. Substitute as equal weight of grits for the soybeans in the basic recipe. a) To Pressure Cook: Soak as for whole soybeans, then pressure cook for 12 minutes. Continue as for the basic recipe. b) To Boil: Combine grits and 5 cups water in a large pot, cover, and soak for 2½ hours. Bring to a boil over low heat and simmer for 1 hour with lid slightly ajar.

5) **Using Alternate Protein and Carbohydrate Sources:** Lists of these are given to pages 44 and 171. All or part of the soybeans may be replaced by other beans. Soak, cook, and add these to the miso as for soybeans. If using alternate carbohydrate sources, add no more than 5½ ounces cooked weight and reduce the weight of koji by one half the weight of the carbohydrates added; mash well before mixing with koji. For example, to prepare a small batch of Sweet Potato Miso: Combine 5½ ounces each dried koji and mashed cooked sweet potatoes. Mix in the salt, cooked (mashed) soybeans, seed miso, and 1 cup mixing liquid (two-thirds the basic abount). Ferment as for red miso.

6) **Alternate Basic Ratios:** There are many different varieties of red miso, each determined by its ratio of basic ingredient weights. The ratio used by the Sendai Miso-shoyu Co., which makes most of the 1-year natural red miso sold in the West, is soybeans 10, koji 5.8, salt 4.5. Mr. Junsei Yamazaki (p. 241) uses 10:10:2.5 for 1-year red miso, increasing the salt to 3.5 for 2 year miso. Mr. Herman Aihara uses 10:10:3.0 for 8-month miso. Other ratios commonly employed in Japan are: a) soybeans 10, koji 6.4, salt 5.3; b) soybeans 10, koji 5.0, salt 4.1; c) soybeans 10, koji 7.2, salt 4.9. Notice that in the latter proportions, the salt is considerably higher than that used in America.

Homemade Barley Miso *(Mugi Miso)*

For basic ratios and amounts of raw materials, see page 172. Prepare as for Homemade Red Miso except: 1) Use barley koji instead of rice koji. 2) Increase the amount of water used in cooking the beans so that the necessary amount of mixing liquid remains when the beans have finished cooking. 3) Using natural fermentation, allow miso to ferment for at least 12 to 18 months; the finest flavor will be attained after 2 to 3 years. If using temperature controlled fermentation, reduce the above fermentation time by one half. 4) Virtually all barley miso calls for 10 parts each by weight of dry soybeans and dry koji. The ratio of salt used in America is as low as 3.5; in Japan it ranges for 4.6 to 6.0, with the latter proportion requiring 2 to 3 years fermentation.

Homemade Light-yellow Miso *(Shinshu Miso)*

For the basic ratio of raw materials, see page 172. Prepare as for Homemade Red Miso except: 1) After soaking, drain the beans, measure the amount of water drained, and add back an equal amount of fresh water. 2) For a lighter colored miso, rub the soaked beans between the palms of both hands to remove seedcoats before cooking. 3) Pressure cook beans to give a light color. 4) For an even lighter color (accompanied, however, by a loss of nutrients) discard all soybean cooking liquid and use boiled water as the mixing liquid. 5) Using natural fermentation, age for the same time as red miso. Using temperature controlled fermentation (to give a still lighter color) ferment for 1 week at 86°F, 3 weeks at 95°F, 1 more week at 86°F, and then allow to stand at room temperature for 1 week before serving. 6) For a slightly saltier miso, increase the ratio of salt from 4.1 to 4.5 and increase the aging time by 10 percent.

Homemade Sweet Red Miso *(Edo Miso)*

This is an excellent variety for those who don't want to wait more than one month to sample their homemade miso. Prepare as for Homemade Red Miso except: 1) Boil the soybeans for 8 to 10 hours, adding water as required. Or boil for 4 hours, allow to stand covered overnight, and return to the boil the next morning. Both procedures give the beans a deep reddish-brown color. 2) Drain beans for no more than 1 minute to prevent them from cooling. 3) Mash no more than 50 percent of the whole beans. 4) Mix beans with koji while beans are still quite hot (140°F to 158°F). Do not use seed miso lest the final miso sour slightly. 5) Pack the mixture into vat while mixture is still quite warm (122°F to 131°F). 6) Wrap vat with heavy towels to minimize heat loss, cover, and press as in the basic recipe. Place in a very warm environment (104°F to 113°F) for 3 weeks, then unwrap container and allow miso to ripen at room temperature for one week before serving. (Or wrap and ferment naturally for 4 to 5 weeks). Refrigerate the remaining miso to prevent spoilage.

Homemade Sweet White Miso *(Shiro Miso)*

Due to its high carbohydrate and low salt content, this miso takes less time to ferment than any other variety and is therefore excellent for homemade miso experimentation. Wash and cook soybeans as for Homemade Light-yellow Miso. Pack into vat while beans are quite warm and wrap as for Sweet Red Miso (above). Proceed as for light-yellow miso except: 1) Reduce fermentation time as follows: If using

natural fermentation, age for 1 to 3 weeks in summer (taste frequently), 5 weeks in spring or fall, and 6 to 8 weeks in winter. If using temperature-controlled fermentation, age at 95°F for 1 to 3 weeks, or 113°F for 1 to 2 weeks. Commercial makers say this miso can be prepared in 24 hours if the basic ratio by weight is soybeans 10, dried koji 20, and salt 1.5, and if the temperature of the room is 140°F. Before serving, grind the miso in a grain mill or meat grinder to create a smooth texture.

Some makers suggest increasing the basic proportion of koji from 20 to 24 if dried rather than fresh koji is used, and increasing the proportion to 30 if the miso is prepared during the winter by natural fermentation. When using temperature-controlled fermentation, many makers mix the miso once midway through the fermentation.

Homemade Mellow Barley Miso
(Amakuchi Mugi Miso)

For the basic ratios of raw materials, see page 172. Prepare as for Homemade Red Miso except: 1) Use barley koji instead of rice koji. 2) Add enough water to the beans so that the necessary amount of mixing liquid remains when the beans have finished cooking. 3) Ferment the miso for the same lengths of time and at the same temperatures as for Homemade Sweet White Miso.

Homemade Hishio

MAKES 4½ CUPS

Also called *Namé-mono* or *o-namé*, hishio is a variety of country-style namémiso requiring a relatively short fermentation. It is generally prepared in farmhouses sometime between October and May. The koji is prepared both with and without soybeans depending on the locality. The method using soybeans is more difficult since, if the temperature rises, *natto* bacteria often propagate and the miso fails. In some localities, instead of stirring the miso daily, a pressing lid is used and the miso is left untouched. Hishio is thought to be the earliest ancestor of present-day shoyu.

4 ounces eggplant, well washed
5 ounces cucumber or *uri* melon, well washed
8 tablespoons salt
3 cups (13.4 ounces) ready-made dried wheat or barley koji
2¼ cups boiled water
2 ounces gingerroot, parboiled, and thinly sliced (optional)

Parboil eggplant and cucumber for about 1 minute to sterilize, then cool briefly and dice. Combine in a small bowl with 1 tablespoon salt, and gently rub salt into vegetables. Set a plate atop the layer of vegetables in bowl and place a 4- to 5-pound weight atop plate. Cover bowl with plastic wrap and press for 1 week.

On the same day vegetables begin to press, combine the koji, water, remaining 7 tablespoons salt and, if used, the gingerroot in the fermentation container. Cover container with a sheet of paper or plastic wrap held in place by a string, and place container in a clean location which receives no direct sunlight. Stir the mixture thoroughly once daily.

After 1 week, pour off all liquid from the pressed vegetables and discard. Wash hands, then squeeze vegetables firmly to expel any excess liquid. Mix vegetables into fermenting hishio. Allow hishio to ferment for 3 more weeks, stirring daily. The finished product should have a very moist texture (similar to applesauce) and pleasant, subtly sweet fragrance and flavor. Store covered in a cool place or refrigerator to prevent further fermentation.

To prepare the same miso using soybeans, use 3⅓ cups rice koji, 1 cup soybeans and ⅓ cup salt, plus other ingredients as listed above. Cook beans, cool to body temperature and mash, then mix with the koji and cooking liquid. Add remaining ingredients and transfer to a crock. Allow to ferment, mixing daily, for about 1 to 2 weeks.

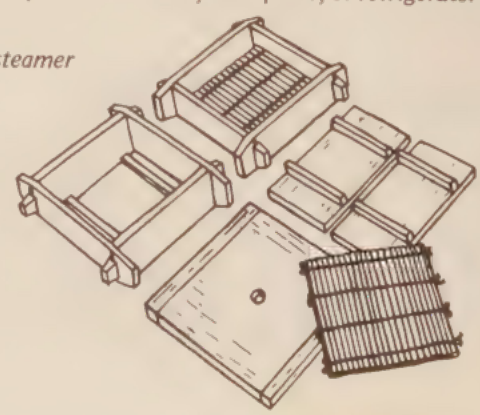
Indian Pulse & Soybean Miso

Developed in 1963 by Dr. T. N. Rao of the Central Food Technological Research Institute in Mysore, India, this flavorful product is a good example of how Japanese miso can be adapted to the tastes and ingredients of other countries. The use of a relatively small proportion of soybeans and peanuts together with local pulses greatly enhances the amino acid balance; the resultant product contains 11.2 percent protein when Bengal gram is used and 8.7 percent with Thur dhal. The percentages of salt are 5.0 and 5.4 respectively. To give a longer shelf life, powdered red peppers or chilies may be added to taste.

2¾ pounds dehulled Bengal gram or Thur dhal, soaked for 15 hours in water to cover
½ pound whole dry soybeans, soaked for 12 hours
¾ pound chopped peanuts
2½ pounds rice koji
¾ pound salt

Pressure-cook pulses like soybeans (25 minutes at 15 pounds), then drain and reserve. Combine soybeans and peanuts, and pressure cook as in the basic method above. Mix cooked ingredients with koji and salt (and spices if desired), add enough cooking liquid to give the desired consistency (45 to 47 percent moisture), and pack into vat. Ferment at 83°F for 5 to 10 days. Store in a very cool place, or refrigerate.

A square steamer



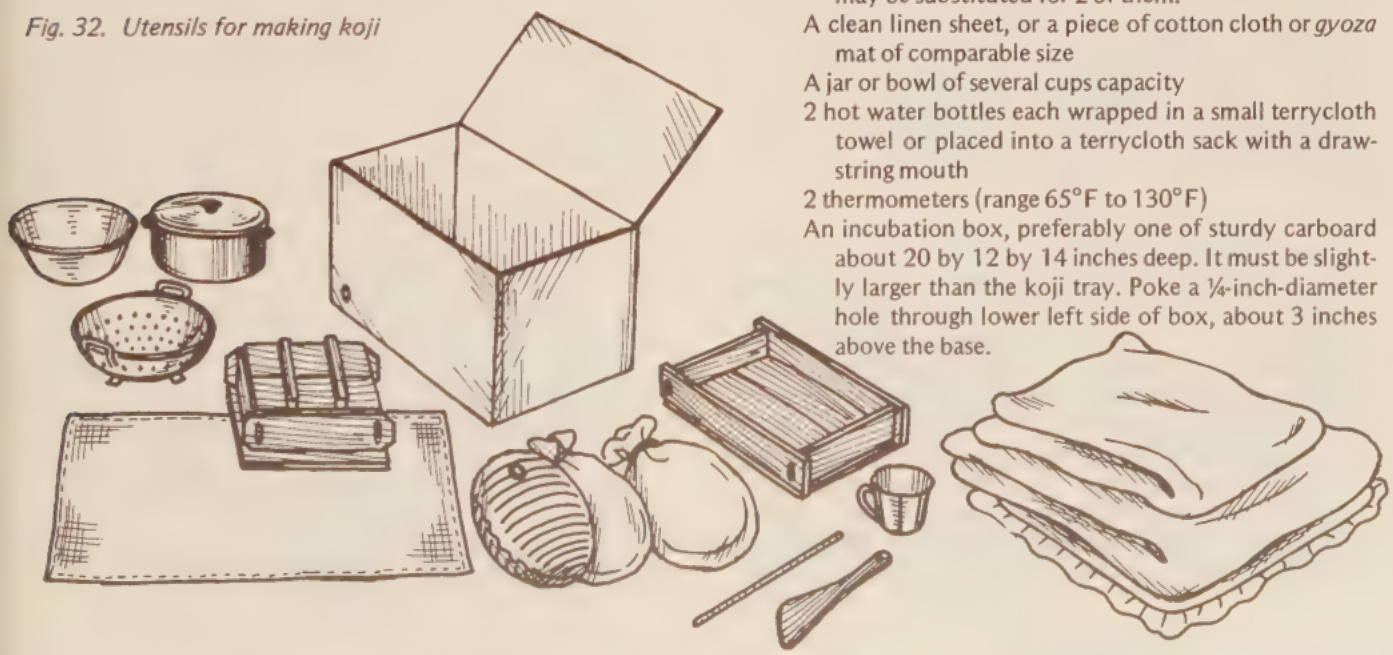
HOMEMADE KOJI AND KOJI STARTER

The preparation of good-quality koji is a fairly sensitive process requiring several pieces of special equipment (steamer and koji tray) that can be made or purchased without much difficulty. Don't be daunted: anyone can make good koji if he or she carefully follows the instructions given below, paying special attention to two basic points: 1) Keep your hands, all utensils, and the entire work area as clean as possible; 2) Keep the koji temperature within the recommended range throughout the 45-hour incubation period.

Most Japanese prepare koji at the same time of year they make miso, in the late fall or early spring, when the weather is cool and the number of contaminating microorganisms in the air is fairly low. The koji is generally prepared indoors in a room with a clean wooden floor. A typical batch calls for about 30 pounds of rice or barley so that the scale is considerably larger than in the following recipe. We have preferred to start with a smaller batch since the equipment is easier to obtain and you can easily increase all of the ingredients by as much as you like after your first small-scale success. The following recipe yields just enough koji for 1 medium-sized batch of Homemade Red Miso (p. 173). The amount of rice given just fills a typical steamer during one steaming.

To obtain a better perspective on the process of making koji, study the traditional miso shop method (Chapter 9), and to see how it fits into the integrated process of preparing Homemade Red Miso, study the flow chart in figure 33. The time schedule built into the following recipe ensures that all of the work can be done during ordinary waking hours. In all koji recipes, 1 pound of uncooked rice yields about 1.14 pounds of fresh koji. In the basic miso proportions on page 172, the weight of ready-made dried koji is the same as the weight of uncooked rice necessary to prepare fresh koji.

Fig. 32. Utensils for making koji



Utensils

A wooden koji tray about 16 by 10 by 2½ inches deep with a lid consisting of 1 or 2 thin boards. Japanese trays are made of cedar (*sugi*), but Douglas fir, cherry, or pine also work well. Join boards with dowels or pegs to prevent rusting. A desk or bureau drawer, a cloth-lined enamel or stainless steel tray, or a shallow fruit box may also be used.

A 1-gallon soaking container

A 1½- to 2-gallon kettle or wok. The kettle must have a flat rim and no handles rising above the rim to interfere with the steamer.

A 2- to 3-quart strainer or a cloth-lined colander

A square steamer (used with the kettle and easily made at home) or a round Chinese bamboo steamer with a woven bamboo lid (used with a wok and available at most Chinese hardware stores). Additional layers of steaming compartments may be added when using more than 6 to 8 cups of rice. The square steamer shown in figure 32 is made of ¾-inch-thick cedar boards; it is 9½ inches square and 4½ inches deep inside. Two ¾-inch-square boards near the bottom support a 9½-inch square bamboo mat which forms the steamer's floor. The base is a 13-inch-square board with a ¾-inch-diameter hole at the center. The steamer lid is composed of 2 boards reinforced on top to prevent buckling. An excellent Western-style steamer my also be improvised by placing a large colander atop several bricks or an inverted bowl inside an even larger kettle.

A steamer cloth made of coarsely-woven cotton or linen about 18 by 30 inches (or 24 inches square when used with the round steamer). Do not use ordinary dish-towel cloth; its relatively fine weave will not allow the passage of steam.

A wooden spatula or spoon

5 to 6 heavy-duty blankets (the oldest ones you have). A thick, flat cushion several feet square and a tarp may be substituted for 2 of them.

A clean linen sheet, or a piece of cotton cloth or *gyoza* mat of comparable size

A jar or bowl of several cups capacity

2 hot water bottles each wrapped in a small terrycloth towel or placed into a terrycloth sack with a drawstring mouth

2 thermometers (range 65°F to 130°F)

An incubation box, preferably one of sturdy carboard about 20 by 12 by 14 inches deep. It must be slightly larger than the koji tray. Poke a ¼-inch-diameter hole through lower left side of box, about 3 inches above the base.

Fig. 33. Miso Flow Chart

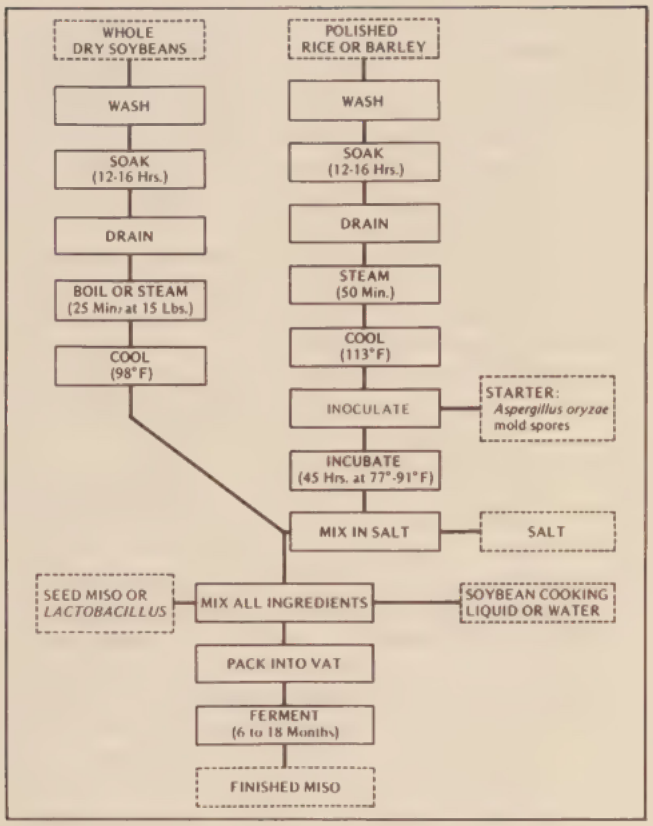


Fig. 34. Composition of Nutrients in 100 Grams of Basic Miso Ingredients

(Source: Standard Tables of Food Composition, Japan)

Ingredient	Food Energy	Protein	Fat	Carbohydrates (incl. fiber)	Ash
	Calories	*Percent*	*Percent*	*Percent*	*Percent*
Koji, Rice	334	6.0	0.7	73.4	0.4
Rice, white	351	6.2	0.8	76.9	0.6
Rice, brown	337	7.4	2.3	73.5	1.3
Barley, pearled	337	8.0	0.7	76.6	0.7
Barley, unpearled	335	10.0	1.9	71.7	2.4
Soybeans, whole	392	34.3	17.5	31.2	5.0
Soybean meal, defatted	322	49.0	0.4	36.6	6.0

Ingredients

Rice: Most rice koji (for *amazaké* and *tsukemono* as well as for miso) is prepared from short-grain white (milled or polished) rice, most modern makers believing that the bran layers of brown rice inhibit the penetration and growth of the mycelium. For a discussion of the basic techniques and difficulties of preparing brown-rice koji, see page 36. Beginning koji makers may wish to experiment with a koji midway between the white and brown varieties by removing 50 to 75 percent of the bran layers and cracking the kernels into several pieces, thereby exposing the soft inner carbohydrate core to mycelium growth. Rice is always steamed, never boiled, to make koji; the latter process creates a wet texture which encourages the growth of undesirable bacteria. One cup raw rice (7.24 oz) yields 1.80 cups (8.25 ounces) fresh koji.

Barley *(O mugi, seimugi, hadakamugi):* For basically the same reasons that white rice is generally used to make rice koji, pearled barley (whole grains of unrolled natural barley with the bran layers removed) is used to prepare barley koji—and has been since ancient times. Barley contains slightly more protein, but slightly less carbohydrate and natural sugar than rice (fig. 34). Thus barley miso generally has a slightly higher nutritional value and is less sweet than rice miso. Other things being equal, the lack of sugars makes it necessary to ferment barley miso somewhat longer than rice miso.

Some miso makers prefer to use "naked" barley (*hadakamugi*) which is sometimes classified as a type of rye and yields miso with a unique aroma and flavor. It is also softer and free of the residual "centerline" and hull characteristic of polished regular barley (*omugi*) so that it gives the miso what many consider to be a more agreeable texture.

Other Koji Grains: In some traditional miso shops and many farmhouses, whole wheat is used to make koji for *hishio* and Kinzanji miso. Cornmeal is also used as the koji substrate in order to create a less expensive miso. In the Shinshu area, where the latter technique originated, cornmeal is soaked in water for 1 hour, steamed for 40 minutes, cooled to body temperature, and then inoculated with starter as for rice koji. In some areas rye, oats, millet, corn kernels and even sweet potatoes are used as the substrate.

Koji Starter *(tané koji, koji kin):* Koji starter is now available from several natural food suppliers in the United States (p. 258) or in small quantities from the Northern Regional Research Center (p. 259). The best source, Westbrae, buys koji starter from Nihon Jozo Kogyo in Japan (p. 258), the producer of eight basic types: one each for red-barley, and mellow barley miso; two for soybean miso; and three for sweet white miso. Each type is available in at least one of three different forms (whole-grain, meal, or spore powder) and some types are fortified with yeasts and *Lactobacillus.* Most starters are a mixture of pure-culture mold strains, each having different capabilities in breaking down proteins, carbohydrates, and oils. Among the total of 17 different varieties and forms produced by Nihon Jozo, those most widely available in North America are the spore-powder starters for red, barley, soybean and light-colored misos, and for shoyu. Each comes sealed in a foil envelope weighing about 1½ ounces. Always keep starters well sealed in a refrigerator at 40°F to 59°F. Do not freeze.

All starter is olive green in color. The spore powder is 5 times as concentrated as the meal or whole grain forms and only 10 grams (1 tablespoon) are required to inoculate 110 pounds of (uncooked) rice. One tablespoon of the other two forms weighs 8.8 grams and will inoculate 19 pounds of rice. In cold weather or with small amounts of rice (less than 5 pounds), doubling the dosage of starter called for on the package yields good results.

If you already have a small amount of starter and wish to prepare more of your own see pages 182 and 249.

Homemade Rice Koji
(Using Koji Starter)

MAKES 3.1 POUNDS (11 CUPS)

6.1 cups (2.7 pounds) white rice
5/8 teaspoon (1.9 grams) spore powder koji starter or 1½ teaspoons (4.4 grams) meal or whole-grain starter
¼ cup (lightly roasted) white or whole-wheat flour

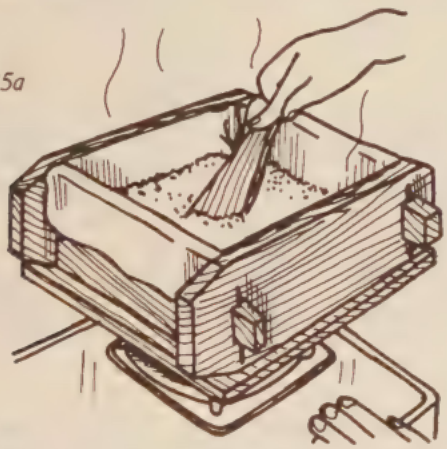
PREVIOUS AFTERNOON

Wash and scrub koji tray thoroughly, rinse with boiling water, and set upside-down to dry in a clean (sunny) place. Wash rice 3 or 4 times in soaking pot and soak for 12 to 16 hours in water to cover.

DAY 1:

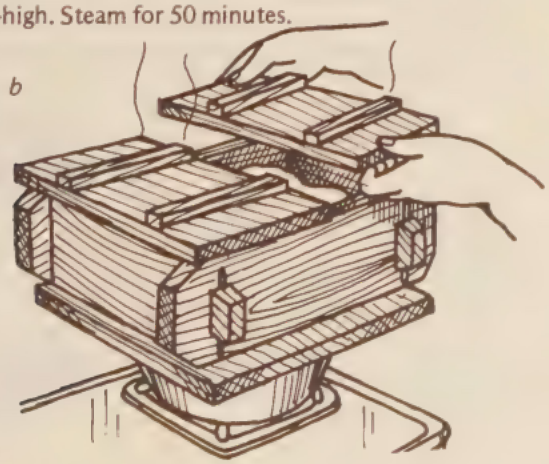
1) 8:00 a.m.: Fill kettle (or wok) two-thirds full of water and bring to a boil. Meanwhile, transfer soaked rice to a large strainer or cloth-lined colander, rinse under cold running water, and drain well. Rinse off steamer, insert bamboo mat, and line bottom and sides with moistened steamer cloth. Place steamer and base atop kettle (or place round steamer into wok) and pour rice into steamer to a depth of about 2 inches. (For large batches of koji, if all rice will not fit into one steamer layer, either add a second layer or steam rice in several consecutive batches.) Using wooden paddle or spoon, press rice firmly into corners of steamer and smooth rice

Fig. 35a



surface (fig. 35a). Fold over ends of cloth to cover. When steam rises through rice, cover with lid (fig. b), and turn heat to medium-high. Steam for 50 minutes.

b

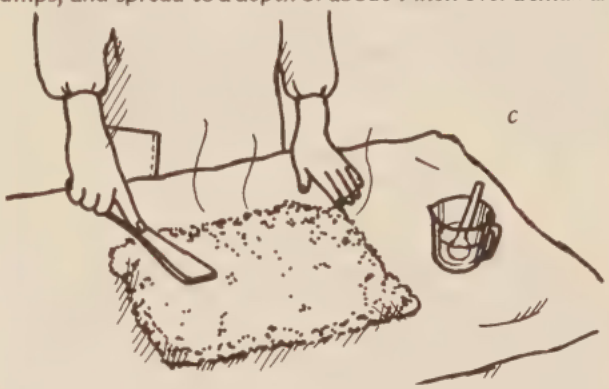


2) While rice is steaming, spread 2 blankets in a double layer atop a large table. Fold a clean sheet end to end and spread atop blankets.

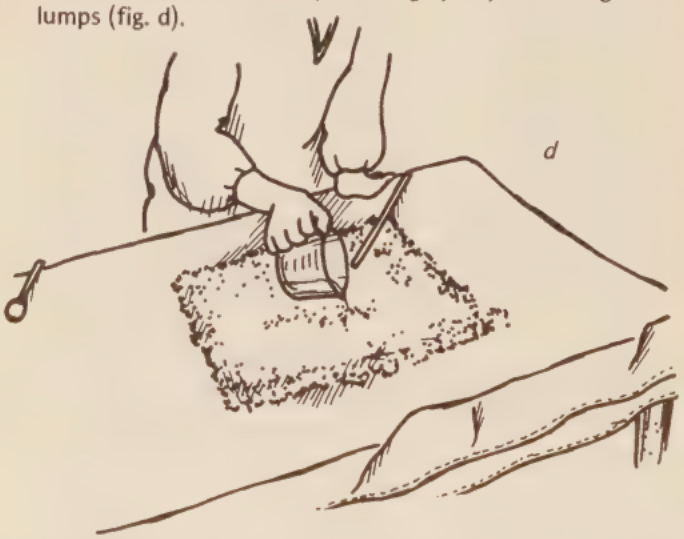
Combine the flour and koji starter in a small cup. Mix well, cover, and place on table near blankets.

Fill a hot water bottle with boiling water; wrap in a small terrycloth towel or place in a towel sack.

3) Transfer hot steamed rice to center of sheet (fig. c). Using wooden paddle, mix rice thoroughly, breaking up all lumps, and spread to a depth of about 1 inch over a small area

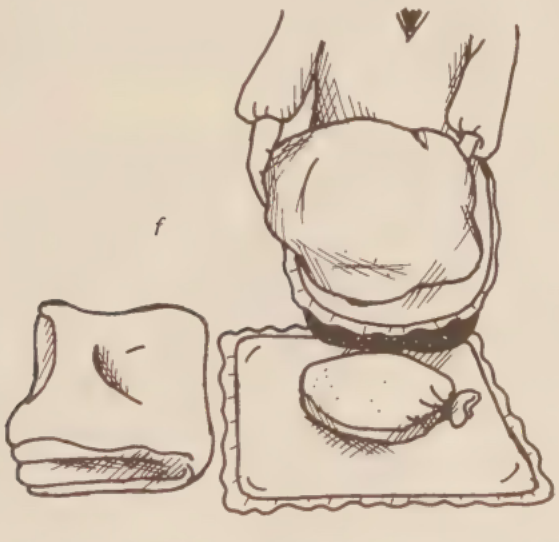


at the center of sheet. Insert thermometer into rice and wait several minutes until temperature drops to 113°F (45°C). Sprinkle one-half of the starter-flour mixture over rice and stir vigorously with paddle until starter spores are evenly distributed throughout grain. Sprinkle on remainder of starter mixture and stir, breaking up any remaining small lumps (fig. d).



4) Mound and pack inoculated rice into a hemisphere at center of sheet. Insert thermometer into rice and fold edges of sheet snugly over hemisphere to form a compact bundle (fig. e). Use the 2 blankets on the table to wrap bundle firmly, to minimize heat loss. Place hot water bottle atop another thick blanket folded into fourths (or a large flat cushion). Place bundled rice directly on top of hot water bottle and cover with at least two more thick blankets. Place this entire insulated "package" in a clean, out-of-the way place, preferably one that is fairly warm. (Avoid locations near circulating air heaters; the Japanese set their koji on boards over a warm bath.)

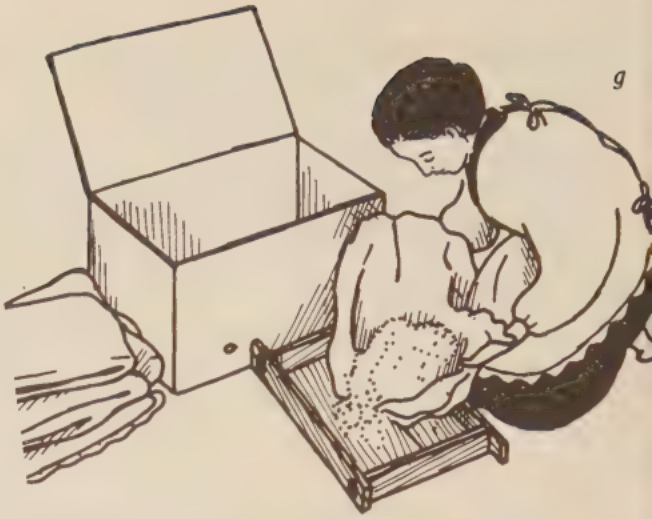
5) Check rice temperature every 2 to 4 hours, seeing that it stays between 77°F and 95°F (25°C and 35°C). To raise the temperature, add fresh or additional hot water bottles and/or more blankets; to lower, transfer hot water bottle to below the bottom blanket and/or remove topmost blankets. Just before retiring, check temperature and insert a fresh hot water bottle (fig. f).



DAY 2:

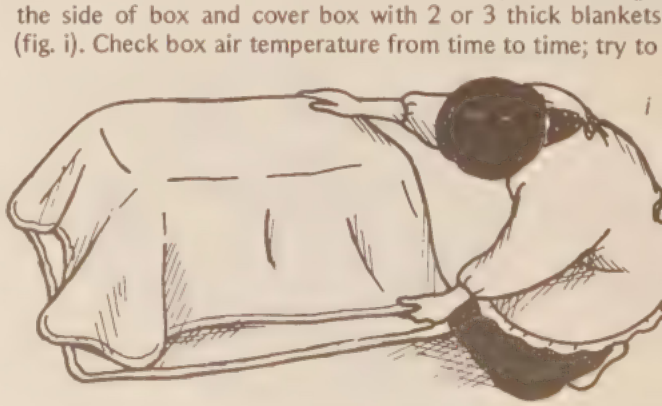
6) 8:00 a.m.: Check that koji temperature is within the range prescribed above. Adjust heat to bring temperature to about 95°F. Wash hands and open bundle. The young koji should now have a pleasant aroma, and individual grains should have a white, powder-like coating and be very loosely bound together by an almost invisible mycelium. If areas of bluish-green, black, or pink molds appear, carefully remove and discard. Now mix rice thoroughly and re-bundle.

7) 10:00 a.m.: Check koji temperature, wash hands, and open bundle. Re-check aroma and appearance, then transfer koji from sheet to koji tray (fig. g). Mix koji, breaking



up any small lumps. Shape koji into an oval mound (fig. h) 2 inches high at the highest points and slightly hollowed at the center. Insert one thermometer into koji and cover tray with

lid(s). Put tray into incubation box; beside tray place 2 fresh hot water bottles and an uncovered jar of hot water (to keep air humidity at 90 percent to 95 percent). Set box atop 6 to 8 thicknesses of folded blankets (or 1 or 2 thick cushions). Insert the second thermometer into the hole poked through the side of box and cover box with 2 or 3 thick blankets (fig. i). Check box air temperature from time to time; try to



keep it at 82°F, or at least within the range of 77°F to 91°F.

8) 2:30 p.m.: Wash hands and check that koji temperature is between 80°F and 98°F. In no case should it be allowed to fall below 77°F or rise above 104°F. Stir koji quickly but thoroughly in order to break up lumps (which can cause overheating), aid circulation, and ensure even mycelium growth. Remound koji into oval volcano shape, re-cover tray with lid set slightly ajar, and re-cover incubation box with blankets.

9) 6:00 p.m.: Check that temperature inside koji is within the range prescribed above. Stir koji thoroughly and spread it in an even layer (about 1 inch deep) over entire bottom of tray. Re-cover tray with lid set well ajar. Replenish hot water bottles and hot water in jar. (Begin to soak soybeans as described in the basic homemade miso recipe given on page173 .)

10) 10:00 p.m. (or just before retiring): Check that koji temperature is between 85°F and 96°F. If necessary, replenish hot water bottles.

DAY 3:

11) 11:00 a.m. (after 45 hours of incubation): Open box and examine koji for doneness. The individual rice grains should now be bound together with a delicate mycelium of fragrant white mold. Break open several grains (they should be soft enough to break easily) and check that the white mycelium roots have penetrated at least two-thirds of the way to the grain's center.

(If koji has a bluish-green color and a moldy or musty odor, sporulation has begun due to over-fermentation. If koji is black and slightly damp, contaminating molds have begun to grow due to overheating. In either case, place koji in a large colander, douse several times with hot water to wash off undesirable microorganisms, and re-incubate. Or discard koji and start again.)

12) Stir finished koji thoroughly, remove tray from incubation box and place in a cool, clean location for about ½ hour, or until koji temperature drops to room temperature. Measure into a large pot the amount of koji called for in the recipe you wish to prepare: a medium-sized batch of red miso, for example, requires 2 pounds 12 ounces times 1.14, or about 3 pounds 2 ounces. Mix this fresh koji with the amount of salt called for in your miso recipe, then proceed to mix with the cooked soybeans as described in variation 3 of the basic recipe for Homemade Red Miso (p. 175).

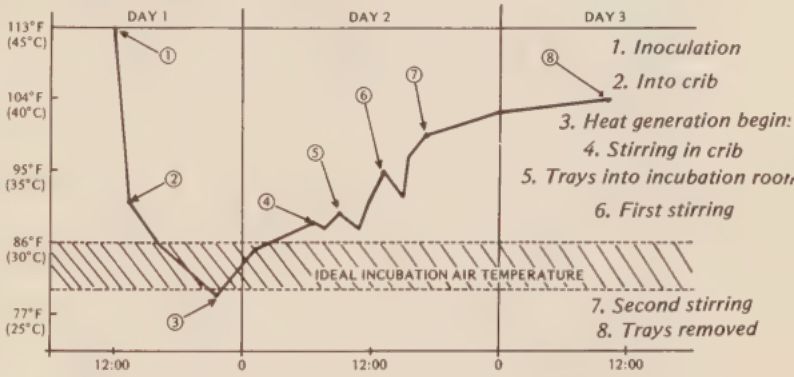
If any koji remains, transfer it to a separate container, seal well, and refrigerate; reserve for use in making *amazaké* or koji pickles (p. 162), or additional batches of miso.

STORING KOJI

If for some reason you cannot use the koji immediately, spread it in a thin layer on sheets of newspaper and allow to dry for 10 to 20 hours in a clean, warm place. Then seal and store in a cool, dry place. It will keep for 1 to 2 months in good condition, or for as long as 6 months, but with a slight decline in flavor and potency.

For even longer storage, spread the (plain or salted) koji on a clean sheet in direct sunlight (or on baking tins in a 113°F oven) until thoroughly dried. Sealed and stored in a cool, dry place, it will last for up to 1 year.

Fig. 36. Changes in Koji Temperature



Homemade Brown Rice Koji

Soak and steam very lightly polished brown rice as described above for white rice. To prevent the growth of alien microorganisms, regulate the koji temperature very carefully, keeping it about 5°F below the average temperature when using white rice. Otherwise the process is the same.

Homemade Barley Koji *(Using Koji Starter)* MAKES 3.5 POUNDS (12.5 CUPS)

To make enough fresh koji for one medium-sized batch of Homemade Barley Miso (p. 175) simply substitute polished (pearled) barley for white rice in the basic koji recipe. Prepare as for Homemade Fresh Koji except: 1) Soak the barley for only 2 to 3 hours. 2) Steam the barley for 90 minutes or until the grain becomes somewhat transparent and slightly rubbery. 3) For best results try to remove the incubating koji when the mycelium is pure white, after about 36 hours. A yellow mycelium is also satisfactory but will yield a sweeter miso. A black mycelium is unsatisfactory.

Homemade Rice or Barley Koji *(Prepared Without Koji Starter)* MAKES 12 CUPS

Preparing this koji using wild mold spores is analogous to making sourdough bread without starter. The best results are obtained in areas where the air is clear and somewhat cold, or in places such as miso shops or rooms where miso is fermenting where there are large numbers of free *Aspergillus oryzae* mold spores in the atmosphere.

In Japan, it is said that the air is much more free of undesirable organisms (that could produce toxins in fermenting koji) than most air in the U.S. or other parts of the West. Thus, unless you live in an area where the air is very clean and preferably, cold, it is better to use koji starter.

Soak and steam the rice or barley as for Homemade Rice or Barley Koji. Spread the steamed grain on a sheet and

allow to stand uncovered overnight so that it "catches" wild mold spores floating in the air. Transfer grain to the koji tray and spread it in an even layer over the bottom. Place tray in incubation box and proceed as for Homemade Rice Koji. Harvest the koji after about 3 to 4 days when it is covered with a white or light-yellow mycelium.

Homemade Koji Starter

Please begin by studying the commercial process for preparing koji starter (p. 233). The best starter is prepared from homemade koji incubated under carefully controlled conditions of temperature, humidity, and cleanliness. If contaminating microorganisms enter the koji, and the koji is then made into starter, their negative effect is multiplied. Starter can also be prepared from commercial koji, but the chances of obtaining a high degree of purity are somewhat less than with the homemade variety. Traditional Japanese homemade miso was generally started either by wild mold spores (described above) or by incubating a portion of each batch of homemade koji for 5 to 7 days, until the molds sporulated, then drying the product thoroughly and storing it for later use as starter. This latter process, known as the "cut-and-dry" method, was generally carried out without the use of brown rice or wood ash now used commercially—and good results were obtained.

To make your own starter, place about ½ cup finished homemade koji in a small wooden bowl, return it to the incubator, and keep at the same temperatures required for the commercial process until the mycelium turns from white to a soft olive green. Crumble, dry in a warm oven as described, and store sealed in a cool, dry place. Use as for whole-grain starter.

HOMEMADE MISO
(*Using Homemade Koji*)

In the following recipes, the preparation of the koji is an integral part of the miso-making process.

Homemade Hatcho or Soybean Miso

MAKES 6.4 POUNDS (10.6 CUPS)

We have had excellent results with this recipe. The key lies in keeping the temperature below 100°F, lest contaminating microorganisms begin to propagate and turn the soybeans into sticky *natto*. Some makers prefer to use a special soybean koji starter, however the regular starter used for rice or barley miso also works well. Please begin by studying the process for Homemade Rice Koji (p. 179), which the following recipe closely resembles, and the process for Commercial Hatcho Miso (p. 210).

8 cups (3¼ pounds) whole dry soybeans, soaked for 10 hours and drained
½ teaspoon (1.5 grams) spore-powder koji starter or 1½ teaspoons (4.4 grams) meal- or whole-grain starter
5 tablespoons (lightly roasted) white or whole-wheat flour
1 cup (10.4 ounces) salt (increase to 1¼ cups if aging miso for 2 years or more)
2 cups mixing liquid (boiled water)
4 tablespoons Hatcho or soybean miso

Place beans in a large steamer (p. 177) and steam for 6 hours, or until individual beans are soft enough to crush easily between the thumb and small finger. Combine starter and flour in a small bowl, mixing well. Cool beans to body temperature, then transfer onto a clean sheet and sprinkle with half the flour-starter mixture. Stir beans thoroughly with a wooden spoon, then sprinkle on the rest of the mixture and re-stir until each bean is covered with the inoculum.

Transfer inoculated beans into koji tray and place into incubation box with hot water bottles and water-filled jar as for Homemade Rice Koji. Keep air temperature inside box as close as possible to 86°F (and within the range of 79°F to 89°F), and stir following the same schedule as for Homemade Rice Koji. If the temperature rises above 100°F or if the beans become sticky, immediately remove hot water bottles and jar and open lid of box until temperature and humidity drop. Then return 1 water bottle but do not return jar for at least 4 hours, or until stickiness has disappeared. Continue incubating for 40 to 50 hours, or until beans are bound together by a dense mat of fragrant white mycelium. Mash or grind two-thirds of the soybean koji and combine in a large mixing pot with the salt, mixing liquid and mature miso; mix well. Transfer to vat, cover with sealing sheet and pressing lid, and top with weights: for Hatcho miso, use a weight equal to that of the fermenting mixture; for regular soybean miso, use one-third to one-fourth the weight. Allow to stand at the natural temperature of the environment for at least 12 months or, for best flavor, for 18 months or more, including two full summers.