



Constructing a Cenicafé Rake for Stirring Deck-Dried Coffee

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The Cenicafé rake can shorten the time needed to dry coffee on a sun deck by a day and increase the uniformity of drying to that of rotary drum dryers. This has been shown both in Kona and at the Centro Nacional de Investigaciones de Café (Cenicafé) in Colombia. The original Colombian rake was only 1 foot wide. A wider, 3-foot version of the rake has been developed. The limitation on rake width is determined by the strength of the person using it.

Materials

- A 4-inch or 6-inch PVC pipe as long as the rake will be wide (18–48 inches). The pipe can be as thin as SDR 41 irrigation pipe; heavier wall pipe such as schedule 40 can be used but is not necessary.
- A handle from another rake, a push broom, or a similar tool.

Tools

- Saw to cut PVC; the width of the saw (kerf) is unimportant as long as it is less than $\frac{1}{4}$ inch.
- A few small pieces of wood or plastic the width of the kerf to use as spacers.
- Drill and bits to make small and large holes.
- Heat gun, 1000 watt.
- Pliers to grasp PVC for twisting the rake teeth while they are hot.
- Clamps or vise to hold PVC while twisting the teeth.

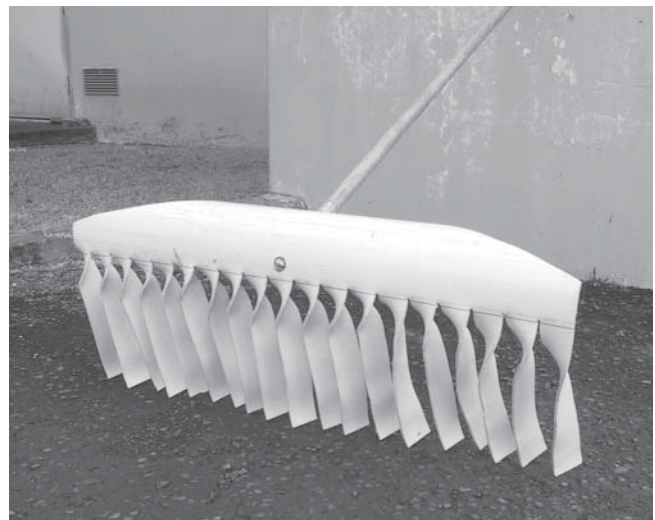
Layout and initial preparation

Make a slit the length of the PVC pipe. Because the pipe will try to squeeze inward, the saw will bind near the end of the slit if spacers are not placed in the slit to hold it open.

The rake's teeth will be $1\frac{1}{2}$ –2 inches wide. Their actual width will vary with the length of pipe used and will involve calculating so that the teeth are each the same width over that length. It is desirable that there be an odd number of teeth, so that the handle will be anchored above the center tooth, as shown below.

Mark a line along the pipe 8–12 inches (for 4- or 6-inch pipe, respectively) from one edge of the slit (this line will be at the top of the teeth). Along the line, mark centers for a row of holes (the distance between marks will be the width of the teeth). Then mark straight lines around the curve of the pipe from each center mark to the edge of the slit from which the 8–12-inch measurement was made (see diagram, p. 2).

When PVC is brought to 215–220°F it will become pliable and take the form in which it is held while it cools. If it is reheated, it will tend to go back to the shape it had when it was originally cast or extruded (i.e., a round pipe).



Cut teeth

Drill a $\frac{3}{16}$ – $\frac{1}{4}$ -inch hole at each spot marked. The holes make a terminal point for the saw cuts and reduce the stress concentration and potential for breakage at this point. Cut along each line from the slit to the hole to form the separate teeth. You can place a piece of scrap lumber or plastic in the slot to make it easier to cut the teeth.

Form teeth

Heat a tooth with the heat gun from the bottom of the tooth towards the row of holes (top of the tooth). Heat from both sides and be careful not to scorch the plastic. When the PVC becomes pliable but not soft, grasp the free end of the tooth with pliers, pull it straight, and then twist it 105° (15° past 90°). Put the twist in the top portion of the tooth. You control the twist by having the portion you want to be twisted the most pliable. Hold the shape while cooling the plastic with the heat gun, using the fan only, or with a damp rag. Repeat for each tooth. Each tooth should take less than 5 minutes to form.

Remember that if you reheat the tooth it will try to return to its original shape. You will need to hold the PVC in the shape you want it to take until it is cooled and solid. The teeth should align in a row. You can make

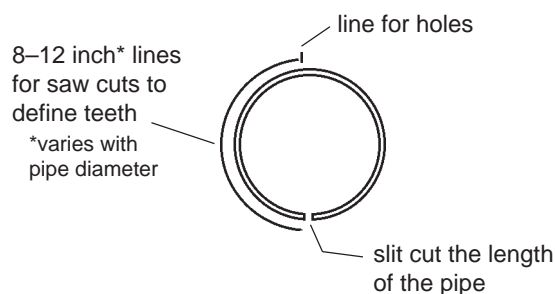
some adjustments by heating the tooth as you move it into proper position. Hold the tooth in the proper shape and continue heating until resistance to holding is slight, then you can cool the tooth. Make sure other teeth are not heated in the process.

Join rake and handle

The finished rake, with its row of teeth, needs to be joined to the handle. The curved section of the original pipe that remains at the top of the rake provides structural support along the length of the rake. Mount the handle by drilling a pass-through hole at the back of the rake and a second hole at the top of the teeth to receive the end of the handle. Avoid drilling the second hole too close to a cut. Place these holes at a position that will give the handle the desired angle in relation to the teeth (see photo below).

If the handle has a threaded end, the hole above the teeth should be of a size such that the handle can be screwed into it. If your handle is not threaded, the hole above the teeth can be a small one that will accommodate a screw. Pre-drill the end of the handle to receive the screw, and use a washer beneath the head.

Cross-section of pipe



Side view of pipe

