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In Pursuit of a Better Seed Trap

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ABSTRACT.—Seed and litter traps are tools used by foresters and ecologists. We describe two different types of a durable trap constructed from plastic plumbing pipe, which are easily assembled/disassembled for efficient transportation and storage.

KEY WORDS: seed production, litter production, forest regeneration.

Seed and litter traps have been used for decades by foresters and forest ecologists to monitor various aspects of production and dispersal of seeds and litter. The method of construction and materials used, as well as the shape and size of the traps, vary depending on the specific needs of the project and the resources available to make or buy the traps; often, any convenient type of container that can catch and retain seeds is used. The most traditional design is a wooden frame with a screen bottom, with (seed trap) or without (litter trap) a hardware cloth top, and with a surface area of 2.6 to 10.6 ft^2 (Leadum *et al.* 1997)[1]. However, many other types of traps have been used, e.g., funnel-shaped traps elevated 3 to 4 ft above the soil surface or top set at ground level (Christisen and Kearby 1984; Sarvas 1962, 1968; Zasada and Gregory 1972), traps with cloth or screen bags attached to some type of metal frame (Hughes *et al.* 1987), traps containing water or a commercially available soil mixture that catches seeds and allows them to germinate in place (Walker *et al.* 1986, Zasada and Densmore 1979), plastic buckets (Jones *et al.* 1994). and traps with a sticky surface (like fly paper) to which seeds adhere.

The choice of trap should be based on such considerations as type of seed dispersal unit, timing of dispersal, and expected density of seedfall. For example, Walker *et al.* (1986) used traps containing water to estimate seed rain of Salicaceae seeds, and they used more standard wood frame traps for *Picea* and *Alnus* seeds. Cameron and Foreman (1997) reported that traps with larger collection areas (up to 4 m^2) may be necessary to estimate seed density when seed crops are small, while small traps (0.25 m^2) may be adequate during years of high-density seed rain. Species differ in the potential magnitude of seed production. Birch, for example, consistently has greater seed production than white spruce. Thus, small seed traps (e.g., 0.25 m^2) may be appropriate for birch, while larger traps (1 m^2) may be necessary to obtain reliable estimates for white spruce.

Most trap designs have strengths and weaknesses. Wood frame traps if not made from treated wood eventually deteriorate. Depending on their size, they may be difficult to store and may be unwieldy and difficult to carry into relatively remote sites. Traps with cloth, plastic, or screen bags (Hughes *et al.* 1987) attached to metal frames may be unstable with snow loads, and the bags are often the target of bears, squirrels, and other animals. However, these traps are very portable, inexpensive, and more readily stored than wood frame traps. Traps that use water or a soil mix are difficult to maintain because water needs to be added to them periodically for proper functioning.

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[1]*Metric equivalents of English units used in this report: 1 foot = 30.48 centimeters or 0.3048 meter; 1 square foot = 0.0929 square meter; 1 inch = 2.54 centimeters.*

In search of a trap that might be more durable for both summer and winter use, easily transported, and efficiently stored when not in use, we have designed a trap constructed of standard plastic pipe used in home plumbing (PVC). Although this trap may not be perfect for all applications, it provides another design to consider. In the following, we describe how to build a flat trap similar to the traditional wood frame trap as well as a deeper basket trap that is similar to the funnel-type trap. PVC, rigid by nature, has many accessories (i.e., T-joints, various angle joints) that allow for flexible design options. The traps we describe are but two examples of options made available by the use of PVC.

FLAT TRAP

The materials and equipment needed to construct a trap (fig. 1A) with a sampling surface area of 7.4 ft² (33 in. x 33 in.) are as follows:

Flat Trap Materials List

1. 30 ft of PVC pipe
2. Eight 90° elbows (PVC)
3. Four 3/8 in. dowel rods
4. PVC cleaner
5. PVC cement
6. 12 ft of weather stripping
7. Nylon screen (comes in 3 ft widths)
8. Hardware cloth (1/2 in. openings)

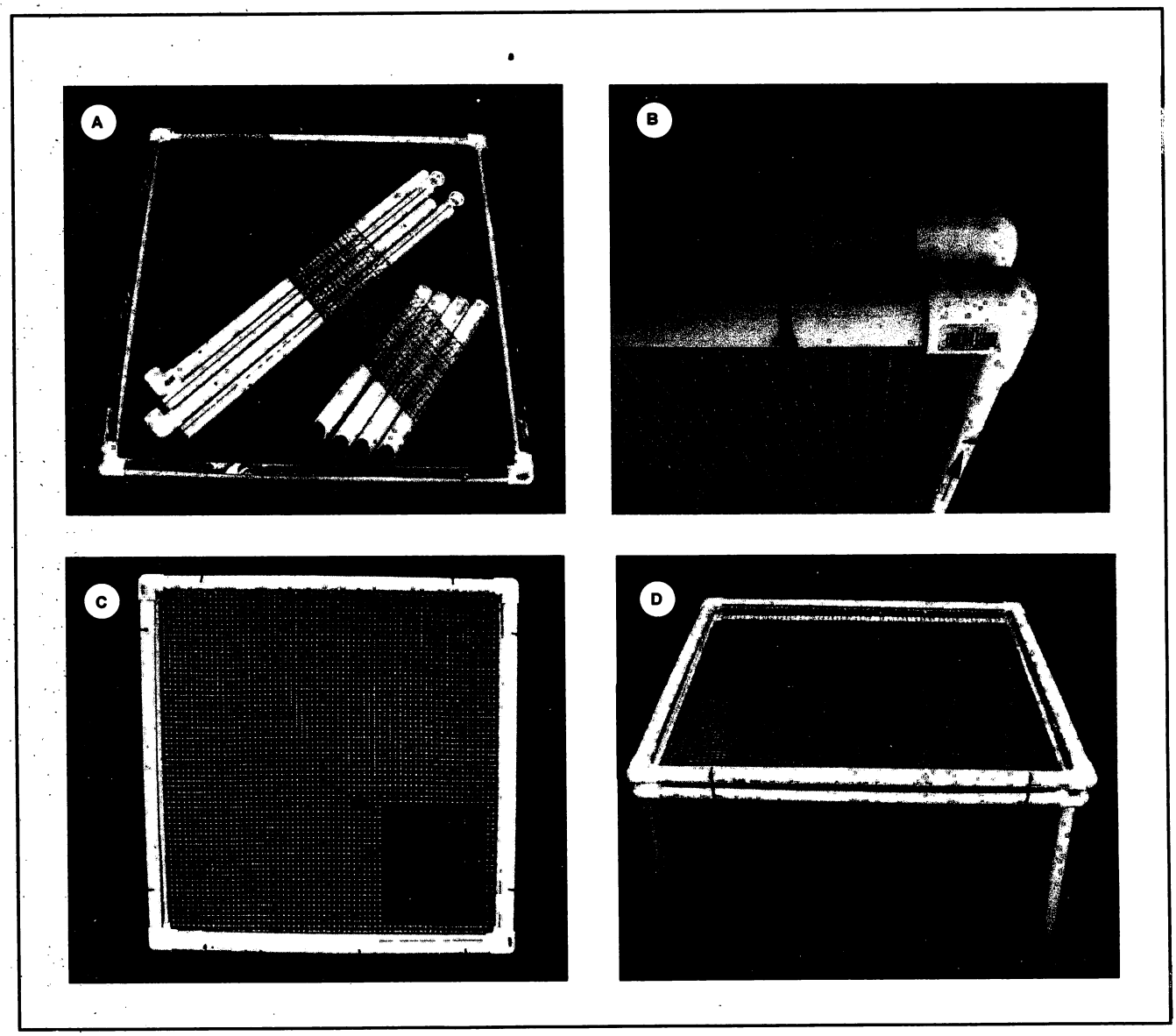

Figure 1.—*(A) Lower half of flat trap with screen bottom and top half of trap with hardware cloth unassembled. Longer pieces are trap frame; note slots into which dowels or hardware cloth fit. Shorter pieces are legs (see 1D). Note darker area just inside assembled frame—this is the seam that forms the sleeve for a dowel. (B) Arrow nearest center of photo shows gray weather stripping. Black cable tie holds trap together at other arrow. (C) Top view of assembled trap; inset shows hardware cloth top and screen bottom. (D) Fully assembled trap with legs.*

9. Propane torch
10. Copper tubing 1 ft x 1/2 in. diameter
11. Cable ties
12. Drill and drill bits of assorted sizes
13. Table saw
14. Miter saw

We chose these trap dimensions because both the nylon screen and hardware cloth were available only in 36-in. widths. Traps with a larger surface area could be easily constructed, but both the screen and hardware cloth would have to be spliced to make larger pieces.

The procedure we used in constructing the flat traps can be broken down into the following steps.

Step 1.—Cut the PVC pipe into eight 33-in. sections (fig. 1A). This length will make the outside seed trap dimensions 36 in. x 36 in. when the 90° elbows are added to these pieces. We used a compound miter saw in this step.

Step 2.—Cut pipe sections so that a slot is formed through one of the two walls of the PVC (fig. 1A, 2C). To safely cut these sections, clamp a block of wood to the table saw so that the saw blade is centered between the fence

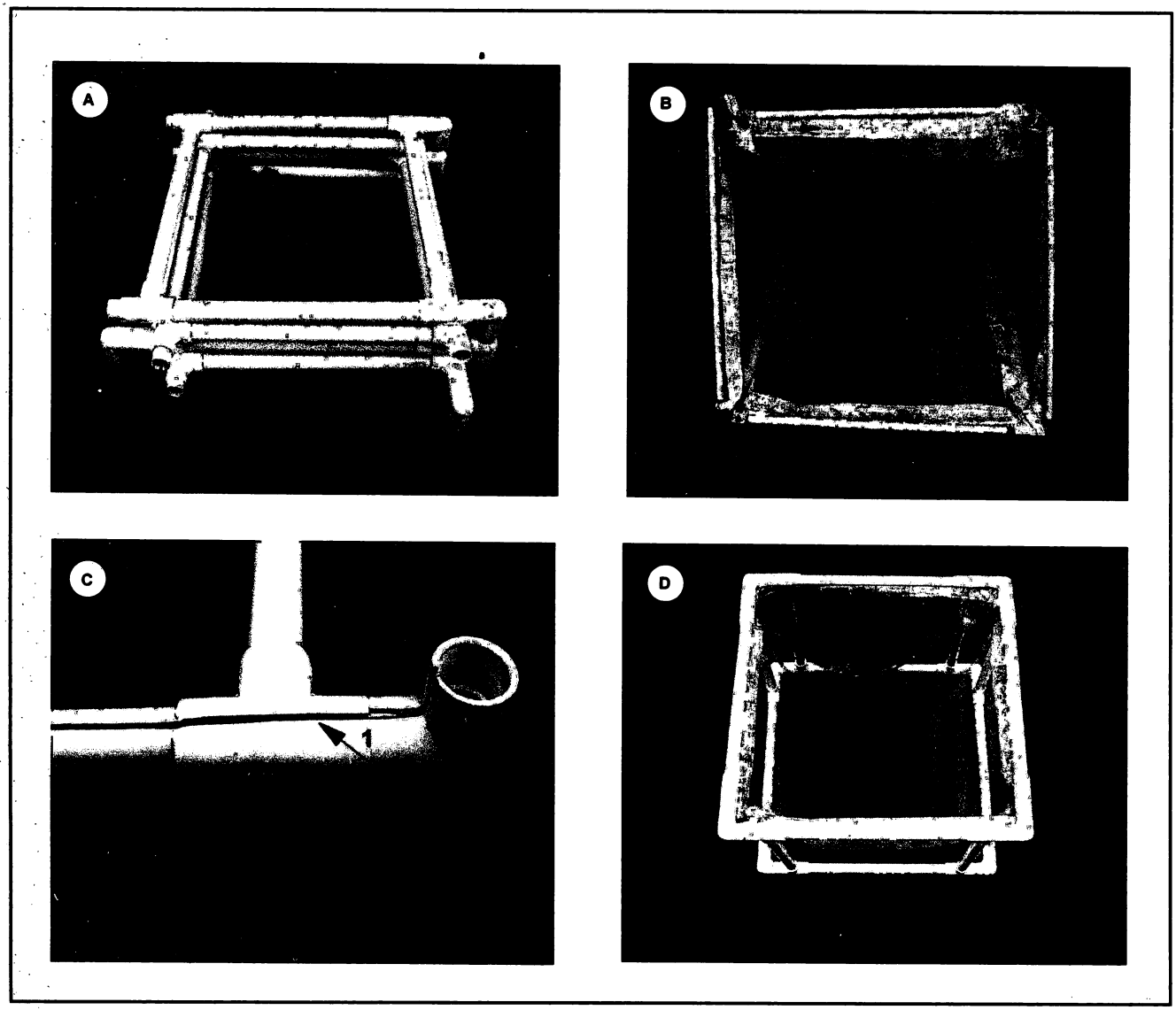

Figure 2.—*(A) Unassembled frame for basket trap. (B) Screen basket showing bonded seams. The wooden dowels are shown (1 and arrow) positioned in sleeves. (C) Corner of frame showing T-junction, 90° elbow, and slot (1 and arrow) through which the dowels are inserted to hold the basket securely in place. (D) Top view of fully assembled trap.*

and the block of wood to guide the sections through the saw.

Step 3.—Cut the 90° elbows as in step two. This cut is a little more difficult to make (fig. 1A, 2C). The 90° angles should be placed on edge with the point of the angle facing upward. Once you've made these cuts, put the PVC together so that the slots are all in line (do not glue together).

Step 4.—An iron or other material that can be heated to bond/melt the nylon screen together is needed for this step. We used a piece of copper tubing 1/2 in. in diameter. The end of the tubing was placed in a vice and flattened, creating an ironing surface 1 in. wide. The flattened surface was then bent to about a 30° angle. The flattened end was heated with a propane torch to a temperature that melted two sections of nylon screen together, creating a solid bonded screen.

The dowel rods are to hold the nylon screen in the slotted PVC (fig. 1A, 2B) and should be 33 in. long. Once you've cut the rods, roll the nylon screen out on a good size table so that there is plenty of room to work. Center one of the dowel rods on the screen approximately 1 in. from the edge of the screen. Roll or fold the screen over so that there is room for the dowel to slide easily into the sleeve and about 1-in. additional screen (fig. 2B). At this time, the propane torch is needed to heat the iron. Once the iron is heated the screen can be melted together forming a small sleeve that will hold the dowel rod (fig. 2B). Slide the dowel into the sleeve, and slide the screen and dowel into one of the slots that was cut into the PVC. Use this same procedure for the opposite end of the screen. Now that two sleeves have been formed, each holding a dowel rod, the same must be done on the remaining two sides (fig. 2B).

Step 5.—The hardware cloth for the top of the trap must be cut so that a 90° bend can be made on two sides only. Because the hardware cloth is rigid, this bend is all that is needed to hold it firmly inside the slots of the PVC. At this time, the PVC cement and cleaner will be used to secure one of the 90° elbows to one section of the PVC that measures 33 in. Be sure to secure only one 90° elbow to one section of PVC so that you can insert the screen from the other end of the PVC (fig. 1A, 1C).

Step 6.—Stick weather stripping to the top of the PVC section that holds the nylon screen. Then, place the top and bottom of the trap together, sandwiching the weather stripping (fig. 1B).

Step 7.—Finish the trap by drilling holes through both halves, allowing room for cable ties to be inserted and cinched together. Cable ties may be added to the section of the seed trap that holds the hardware cloth to the PVC if so desired for extra support (fig. 1B).

Step 8.—If the trap needs to be off the ground, make legs for it by using a hole saw that matches the diameter of your PVC. Simply take the PVC and drill through both walls; this will create a concave or (U) shape in the PVC on one end and act as a cradle for the 3-ft x 3-ft frame. Now you can make a straight cut on the other end of the PVC to the desired leg length. This will hold the flat trap in place once the legs are driven into the ground to the desired trap height (fig. 1D).

BASKET TRAP (LITTER)

The basket trap (fig. 2D) described here is 18 in. in length, width, and height. For traps with these dimensions, the following materials are needed:

Basket Trap Materials List

1. 20 ft of 3/4-in. PVC
2. Eight 90° elbows
3. Sixteen 3/4-in. T's
4. PVC cement
5. PVC cleaner
6. Propane torch
7. Copper tubing to make iron
8. Nylon screen
9. Dowel rods (3/8 in. in diameter)
10. Table saw
11. Miter saw

Step 1.—Cut sixteen 12-3/4-in. pieces of 3/4-in. PVC.

Step 2.—Cut sixteen 1-1/8-in. pieces from the remaining 3/4-in. stock. These pieces will be used to connect the 3/4-in. T's to the 90°

angles. Only half of these 1-1/8-in. pieces will need to have slots cut through one of the two walls of the PVC (fig. 2C). The remaining 1-1/8-in. pieces will be used on the bottom of the litter trap. Before cutting the 1-1/8-in. pieces to size, cut a section of the PVC from which the smaller pieces will be cut later; it is easier and safer to cut the slots in the longer piece.

Step 3.—With the table saw, cut the slots in four of the 12-3/4-in. pieces (fig. 2C), the 90° elbows, and the T's (fig 2C). Cut the slots in only one-half of the 90° elbows and the T's; the remaining pieces will be used on the bottom of the litter trap. When cutting the 90° elbows, remember to cut the groove with the outside of the 90° angle facing upward (the openings facing down). When cutting the slots in the T's, lay the T on its side and cut across the straight portion of it (fig. 2C). After making all cuts, assemble the trap to make sure the slots are all aligned (fig. 2C).

Step 4.—After assembling the frame work, remove one of the sides. Make sure that only one of the upper 90° elbows stays with each of the four sides; this will allow for bag installation. Now, carefully clean and cement together one piece at a time, making sure that all of the slots are aligned (fig. 2C). Do this for the remaining three sides of your trap. **DO NOT** cement all four sides together!

Step 5.—Bond the nylon bag together in the same manner as in the flat trap. Cut one piece of screen, 76 in. x 14 in. This section of screen will make up all four sides of the bag including the sleeves for the dowel rods. Once the sleeves have been made and are holding the dowel rods (fig. 2B), it is a good idea to place the screen, sleeve, and dowels into the slots to check the fit before melting the screen together. After checking the fit, melt the ends together to form a square.

Step 6.—When making the bottom section of the basket, be sure to leave enough screen so that there will be at least a 2-in. overlap for a seam. The bottom section of screen should be approximately 22 in. x 22 in. Once this section of screen has been secured to the bottom of the basket, the litter trap assembly can be completed (fig. 2D).

The main reason we designed both the flat trap and the basket trap in this fashion was to create a sturdy, but light and collapsible structure that can be easily transported and stored. The traps are constructed from materials that will hold up for many years when used in the field. These materials are readily available but have not been commonly used for construction of seed traps. The use of PVC, in conjunction with a large assortment of angles, diameters, and differing lengths, makes these trap designs adaptable to many scientific needs and configurations.

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