

A Technique for Establishing Microplots in the Field¹

J. T. Johnson, J. R. Rich, and A. W. Boatright²

Microplots have been shown to be useful in studying the biological interactions of plant-parasitic nematodes and crop plants (1,3,4). They offer advantages of field growing conditions while allowing inoculation of plants or infestation of soil with known numbers of nematodes. Barker et al. (2), who were among the first in the United States to utilize large numbers of fiberglass microplots in nematological research, have

developed a tool, the M-cutter, for their installation. The M-cutter, however, does not perform satisfactorily in the deep sand of Northern Florida. These sands are poorly aggregated and cause excessive resistance to motion of the machine. We developed an alternative technique for inserting cylinders into the soil that is satisfactory for sandy soil and, with some modifications, would be acceptable for use on heavier soils. Our system uses water pressure to displace the soil in a 4-cm band on the perimeter of a 76-cm-d circle to a depth of 50 cm. We developed two tools for this purpose.

Small WJM-Placer: The small WJM-Placer (waterjet microplot) was constructed

Received for publication 30 April 1980.

¹Florida Agricultural Experiment Stations Publication No. 2415.

²Respectively, Associate Professor, Department of Agronomy, Assistant Professor, Department of Entomology and Nematology, and Ag Tech Supervisor, University of Florida, Agricultural Research Center, P. O. Box 1210, Live Oak, FL 32060.

to test our hypothesis that water could be used to insert cylinders into the soil. It has since proven useful for installing small numbers of microplots. The small WJM-Placer consists of a 1-m length of 12.7-mm-i.d. galvanized iron pipe connected to an external source of water via a 90° elbow and 3-m length 2.5-cm-i.d. flexible hose. The open end of the outlet pipe is crimped to increase the water velocity coming from a 7.6-cm-i.d. irrigation outlet. When using this WJM-Placer, the operator stands on a 76-cm-d circular piece of plywood (same diameter as the fiberglass cylinders). The water is turned on, and the operator repeatedly presses the pipe into the soil on the perimeter of the plywood circle. When the soil has been displaced to a depth of 50–60 cm around the plywood, a 76-cm-d × 60-cm-high fiberglass cylinder is inserted into the soil. A piece of plywood slightly larger than the cylinders is placed on top of the cylinder and sufficient pressure is exerted to force the cylinder into the water-saturated soil. The entire procedure requires approximately 30 min.

Large WJM-Placer: After determining that the technique was satisfactory, we developed a larger apparatus (Fig. 1) for faster, more uniform placement of the fiberglass cylinders. The large WJM-Placer consists of 12-9.6-mm-i.d. galvanized iron pipes 91 cm long connected vertically at equidistance points around the circumference of

a 76-cm-d circle to a 14-cm-i.d. central manifold by a 90° elbow (5.7 cm) and a 38-mm-i.d. connecting pipe (Fig. 2). The manifold is necessary to assure even water distribution to each of the 12 outlet pipes. Water is supplied to the manifold through a 3.2-cm-i.d. flexible hose connected to 7.6-cm-i.d. aluminum irrigation pipe. A circular disk of 3.2-mm thick sheet metal is welded to the upper surface of the connecting pipes to increase rigidity and support the manifold. The outlet pipes are braced 25 cm below the elbows by inserting the pipes through holes cut in a 5-cm wide circle of 3.2-mm thick sheet metal and welding the pipes to the hoop. The depth control component prevents the apparatus from sinking below the desired depth during operation and consists of a 30-cm high metal can attached to the lower surface of the larger disk (covering the manifold). Two 1.8-m × 9.6-mm galvanized iron rods are welded to the covering disk to serve as handles.

Placement of a fiberglass cylinder requires about 4 min; three individuals are needed, two for handling the apparatus and one for turning the irrigation valve on and off. A fiberglass cylinder is inserted in the WJM-Placer before turning on the water. With the WJM-Placer in the upright position, the water is turned on and the apparatus is rotated horizontally. Slight downward pressure is applied as the water loosens the soil. When the fiberglass cylinder has

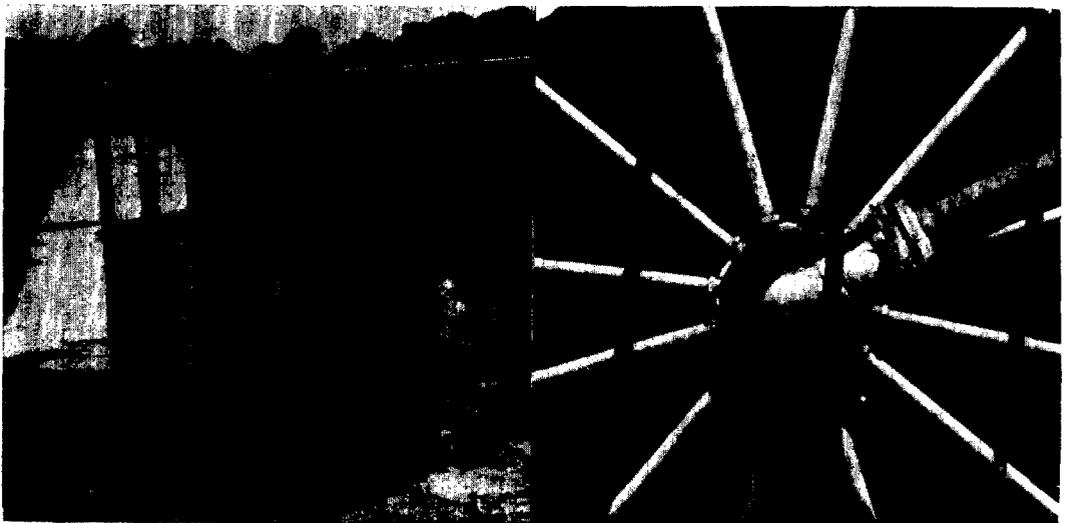


Fig. 1. Large water jet microplot placer with fiberglass cylinder ready for installation into soil. Fig. 2. Central manifold of large WJM-Placer and attached water supply elbow.

been inserted 50 cm into the soil, the depth control component contacts the soil and prevents further downward movement of the apparatus. The WJM-Placer is then lifted out. A small trench is formed on the inside and outside of the microplot and must be filled with soil.

Either WJM-Placer works well in deep sands and reasonably well in finer textured soils. In finer textured soils, however, more water outlets were found to be necessary. In layered soils some structural mixing occurs on the outer margins and on the soil surface, but this does not appear to be a major problem. The WJM-Placers are inexpensive to build and require no special equipment, but they do need an adequate high-pressure (4.2–5.6 kg/cm²) water supply for operation.

Assembling fiberglass cylinders: We use a flat clear fiberglass, (786 g/cm²) supplied by Lasco Industries of Montebello, California, in rolls measuring 15.2 m × 60.9 cm. The fiberglass is cut into 2.5-m lengths and four holes are drilled into each end at 15-cm spacings. The ends are then overlapped 5 cm and the cylinders secured by rivets. We constructed a mechanical cutter consisting of a 2.2-m × 0.9-m table with a bedknife, formed from angle iron, on one end. A curved knife blade formed from

scrap iron was attached to the table so that when the knife blade was pulled down it would pass within 4 mm of the bedknife. The knife is held in an upright position by a counterweight and is operated manually. The fiberglass rolls are mounted on a 90-cm length of 2.5-cm pipe and placed on an attachment which holds the roll horizontal to the table top allowing the fiberglass to be unrolled for cutting. The sheets may be stacked and the rivet holes bored with a power drill. The cylinders are placed one inside the other for storage until used. Three people can construct approximately 125 cylinders in 4 h.

LITERATURE CITED

1. Barker, K. R., and T. H. A. Olthof. 1979. Relations between nematode population densities and crop responses. *Ann. Rev. Phytopathol.* 14:327-353.
2. Barker, K. R., B. I. Daughtry, and D. W. Corbett. 1979. Equipment and techniques for establishing field microplots for the study of soil-borne pathogens. *J. Nematol.* 11:106-108.
3. Jones, F. G. W. 1965. Soil populations of beet ceelworms (*Heterodera schachtii* Schm.) in relation to cropping. II. Microplot and field plots results. *Ann. appl. Biol.* 44:25-56.
4. Olthof, T. H. A. 1978. Influence of population densities of *Heterodera schachtii* on sugarbeets grown in microplots. *J. Nematol.* 10:255-58.