determine the causes of poor uniformities. They also allow for identification of changes in design, installation, and maintenance which can improve water application uniformity. The above measurements are also necessary for efficient and effective irrigation system management. Field evaluation of the system should be conducted at least annually to monitor changes in system performance and to identify the needs for maintenance or repair.

Measuring Operating Pressures

It is important to monitor pressures at various critical points in a irrigation system. A well-designed and well-installed system will have permanent pressure gauges at the critical points such as the pump outlet, both sides of the filtration system, and at the inlet to each irrigated zone. They allow the system manager to monitor the performance of the system and help to pinpoint any problem in the system. For example, low pump discharge pressure may be the result of pump wear, insufficient impeller speed, excessive drawdown, or may be an indication of problems downstream of the pump such as broken pipe, too many zones running at the same time, or excessive discharge from the nozzles. These gauges should be checked periodically for proper functioning and replaced as needed.

Sprinkler Irrigation Systems

A sprinkler is designed to operate efficiently over a specific range of pressures, and its performance is reduced at other pressures. Excessive pressures produce very small droplets, resulting in fogging, irregular rotation, and higher water application near the sprinkler. Operating pressures that are too low produce a doughnut-shaped spray pattern with very little water near the sprinkler. The system uniformity will definitely be affected if sprinklers aren't operated within the range of pressures specified by the manufacturer.

Periodically, operating pressures within each zone should be tested to evaluate system performance. They can be measured at the sprinkler nozzles using pitot tube attached to a pressure gauge. The pitot tube should be placed about 1/8-inch from the nozzle and adjusted until the highest constant pressure can be read. This procedure is illustrated in Figure 1. Pressures should be recorded at various points of the irrigation zone with the close and distant sprinklers included in the test.

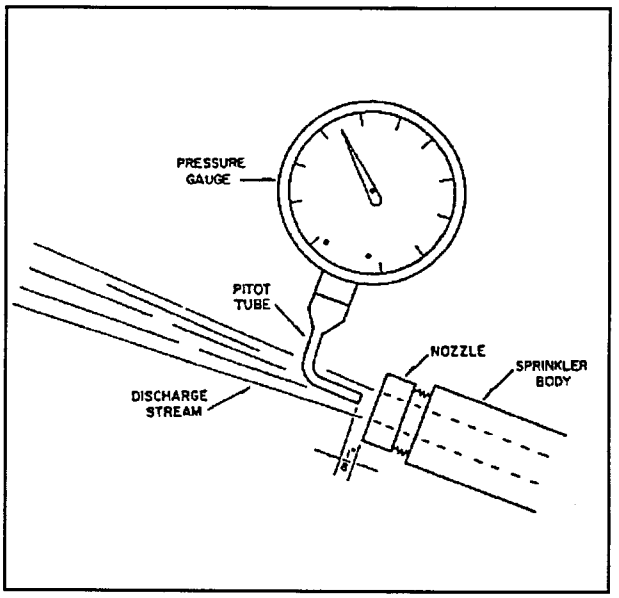

Figure 1. Using a pitot tube to measure pressure at a sprinkler nozzle.

Microirrigation Systems

Some microirrigation systems use pressure-compensating emitters or have pressure or flow regulation at the inlet to each lateral to minimize pressure variation throughout the system. However, most systems have pressure control only at the inlet to the manifolds and use emitters with flow rate dependent on the pressure within the line. In this case, large variation in pressure can have a significant impact on the uniformity of water distribution throughout the system.

Pressures can be measured using a portable pressure gauge equipped with a flexible tube and a fitting which allows replacement of an emitter with a gauge. The pressure distribution in the lateral line with a large number of emitters (more than 10) will not be significantly affected by blocking one emitter while the others continue to flow. Some portable pressure gauges are manufactured with a needle on a flexible tube for direct insertion into the lateral line. This method functions well for laterals constructed out of the heavier materials with the walls at least 0.04 inches thick, which are typically used in nursery systems. In these lines, the needle opening tends to close when the needle is removed. In addition, pressures should be measured at the inlet to the laterals and at the end of laterals to determine pressure drop along the lines.