further resolution is needed after seeing the results of the first samples analyzed. This reduces the amount of laboratory work and expense while ensuring that the nutrient concentration time series is available if desired.

Alternatively, if the operator is not concerned with the behavior of nutrient concentrations over time, sample load can be reduced by using a compositing autosampler. Individually collected samples can be composited in a flow-weighted manner by simply using flow records collected during the event and combining flow proportional amounts of sample from each bottle.

Finally, one can eliminate the collection of time sequenced samples by using a flow integrating composite autosampler. In this case, a single flow proportioned sample is collected during a drainage event using an appropriately configured autosampler.

In addition to sampling at the main pump stations, a grower may wish to sample water at points in the interior of a farm. Likely locations would be at discharge and inlet points to blocks of land dedicated to a particular crop. For example, ditches serving vegetable seedbeds or production areas, or rice fields, within a sugarcane farm would be ideal sampling sites. A schematic of a typical water quality monitoring arrangement for a hypothetical farm is shown in Figure 3. These water samples from sites internal to the farm would yield valuable information for establishing background concentrations and for making BMP or other crop management comparisons. They would, however, have little use if the only desire was to monitor composite farm discharges and inflows.

Drainage water nutrient concentrations vary through the year and with rainfall intensity (Izuno et al., 1990a) as was shown in Figure 1. Although there are definite rainy and dry seasons, drainage pumping can occur throughout the year. Hence, it is important to monitor nutrient concentrations over the entire year, not just during a few isolated rainstorms or drainage events randomly scattered or tightly grouped in time. In other words, collecting hundreds of samples during a couple of drainage events following major rainfalls during the peak of the rainy season, while ignoring drainage events during the dry season, will yield an erroneous picture of the nutrient concentrations in EAA drainage water. In fact, the error will generally be on the high side. Likewise, sampling during short drainage events during the dry season will not adequately characterize the farm nutrient discharge for the year. It is obvious that a comprehensive, well thought out monitoring program is mandatory to obtain accurate information.

Irrigation monitoring

While public attention is focused on the quality of drainage water, monitoring the quality and quantity of irrigation water is equally important. Area canals contain nutrients in concentrations that vary according to hydrologic and hydraulic conditions. A farm nutrient budget must account for how much nutrient enters a farm in irrigation to avoid misconceptions that all nutrients in farm drainage water originate on the farm. While fertilizer and mineralization are looked upon as obvious nutrient sources, irrigation water can contribute significantly to the nutrient input to the farm, especially since large amounts of water may be let into the farm during a year. In some cases, irrigation water is pumped or gravity fed into a farm and then pumped right back out when an unexpected rainfall occurs. Likewise, a farm may be drained in anticipation of a major rainfall and then irrigated when the rainfall didn't materialize or was of lesser intensity than expected. To obtain an accurate picture of a farm's net P balance and related nutrient loading problems, irrigation water should be monitored.

In many instances, the same installation used for collecting drainage water samples can be used for sampling irrigation events. If irrigation water is let into the farm at a point at or near the pump station, an autosampler located upstream of the pump station will suffice. A collection installation in the drainage pipe cannot be used for irrigation water sampling unless backsiphoning or reverse pumping is used for irrigation. Depending on the hydraulic arrangement at the inlet of the pump station with respect to irrigation and drainage facilities, a sampling station in the drainage inlet sump may or may not suffice.

Soil solution sampling

Sampling the soil solution, or water stored in the soil profile for nutrient analysis serves a unique purpose. Analysis of these samples can indicate the amount of phosphorus in the soil solution and whether it is increasing or decreasing under different BMPs imposed. This information is useful during BMP evaluation.