Discovery Farm Methodology

Monitoring objectives will document sustainable and viable farming systems. Evaluating this data will determine if the systems are cost-effective and environmentally sound. Specific objectives are to: 1) Conduct on-farm monitoring to assess the effectiveness of core and supporting practice adoption. 2) Provide on-farm verification and documentation of nutrient and sediment loss reductions and water conservation in support of implementing core and supporting practices. 3) Develop and deliver educational programs from information gathered on these farms that will assist agricultural producers in achieving both production and environmental goals while also supporting sustainable farming in Arkansas.

The most widely accepted approach to reducing nutrient and sediment loss from agricultural operations within a watershed is developing and implementing Conservation Practices (CPs) on a farm-by-farm basis. Edge-of-field monitoring will be conducted by the University of Arkansas’ Division of Agriculture under the Arkansas Discovery Farms Program to document the outcomes of core and supporting conservation practices on real, working farms in Arkansas. The program utilizes a unique approach based on agriculture producers, scientists, and natural resource managers working together to jointly identify issues and potential solutions as well as conduct outreach and educational opportunities. It shares the goals and objectives of the NRCS Mississippi River Basin Initiative, which provides a logical and strategic partnership in this effort.

Field Methodology

An operation reflective of typical farming systems will be utilized in the project as “Discovery Farm,” where edge-of-field monitoring will determine runoff volume as well as nutrient and sediment loss from a minimum of three sites where specific conservation practices are installed and with a fourth untreated site acting as a control. The CPs that will be evaluated are specific to the particular farm and the needs of the farmer. Field, farm, and watershed level response to conservation practice implementation can take several years to be fully manifested. Thus, we plan to monitor the sites for a minimum of 5 years to ensure that reliable water quality response changes can be documented. Specifically, monitoring at each site will be comprised of runoff and water
flow measured by strategically located gauged flumes or weirs, along with auto-samplers to collect water samples for analysis of nutrients, and sediments during flow — runoff events. At each field site, surface runoff water leaving a field will be measured at existing discharge points, such as outlets or standpipes already in place as part of the field management and drainage operation. These pipes accumulate runoff water leaving a field to one point where we can continuously measure flow volume and rate by automatic stage height and transducer equipment (see Photos 1 and 2). Where no such outlet exists, we construct berms at predetermined positions to direct surface runoff to a single collection point, where we install a flume or weir, depending on the size of the field drainage area and potential receiving water volumes; to continuously measure flow volume and rate as above (see Photos 3A-B).

At each field outlet site, an automatic water sampler (ISCO) is installed to collect runoff samples at predetermined intervals during a discharge event (see Photos 4A-B). A sample is collected on a unit flow basis, such that a composite flow-weighted sample for the whole discharge event is obtained. This sample is collected from the auto-sampler within 24 hours for determination of nitrogen (N), phosphorus (P), and sediment concentration, as described below.

For row crop situations where irrigation is utilized, irrigation inflow will be measured with in-pipe flow meters to determine application rates and cumulative irrigation volume.

Analytical Methodology

Soil Sampling

Soil samples are collected at a depth of 4” each spring according to the University of Arkansas System Division of Agriculture recommendations (Daniels et al., 2005); or if need dictates, grid-soil sampling. A sub-sample will be taken for analysis. Samples can be held indefinitely once thoroughly mixed and air-dried. Samples are delivered to the University of Arkansas Soil Testing Laboratory where they will be analyzed. Analysis includes Mehlich-3 soil test P at the standard 1:10 extraction ratio. Mehlich-3 extractable P is determined by shaking 1g soil samples with 10ml of 0.2M CH₃COOH, 0.25M NH₄NO₃, 0.015M NH₄F, 0.013M HNO₃, and 0.001M EDTA for 5 minutes (Mehlich, 1984), filtering, and analysing the extract for P by ICP.

Soil Sample Handling Protocols

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Container</th>
<th>Volume</th>
<th>Preservative</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mehlich-3 (1:10) soil test P</td>
<td>Paper box (new)</td>
<td>1 Pint</td>
<td>Air dry within 2 days and store at room temperature</td>
</tr>
</tbody>
</table>

Runoff Water Samples

Data pertaining to time of sampling, length of sampling, flow rate, and volume of runoff is downloaded from each automatic water sampler. Notes are made of anything that might be useful (water smell, color, clarity, etc. — these notations are for research purpose
Any failures to sample due to problems should be recorded in the logbook. Downloaded data from each sampler are transferred to the PC of the co-principal investigator. Information is sent to the principal investigator to provide a backup of the recorded information.

ISCO water samplers are programmed to deliver a composite water sample into a clean, acid washed polyethylene bottle. Water samples are then placed in clean, acid washed polyethylene bottles with caps and labeled with site number, date, time and collector’s name and transferred as quickly as possible to the certified laboratory. Samples for dissolved P, nitrate-N and ammonia-N are filtered through a 0.45 μm membrane into a sterile glass vile and stored at 4°C in the dark along with unfiltered samples, within 24 hours of collection. Dissolved P, nitrate-N, and ammonia-N are determined colorimetrically by standard US EPA methods. Total N and P are determined by the same colorimetric methods after Kjeldahl digestion of an unfiltered water sample. Particulate P is calculated as the difference between total and total dissolved P. The suspended sediment concentration of collected runoff water samples is determined gravimetrically, as the difference in weights between oven-dried (105°C), unfiltered and filtered samples.
Four monitoring stations assess the benefits of winter cover crops on our row crop Discovery Farm in Atkins, Arkansas.

References