



Best Management Practices (BMPs) and Water Quality Parameters of Selected Farms Located in the Arroyo Colorado Watershed



Agriculture in the Arroyo Colorado Watershed

Excess water from various landscape activities in the Lower Rio Grande Valley are drained through the Arroyo Colorado eventually emptying into the lower Laguna Madre. The Laguna Atascosa National Wildlife Refuge and several county and city parks are located within the Arroyo Colorado watershed. The watershed is also the habitat of several semi-tropical plants and animal species. The Arroyo Colorado also boasts many recreational opportunities and attracts a large number of tourists annually. Agriculture, municipal and industrial activities are all contributors to water quality issues and impairments in the Arroyo Colorado watershed. The main concern coming from agriculture are chemicals such as fertilizers and pesticides that can be carried with the irrigation water through runoff and deep percolation. Agricultural producers can improve the water quality of the Arroyo Colorado by implementing best management practices (BMPs) that reduce nonpoint source (NPS) pollution from agricultural lands. Several demonstrations, one further described below, have been

developed since 2006 to characterize the water quality of irrigation and runoff water and to evaluate the effectiveness of BMPs on water quality at the field and sub-watershed level. These activities have been conducted in an effort to implement the Arroyo Colorado Watershed Protection Plan and achieve its goals of reducing pollution from various sources, one of those being agriculture.

Objectives

One of the main sources of pollution are the nutrient loadings from agricultural runoff and leachates; therefore, a study focused on identifying the effect of agricultural management practices on NPS pollution from surface irrigated farms in the Arroyo Colorado watershed was initiated. The objective of the study was to obtain water quality information (parameters including: total dissolved solids, nitrates and nitrites, orthophosphate phosphorus, total phosphorus, and total Kjeldahl nitrogen) of irrigation water runoff and groundwater in six agricultural fields during the 2009 and 2010 growing seasons.

BMPs Implemented at Demonstration Sites

- Crop rotation
- Crop residue management
- Nutrient Management
- Pest Management
- Irrigation Land Leveling
- Irrigation Management
- Irrigation with poly-pipe
- Subsurface drainage
- Vegetation filter strips



Figure 1: Irrigation poly pipe utilized during an irrigation event

Best Management Practices (BMPs) and Water Quality Parameters of Selected Farms located in the Arroyo Colorado Watershed

Results

The predominant irrigation system in the Lower Rio Grande Valley is surface irrigation. The primary BMPs adopted by irrigating farmers in the Arroyo Colorado watershed are conservation crop rotation, irrigation land leveling, the use of poly-pipe and nutrient management. During this project only one site had filter strips at the lower end of the rows which received irrigation runoff. The main results of this study are listed below.

1. The results indicated that the irrigation water already contained high concentrations of nitrates, nitrites, orthophosphates, total phosphorus and total Kjeldahl nitrogen. Also, these concentrations varied from irrigation to irrigation.
2. The gains of nitrates, nitrites and total Kjeldahl nitrogen loadings from the fields were small. The activity that resulted in the highest influence on nutrient loadings was the amount of runoff. This could be reduced through improved irrigation management.
3. Nutrient loadings due to orthophosphates and total phosphorus were extremely low for all sites during both years, and these loadings were also influenced by the amount of runoff. High total dissolved solids could have resulted from higher furrow flow-rates that produce increased erosion and transport of sediments. These higher flow rates also result in higher nutrient loadings of orthophosphates and total phosphorus. The use of poly-pipe can reduce erosion, facilitate irrigation management and may have an influence on orthophosphates and total phosphorus.
4. The nutrient values within groundwater fluctuated from year to year and from irrigation to irrigation, but they were generally low. The few sites that had nutrient management implemented as a BMP were the sites that had some of the lowest nutrient values in groundwater.



Figure 2: Runoff resulting from an irrigation event being measured.

Recommendations

Producers can implement multiple BMPs to protect the water quality of the Arroyo Colorado. The combination of multiple practices can create a greater impact of nutrient reductions to the Arroyo Colorado. Some practices such as land leveling with some grade and the use of poly-pipe facilitate irrigation management and thus, have an impact on improving yields and profits. The two BMPs that reduced nutrient runoff the most were nutrient management and irrigation management. Nutrient management typically consists of applying fertilizer at a specific rate according to a soil analysis test. Irrigation management includes controlling the total amount of water applied to the land focusing on using non-erosive flow-rates, thereby reducing runoff.

This project was funded by a Clean Water Act §319(h) grant through the United States Environmental Protection Agency administered by the Texas State Soil and Water Conservation Board.



Texas Water Resources Institute EM-113