ADEQ
Arizona Department of Environmental Quality

RESOURCE SUMMARY

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Pollution Prevention (P2) for the Agriculture Industry

Agriculture and Economy

The agriculture and farming industry is an important contributor to rural Arizona's economy, accounting for over $17 billion to the state's output[1] and retention of over 80,000 jobs.[2] However, this industry places some of the highest demands on the environment's natural resources, such as water and soil. As the population grows and more food is required, proper management of these resources will become increasingly critical. P2 measures enable both a reduction of environmental impacts in the sector, as well as cost savings to the producer.

Prevention of Surface and Groundwater Contamination

Applying excess nutrients to soil can result in unnecessary costs and potential surface and groundwater pollution. This can be prevented through regular soil sampling to gauge soil fertility levels and enable cost-efficient, sustainable decision making.

Proper soil nutrient levels can be maintained by applying nutrients in accordance with the result of each soil test, which leads to increased crop yield, reduced production costs through less waste and prevention of surface and groundwater pollution at the source.[3] The National Resources Conservation Services (NRCS), under the US Department of Agriculture, provides a comprehensive Nutrient Management Plan,[4] with detailed steps on the soil sampling process including ways to analyze and make decisions based on findings, individualized to all 50 states.[5] This enables managers to efficiently utilize nutrients at the inception of use, thereby eliminating the need to remediate excess nutrient runoffs.

Reduce Nonpoint Source Pollution

Agricultural nonpoint source pollution has proven to be the leading source of water quality impacts on tested rivers and streams, and significantly impacts various other groundwater streams.[6]

Nonpoint source pollution is an indirect form of water contamination. It occurs via rainfall or snow melt that carries pollutants from the source, over and through the ground and deposits them in waterways. The contaminants in the runoff accrue over time, eventually depositing into lakes, rivers, wetlands and other water sources.[3]

There are many steps that can help reduce the production of nonpoint source pollution respective to the agricultural sector:[7]

- Proper disposal of oil and chemicals that are used on site.
- Water quality assurance in regards to interaction with livestock. One of the best ways to do this is to block livestock animals from directly accessing streams, rivers and other water bodies.
- Reduction of sediment run-off from fields.
- Reduction of nutrient and fertilizer run-off from fields.
- Promulgation of riparian corridors (buffer zones between land and stream).

Reduce GHG Emissions through Proper Manure Application

The three main greenhouse gas (GHG) emissions in the agriculture sector are methane, nitrous oxide and carbon dioxide. Livestock manure accounts for the majority of methane and nitrous oxide emissions. However, manure is a very valuable resource, nutrient-rich and an excellent soil amendment to bolster quality, tilth, and productivity, thereby reducing the need for additional soil fertilizers.

Proper processing of manure prior to land application can significantly reduce GHG emissions.[8] Digesting and/or composting manure are preferred first steps in manure management systems, with the resultant methane gas captured and potentially used as a fuel source. The EPA[9] and National Center for Biotechnology Information[10] provide ample information on the correlation between manure management and resultant GHG emissions.

Over-application of manure could result in increased non-point source pollution, extreme care should be taken when

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applying any type of manure (solid, liquid, slurry).

Soil Conservation

Integrating all other soil-related management techniques, protecting soil vitality is critical in maintaining productive land, preventing non-point source water pollution via sediments, and reducing air pollution from wind erosion.[11] It is less costly to prevent the generation of polluted runoff than it is to treat and mitigate it. There are various methodologies available to best conserve and prolong soil health. Best management practices (BMPs) that focus on holistic techniques such as cover crops, conservation tillage, irrigation efficiency, contour farming and agroforestry reduce non-point source pollution from agriculture.[12] Conservation tillage,[13] for example, is a method of soil cultivation that leaves previous years' crop residue on fields before and after planting the next crop; the extra insulation reduces soil erosion and runoff, bolsters carbon sequestration in the ground, and makes ideal utilization of leftover crop residue, thereby decreasing any efforts needed to otherwise dispose of it.[14] Conservation buffers are small areas or strips of land that are designed to intercept potential pollutants and sediments that may otherwise move into nearby surface waters. Irrigation efficiency is not only sustainable, but also reduces expenditures, due to reducing water utilization at the source. A farm in Central Arizona exemplifies creative practices undertaken in order to conserve water in irrigation.[15]

Integrated Pest Management

Chemical pesticides are frequently used, however, effective pest control methods through the use of integrated pest management (IPM) significantly reduces the amount of chemical pesticides dispensed into the environment. IPM is a comprehensive methodology of long-term pest control using ecological knowledge of pests and the environment to suppress pest populations below economic injury level

(EIL). EIL refers to a threshold of the smallest number of insects (amount of injury) that will cause crop yield losses equivalent to the insect management costs.[16] There are four main types of controls.

Biological controls — use of natural repellents or predators to reduce pest population.

Cultural controls — changes in farm operation which reduce likelihood of pest outbreak. For instance, more efficient irrigation systems can lead to less pests, since overwatering can result in weed growth.

Mechanical and physical controls — physical methods to either directly kill a pest (like rat traps), block a pest from entering the farm (mulches for weeds), or make the area inhospitable.

Chemical controls — the use of pesticides. These should only be used after the other controls have been exhausted. For more information visit University of California's IPM page.[17]

Biopesticides

Biopesticides are specific types of pesticides derived from animals, plants, bacteria and certain minerals.[18] *Bacillus thuringiensis*, for example, is a bacterium that produces proteins capable of starving insect larvae. The gene responsible for producing that specific protein can also be incorporated into plant genetic material, termed Plant-Incorporated-Protectants (PIPs).[19] Generally less toxic than synthetic chemicals, biopesticides aim to only affect targeted pest populations due to their specific formulations, as opposed to other, broad-spectrum methods that may have more amplified effects on surrounding birds, insects and mammals. Biopesticides can significantly reduce the use of traditional chemicals in favor of less toxic approaches, making it a component of IPM.

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References

[1] Arizona Department of Agriculture. *Annual Report FY 2016.*
[2] University of Arizona. *Agriculture in Arizona's Economy: an Economic Contribution Analysis.*
[3] EPA. *Nonpoint Source: Agriculture.*
[4] NRCS. *Comprehensive Nutrient Management Plan.*
[5] NRCS. Field Office Technical Guide County Locator.
[6] EPA. *Water Quality Assessment and TMDL Information.*
[7] Indiana Department of Environmental Management. *What You Can Do to Reduce or Stop Nonpoint Source Pollution.*
[8] Extension. *Reducing or Mitigating Greenhouse Gas Emissions in Animal Agriculture.*
[9] EPA. *Animal Feeding Operations (AFOs) -- Manure Nutrient Management Technologies.*
[10] Peteren, S.O., et al. *Manure Management for Greenhouse Gas Mitigation.*
[11] National Soil Erosion Research Laboratory. *Wind Erosion.*
[12] The Nature Conservancy. *Agricultural Best Management Practices.*
[13] Conservation Technology Information Center. *Conservation Tillage Photos and Graphics.*
[14] Janssen, C. and Hill, P. Purdue University. *What is Conservation Tillage?*
[15] Russell-Sluchansky, Carmen. National Geographic. *Young Farmer Saves Water in Innovative Ways.*
[16] University of Nebraska. *The Economic Injury Level and the Economic Threshold in IPM.*
[17] University of California. *What is IPM?*
[18] EPA. *Biopesticides.*
[19] EPA. *What are Biopesticides?*

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