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A Meta-Analytical Approach for Determining the Effectiveness of Agricultural Best Management Practices for Reducing Nutrient Pollution in Florida, Phase 2: Meta-Analysis of Cow/Calf Operations, Vegetable Crops, and Agronomic Crops

February - December 2015

Client: Florida Department of Agriculture and Consumer Services

Project Summary

The Florida Department of Agriculture and Consumer Services (FDACS), Office of Agricultural Water Policy (OAWP), contracted with Frydenborg EcoLogic to conduct a meta-analysis of over 300 publications that contained information on Florida-specific agricultural BMPs. Frydenborg EcoLogic synthesized the quantitative evidence associated with the effectiveness of the DACS agricultural BMPs for reducing nutrients from agricultural operations to off-site environmental media (soils, groundwater, and surface water) in Florida. The meta-analysis demonstrated that there were no statistically significant BMP effects for either nitrogen or phosphorus for the cow/calf operations, likely due to the small number of studies included (four) and relatively low absolute value of nutrients associated with cow/calf operations. For agronomic crops, BMPs provided a statistically significant reduction in nitrogen (equivalent to an average of 60% reduction compared to using no BMPs) but no significant reductions in phosphorus (there were only two agronomic studies that measured a phosphorus response). For vegetable crops, BMPs provided statistically significant reductions in both nitrogen and phosphorus (equivalent to average reductions of 66% and 35%, respectively), compared to using no BMPs.

Innovative Approach

Effect Size [95% CI] Study: BMP Woodard et al., 2002a; controlled release and low rate (exp 5) -3.01[-3.92,-2.11] Woodard et al., 2002a: controlled release fertilizer high rate (exp 3) -2.32 [-2.94 , -1.70] Zotarelli et al., 2008a: irrigation (exp 1) -1.81 [-1.95 , -1.67] Woodard et al., 2002a: controlled release fertilizer low rate (exp 4) -1.58 [-3.07 , -0.09] Woodard et al., 2002a; fertilization rate (exp 1) -1.40 [-2.49 , -0.32] Schaffer et al., 2001: fertilization rate (exp 1) -0.77 [-1.98 , 0.43] Woodard et al., 2002a: fertilization rate (exp 2) → -0.60 [-1.72 , 0.52] IFAS and SRWMD, 2008; irrigation and fertilizer rates (exp 3) ■ -0.15 [-0.22 . -0.08] Potter et al., 2005: cover crop (exp 1) --- -0.10 [-0.91 , 0.71] IFAS and SRWMD, 2008: irrigation and fertilizer rates (exp 1) -0.02 [-0.49 , 0.45] IFAS and SRWMD, 2008: irrigation and fertilizer rates (exp 4) • 0.04 [-0.39 , 0.48] -1.04 [-1.67 , -0.40]

Agronomic BMP non-aggregated effects on Nitrogen

Meta-analysis is a method for systematically combining pertinent data from studies meeting predetermined inclusion criteria, generating conclusions with greater statistical power than the individual studies. This type of analysis had not previously been attempted for Florida agricultural BMPs.

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Log Ratio of Means