



DELAWARE DEPARTMENT OF
AGRICULTURE

2320 SOUTH DuPONT HIGHWAY
DOVER, DELAWARE 19901
AGRICULTURE.DELAWARE.GOV

TELEPHONE: (302) 698-4500
TOLL FREE: (800) 282-8685
FAX: (302) 661-7036

Monday, April 15, 2019

Timothy Sexton
Expert Panel Chair
Virginia Department of Conservation and Recreation
600 E Main St. 4th Floor
Richmond, Virginia 23219

RE: Irrigation Expert Panel Report

Tim
Dear Mr. Sexton,

The following is a list of comments on the report titled "Recommendations of the Best Management Practice (BMP) Expert Panel for Cropland Irrigation". These comments exclude edits made to the final draft document and were made by Delaware Department of Agriculture Nutrient Management Administrator Chris Brosch (CB) and University of Delaware Associate Professor and Extension Specialist Dr. Amy Shober (AS).

- The report both dismisses (p16) and embellishes (pp16-25) the relevance of mid-west research studies as a proxy for CBW effects for irrigation. As the report states, the ubiquity of irrigation in the mid-west limits the applicability of the results to our region and systematically limits the comparison to dryland production, which for the CBW is a baseline condition. These papers, rather than be categorically summarized and cited, should merely be referenced as the independent variables are insufficiently similar to CBW to influence the report's findings, again stated on page 16 of the report.
- The term of baseline conditions are used interchangeably to refer to regional agriculture status quo, model conditions without a BMP, irrigation system parameterization and soil moisture/background N levels.
- The report should diligently list for all studies whether antecedent groundwater (used as irrigation) nitrate was measured, reported or corrected for when considering the nutrient use efficiency of irrigated crops compared to dryland acreage. Also reported consistently should be the method by which irrigation rates were determined.
- The final version of this report, perhaps inadvertently, largely ignores the other major pathway for nutrient loss, overland flow. This component should be carefully considered and added as a parameter for rating irrigation. Improper sprinkler irrigation can promote overland loss according to newly cited research presented in these comments and some measure was taken to better incorporate this concept in the marked up report.
- The report's scientific literature review mixes approaches for assessing nitrogen benefits on irrigation. Nitrogen use efficiency (NUE) is a proxy for the reduced leaching or overland flow of

nitrogen, and measured soil nitrate below the root zone is an acceptable direct measure for leaching loss. These approaches for effectively measuring an irrigation treatment would rarely if ever be mixed and the report should consider them separately. The comingling of approaches may have resulted in confusion when searching for effectiveness because no study reviewed had both.

- Additionally, Delaware would like to reiterate, commensurate with the BMP Expert Panel review protocol, modeling exercises can be used to justify the benefit of a BMP where peer-reviewed or unpublished data fail to provide a reliable estimate. The CBPO submitted version of this report states that there was not sufficient science-based evidence to indicate a reduction (p16). While we believe there is this evidence, as presented in this letter, further simple model experimentation calculating N savings as prevented loss of N from drought induced underperformance in cropland under regional nutrient management can be cited as evidence for an efficiency so long as it is weighted less than other local, science-based research. Delaware expects that this effort be undertaken either by this expert panel or by a new expert panel before a final report be approved without an efficiency estimate. This effort is endorsed by the BMP EP Protocol and there is no justification in this report why such an exploration was not attempted by this panel.
- Degree-earning research is recommended by Delaware reviewers as references to be subsequently and natively added to this report. The suggested 15% nitrogen efficiency, justified by Soroka (2015), has been added in a red-line review of the report, but the Panel is the only body empowered to dictate a summary of the newly provided research in the appropriate sections of the report.

Included as an attachment to this letter is an itemized summary of comments from the two named reviewers to facilitate the Expert Panel's response. Delaware hopes concurrence of the suggested changes can be accommodated by the expert panel and is dually supportive of on-going research to continue to justify the water quality benefits and limitations of this practice. The comments, suggestions and concerns raised in these documents shall in no way diminish the effort of the Expert Panel convened to tackle this scientific question.

Thank you,



Chris Brosch

C: Jason Keppler, Matt Monroe, Jeremy Hanson, Loretta Collins, Alexandra Wagner

Attachment A: Summarized tracked changes

Page 3 CB: Various edits for clarity and substance.

Page 4 CB: Various edits for clarity and substance.

Pages 7-9 CB: Rewrote Key terms, definitions and concepts section.

Page 12 CB: Formatting

No reference cited

Where is the mention of dryland as a baseline condition?

It appears as though baseline conditions, as a term, is being misapplied here. The baseline condition in the model is dryland acres, and as the preamble indicates, just for corn. Is the point here that elements of the irrigation system for which credit be given need to be constrained based on certain criteria? If so, this should be articulated and examples be given.

Page 13 CB: Text insert.

Page 14 CB: Text insert.

Shouldn't some context about why DE, MD and non-CBW NY be given here? I would say it is fair to assume soil type and vegetable crops are what cause these three states to float up to the top among those in the Bay.

Page 15 CB: Formatting.

Pages 18-20 CB: Deleted former Key terms, definitions and concepts section.

Page 21 CB: Where does this threshold come from? Consider striking. The true limitation is research not "available" acres.

What is the purpose of this statement? It is in reference to the SOW related to the design of irrigation systems? Certainly the emphasis is on water quality and nutrients from sprinkler irrigation. Is this type of irrigation not specific enough to be the litmus test for applicable literature?

Various edits for clarity and substance.

Page 22 CB: Various edits for clarity and substance.

This paragraph starts describing the means for calculating an efficiency and then changes to describing difficulty identifying measured leaching. These are disparate strategies for scientifically detecting a difference in N transport from cropland. DE expects that this effort be undertaken either by this expert panel or by a new expert panel before a final report be approved without an efficiency estimate. This effort is endorsed by the BMP EP Protocol and there is no justification in this report why such an exploration was not attempted by this panel.

Page 22 AS: Cited in this report? Or available in the literature?

Or could be because they over irrigated or applied too much fertilizer?

Page 23 CB: Consider Soroka thesis and cited Sims' papers for this section. They should have been considered.

DE would submit that the Hana dissertation be cited here with the benefits to leaching measured in his modeling study.

Various edits for clarity and substance.

Page 24 CB: Various edits for clarity and substance.

1. Not identified as Nebraska research; 2. Implied to be Delmarva research with parenthetical uncited claim; 3. study compares treatments of insufficient irrigation to over-irrigation and this treatment scheme does not support the claim; 4. is not relevant to CBW without a dryland pseudo-control. In this study grain yield and N uptake were not significantly affected. This is not applicable research to the Delmarva or the SOW of this report.

- Page 24 AS: James Adkins had a SARE project where they evaluated a lot of irrigation systems on Delmarva. I believe he reported that systems typically applied 85% of what farmers thought they were applying. So unless they have their system checked, they likely apply less water than they thought. That doesn't mean that they don't still over irrigate, but it's a point you can make.
- Pages 24-28 CB: This summary and several that follow are well noted in their applicability! Unfortunately, like Hergert, the relevance is extremely limited to Delmarva and should not be considered due to a lack of dryland baseline or control.
- Pages 28-29 CB: This does not contribute to measuring the benefit of irrigation management as a BMP and should be considered as an Appendix since it was not considered in the SOW. Additionally, the studies cited are all of poor applicability to the Delmarva conditions.
- Page 28 AS: See my note earlier that James' work suggests that most growers are applying less water than they think. This might be the most relevant of the reviewed studies in this section
- Page 29 CB: Soroka thesis should be considered to be summarized here as well.
- Page 29 AS: To some extent the Sims and Leathers (2012) report also discusses yield consistency. I think Alex elaborated on it though. Both of these reports have cited literature that may be relevant. See section 1.4.4 in the Soroka thesis (Irrigation Effects on Corn Yields and NUE) MD variety trial data may also show some of the same yield stabilizing trends that we saw in DE. I think Jason Wight is the one you should talk to get data from them, if you want it. I couldn't find information quickly on their website.
- Page 31 AS: So I don't really follow the logic here. We still apply on a "per acre" basis, with the rate based on the yield goal (i.e., a crop with 150 bu/ac yield goal would receive 150 lb N/ac). MN uses the maximum return to N approach, which factors in economics and yield response across regional field trials. So yield is indirectly included here, as regionally, soils and yields are expected to be somewhat similar. But they did see improvements in yield with the higher irrigation rates? Was this the 33%? This section is confusing and is lacking in the detail that would be relevant. What was the residual soil N follow corn with high irrigation vs dryland?
- Page 31 CB: Replacement wording. This evidence needs to be converted to common units with the Nebraska research to be compared in this way. As presented this is apples and oranges.
- Page 31 AS: I disagree with this statement. This is only true if the 40 lbs of N was all applied at a time that the crop can utilize N. Later in the season, N applications will not contribute to yield. Would reducing N application by 40 lbs result in not enough N during the period of rapid N uptake?
- Page 33 CB: Various edits for clarity and substance. Surely these studies can be grouped with the NUE, WUE, yield consistency and Water quality sections in the preceding review for consistency and placed in such a way to emphasize their relevance. So much of the synthesis of other research should be pulled out or recompiled in an appendix. Additionally, the Soroka thesis, cited Sims papers and Hana dissertation would fit in this section were it to remain.
- Page 33 AS: Various edits for clarity and substance. Sims and Leathers (2012) report show trends in weather from 1970 to 2011.

For the different irrigation treatments, they all got sidedress applications, I believe. In-season application was applied as none, sidedress, or fertigation for the N fertilizer trials. There are two studies.

N rate was only varied for irrigated treatments. The non irrigated control and the irrigated N treatments that can be compared only received manure and starter P or no N.

I think I would move this back where it was.

Page 34 AS: 2016 data was not identified in my report. It was there, but I didn't state "in 2016" explicitly. I need to revise and update the report.

I also converted to English units if that helps anyone.

I had to make significant changes here. I revisited the report and realized that the writing was not clear. Upon reviewing my statistics, it was clear that our work was misrepresented in the original report text.

What was missing was the fact that irrigation improved NUE in 2 of 4 years when compared with the non-irrigated control.

All plots had relatively low ef values and high UAN. Irrigation sometime resulted in higher ef and lower UAN. Never was the amount of N subject to losses significantly lower in the non-irrigated control compared to irrigation treatments. As such, claiming that 40% or more of the N available to crops under irrigated conditions IGNORES the fact that the same was true under non-irrigated conditions. And sometimes the non-irrigated conditions was WORSE than then irrigated treatments.

I also took out the discussion of the N rates. This was a completely different study (part of the main project, but different objectives). Irrigation vs. non-irrigation was only evaluated under 1 N rate.

I don't know how I missed this the first time around.

This is not a valid statement. There was an error in translation from my data file to the report and the values were backward.

First of all, you can not know if the results are statistically different because there was no replication.

Page 35 AS: This was moved below.

Page 36 AS: Chris' original comment. "Amy, please confirm this re-write. It appears as though the interpretation they made does not match your subsequent explanation to me, so I made the text match my understanding."

I found an error in my report and therefore I rewrote this section again, with your edits in mind.

Page 37 CB: Was this measured and not found or not measured?

This evidence supports an efficiency. The SD difference of 18 could be considered the improved stability and translate to a commensurate NUE improvement. This estimation should be performed on the CP measurements and those measurements should be presented if possible.

Pages 43-44 CB: Formatting, various edits for clarity and substance.

Page 45 CB: Outside scope. Panel should assume NM and proper irrigation management because, like NM, proper management of water is a cost savings to the farmer. No economic reports were summarized.

Formatting, various edits for clarity and substance.

Page 45 CB: Various edits for clarity and substance.

