4-1-2024

A review of: *Optimized fertilization using online soil nitrate data*

By Yekutiel et al.

Summary and Recommendation

The manuscript describes a pioneering field trial of a new, relatively accurate, soil-nitrate-sensor (SNS) that can measure nitrate concentration in the soil porewater continuously. Soil nitrate was monitored at 3 depths (20, 40, 60 cm) under plots of 2 treatments: 1) prescheduled irrigation and nitrogen (N) fertigation recommended for intensive growing of bell-pepper in greenhouse in the arid Arava Valley (including saline irrigation water and course texture soil); 2) fertigation (and irrigation) was adjusted according to the online porewater-nitrate readings in a trial and error fashion (no controlled algorithm). Yield was non-significantly higher in the adjusted treatment # 2, nevertheless, N application was 38% smaller and nitrate deep leaching 30% smaller in the adjusted treatment 2. These results are promising for future controlled monitored algorithms of N application which will reduce the environmental impacts of intensive agriculture.

The description of the monitored data of the SNS and the potential agricultural and environmental positive impact that such controlled systems can achieve makes the manuscript very attractive for growers, water resources managers, soil scientists etc. The pre-matureness of the controlled field application of the system described here (no algorithm) does not reduce much for this pioneering work. Therefore, I recommend publication following moderate revisions suggested herein.

Major Comments

1) It is much easier for agricultural related nitrogen discussions to use the N, NO3-N, NH4-N concentration convention rather than the NO3 molecule. I recommend to use the 4.43 factor for nitrate and convert all nitrogen species concentrations to N concentrations.
2) The terminology of "eliminating" nitrate leaching or groundwater pollution is inappropriate in any setup of intensive agriculture on earth's soil (rather than soilless media). We can reduce and even reduce tremendously but not eliminate leaching.

Specific Comments

1) P2L4, "eliminate" see major comment 2
2) P3L20 see also Levy et al., 2017, Hydrol. Earth Syst. Sci., 21, 3811–3825
3) P6L5 potential evaporation of 4400 mm/yr sounds too high, more in the area of 2000-2500 from what I know, check.
4) P9L1-4, I assume the multiple regression results in a predicted nitrate concentration (Y) in the form of: Y = a1x1 + a2x2 + a3x3 … (no + signs in the text).
   It would be much better to write the regression model explicitly. What are the 7 adsorption wavelengths predictors? and their coefficients.

5) P10L8, delete" at the three points"
6) Figure 3a – missing legend, what color is what depth?
7) P10L15-16, 106 mg/l nitrate or 106 mg/l N? check
8) P15L32 "equivalent to ~50 ppm m2 day" unclear, perhaps 50 mg/m2/d?
9) Figure 5, concentration in what depth?
10) P16L11-20. I assume the total yield reported is the mean of 8 plots in each treatment (T test answers the question: is the mean of the 2 populations (replicas of the each treatment here) is significantly different?). A table with the statistics of all yield variables (total, high quality, etc) and leachate including (# of replicas, mean, StD, P(Tsest) of each pair (control, experiment) would be a much better presentation of these results.
11) P17L21-30, show the difference in leachate is significant (Ttest), and non significant difference for leaching fraction. Consider all in 1 table together with yield results as suggested in comment # 10.