Impact of lawn fertilization on water bodies

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Introduction

- Blue-green algae increasing in Québec lakes
- Some municipalities have adopted by-laws to limit (or ban) turfgrass fertilization
- By laws are not based on scientific knowledge or sound agronomical practices

Introduction

- Municipality of Lac-Mégantic by-law 1426
  - ✓Natural fertilizers only
  - ✓Only 1 application allowed /year, between May 10th, and June 10th
    - ➢No rate splitting
    - ➢Cool soil not efficient to release nutrients from natural fertilizers
  - ✓No more than 10% N, 3% P, and 6% K
    - ➢No limit on fertilizer amount

Introduction

- Turfgrass is very efficient to intercept and use nutrients
- Nutrients recycling in turf is high
  - ✓Clippings management
- Important organic matter accumulation under turfgrass

(Falk, 1976; Dittmer, 1938; Beard and Green, 1994)

Introduction

- Nutrient losses from fertilized turf are generally not different than losses from unfertilized turf
  - ✓ In some cases, losses from unfertilized turf are higher
    - ➢ Less density -> more runoff
    - ➢ Erosion
- Losses from turfgrass are generally lower than Québec potable water criteria
  - ✓ 10 mg N/L
  - ✓ 0.02 mg P/L

(Morton et al., 1988; Gold and Groffman 1993; Pierson et al., 2001; Shuman, 2002; Moss et al., 2005;Easton and Petrovic, 2004; Frank et al., 2006)

Objectives

- To quantify N and P losses from fertilized and unfertilized turfgrass
- To compare nutrient losses from turfgrass fertilized with natural fertilizer, synthetic fertilizer, and compost
- To measure the impact of cultural practices (aerification, clipping recycling etc.) on nutrient losses from turfgrass

Material and methods

- Need to build hydrologically isolated plots in order to monitor all the water fluxes
  - 15 plots (5 treatments, 3 repetitions, CRD)
- Funded by Québec turf industry:
  - Le groupe Vertdure -ASHOQ
  - Weed-Man -FIHOQ
  - Enviro-Sol -AQCHO
  - Nutrite -APGQ
  - Nuway
  - Pro-vert


CAT
Demers


CAT


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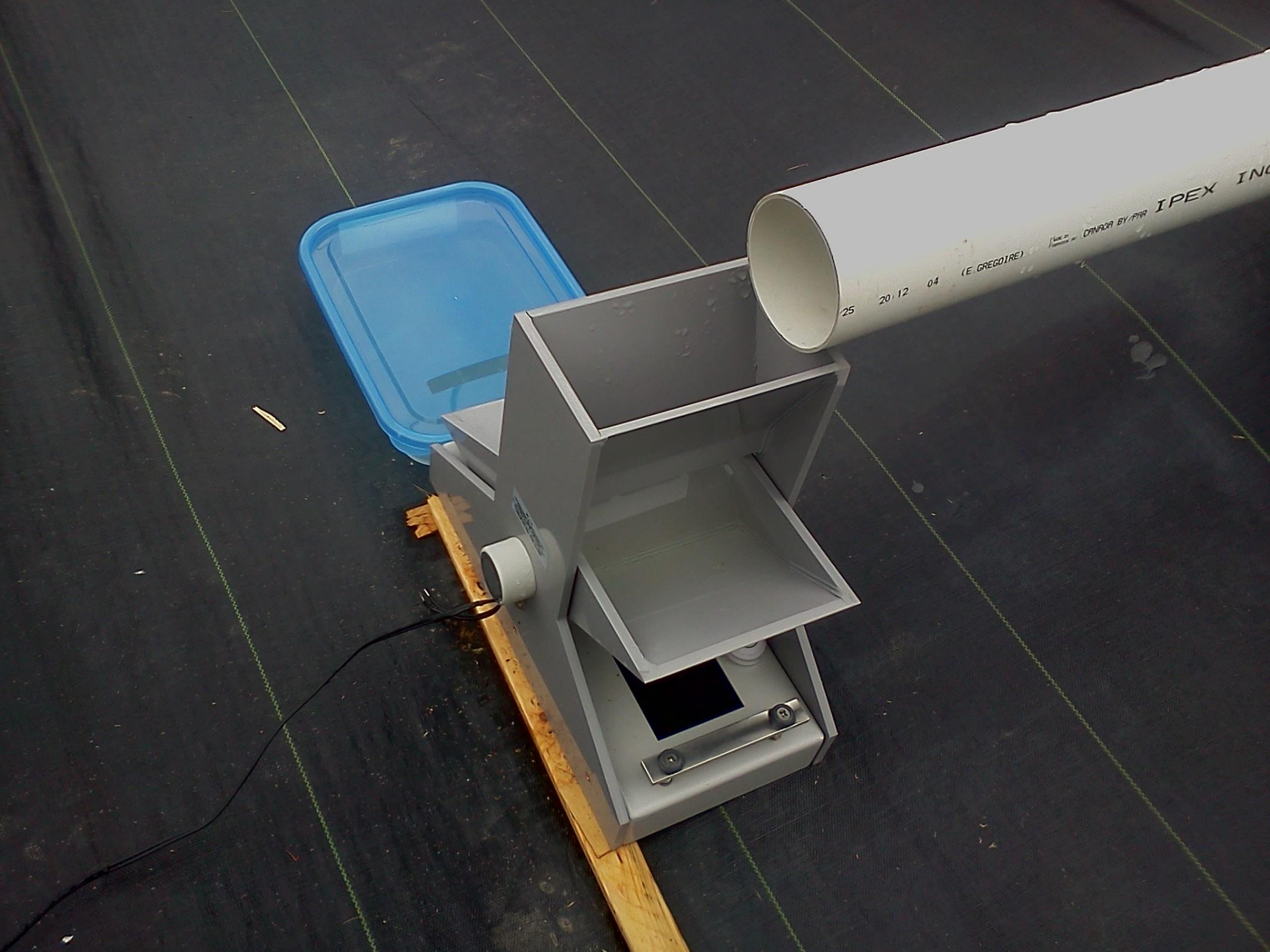
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Treatments

1. Maintained with synthetic fertilizer
   - 4 applications of 20-0-12 (PCSCU)
2. Maintained with natural fertilizer
   - 4 applications of 9-2-5
3. Maintained with compost
   - 1 application of 1.8-1-0.9

(All applied at 1.46 kg N / 100 m^2 / yr)

4. Maintained unfertilized
5. Unmaintained, unfertilized

Collected Data

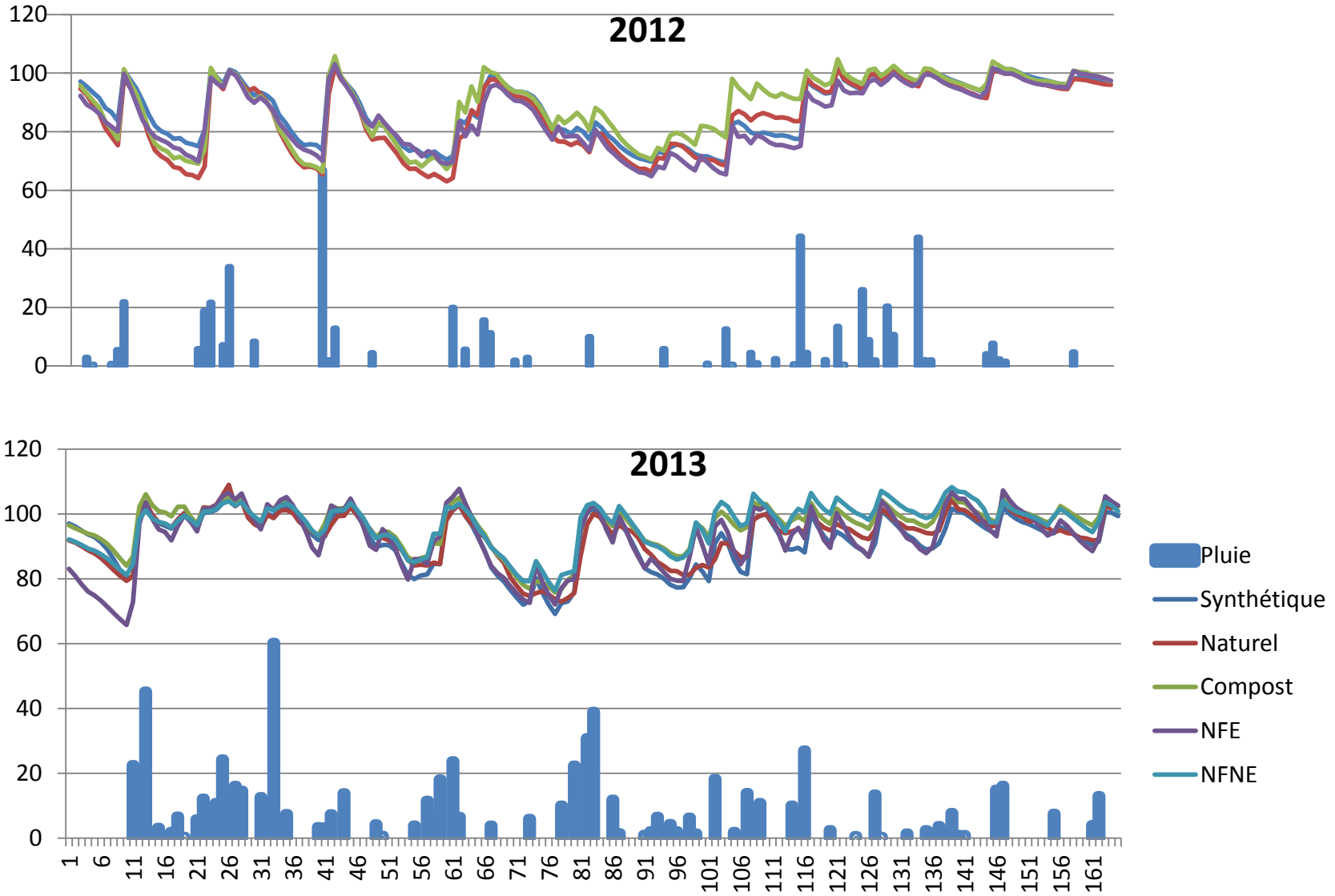
- Turf visual quality (monthly)
- Soil chemical analysis (twice/year)
  - pH, EC, CEC, OM, Mehlich
- Soil water content (hourly)
  - Depth of 10, 20, and 30 cm
- Soil temperature (hourly)
  - Depth of 10 cm

Collected Data

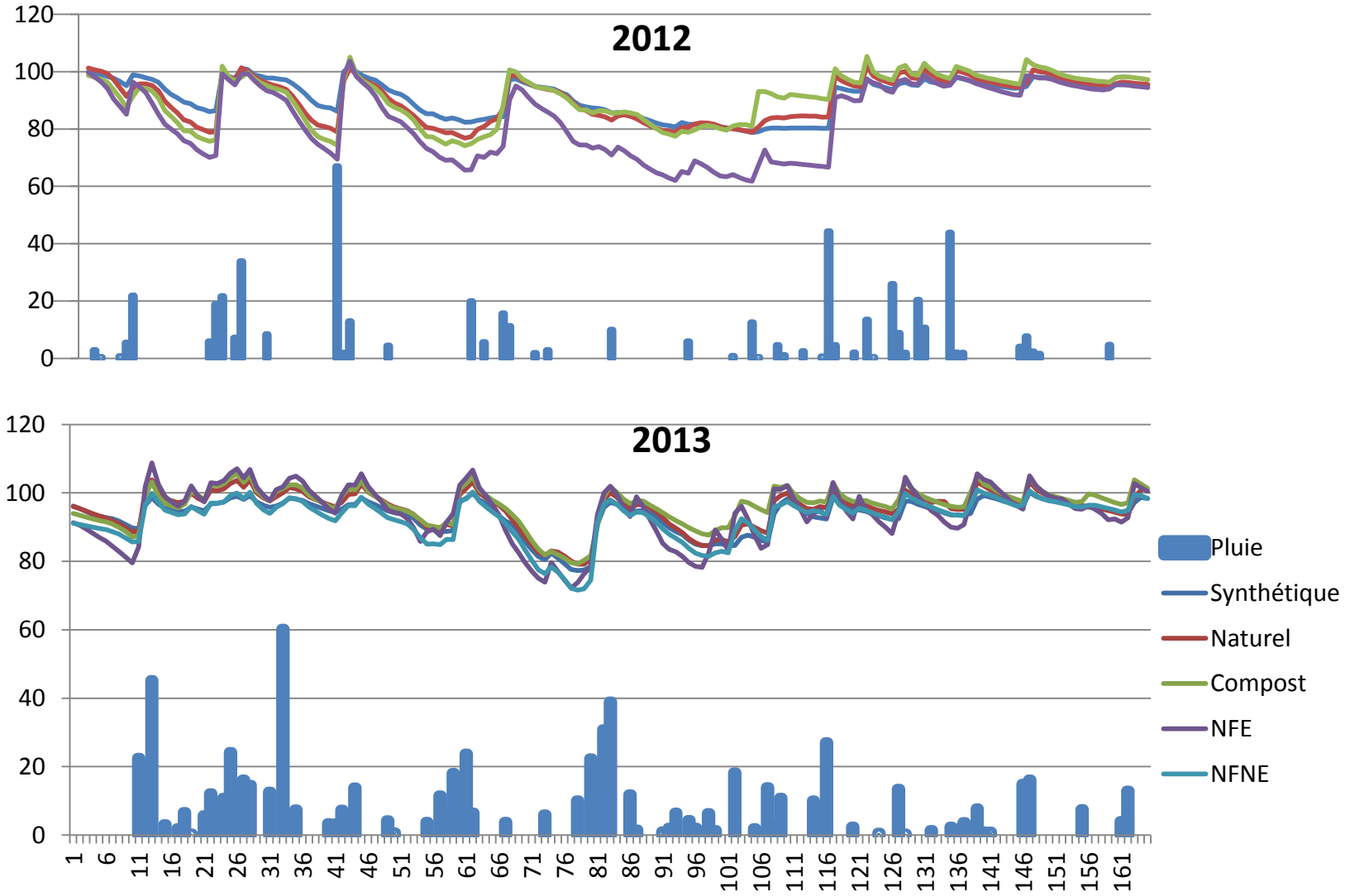
- Runoff (after each raining event)
  - Total volume
  - Water content in:
    - N (total N,, Organic N, NO_3^-, NH_4^+)
    - P (total P (TP), Total dissolved P (TDP), Dissolved reactive P (DRP), dissolved organic P (DOP), total particulate P (TPP))
- Leaching (after each raining event)
  - Total volume
  - Water content in:
    - N (total N,, Organic N, NO_3^-, NH_4^+)
    - P (total P (TP), Total dissolved P (TDP), Dissolved reactive P (DRP), dissolved organic P (DOP), total particulate P (TPP))
- Rainfall + evapotranspiration

Results

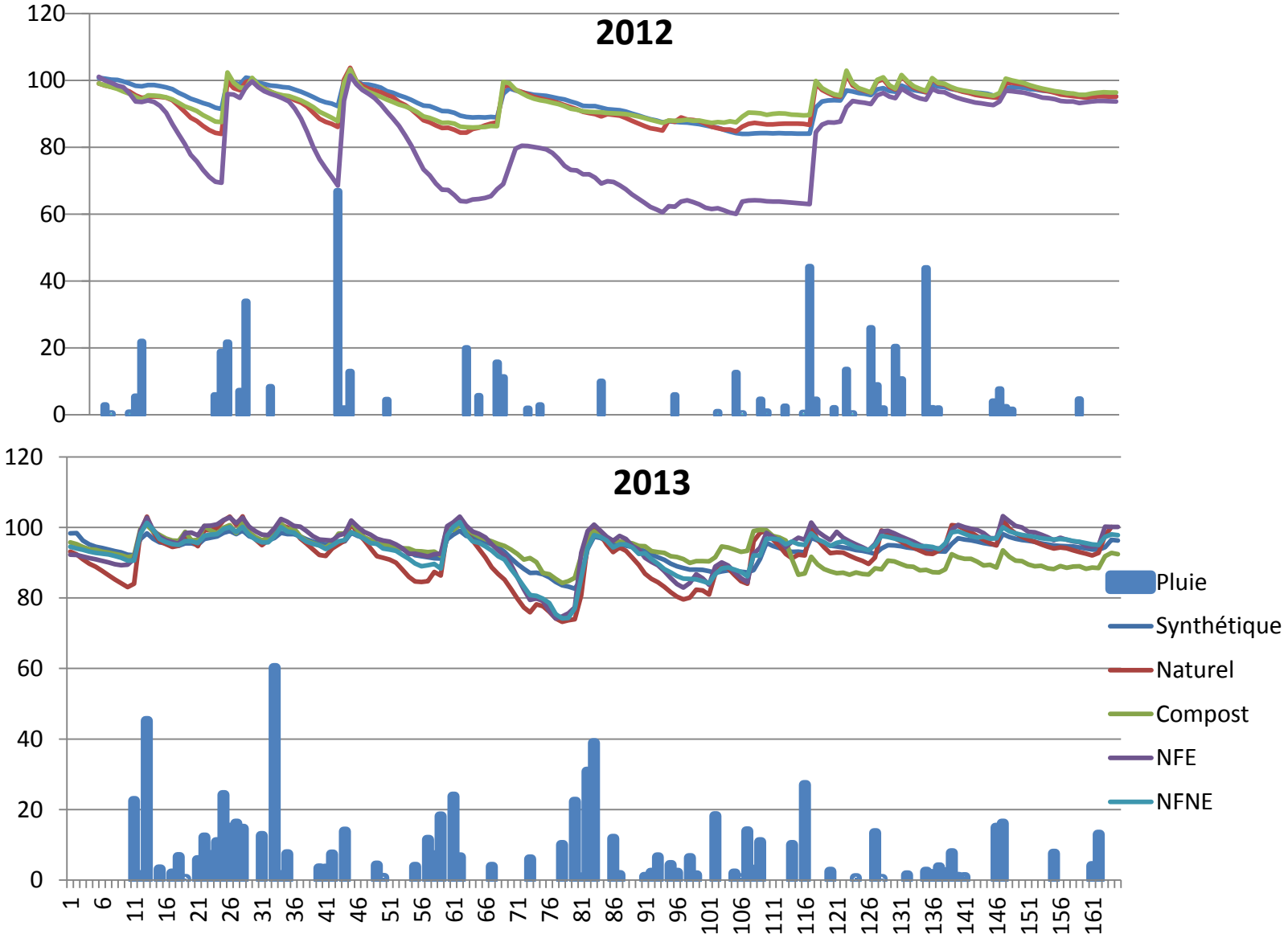
Soil water content– 10 cm



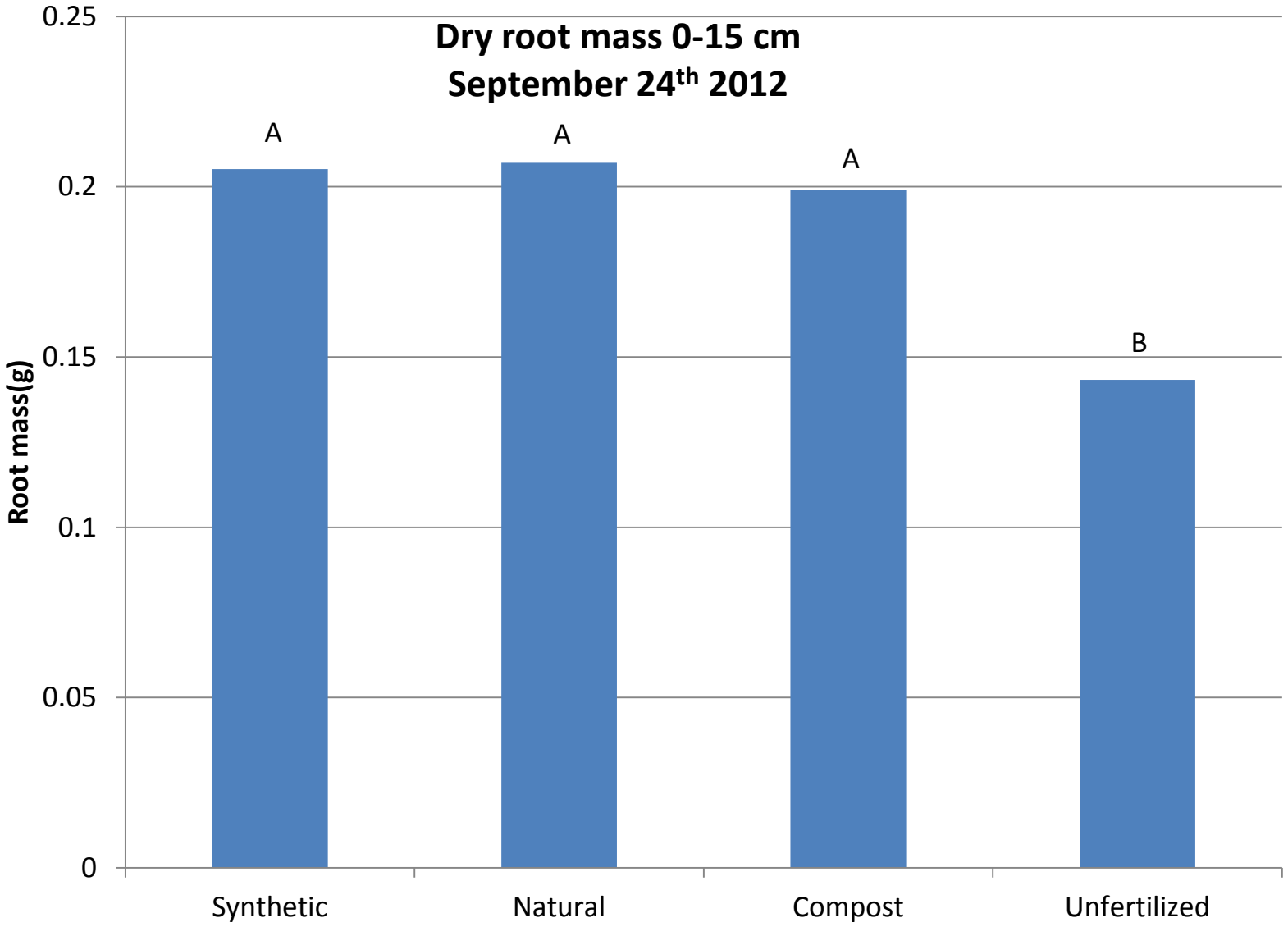
Soil water content– 20 cm



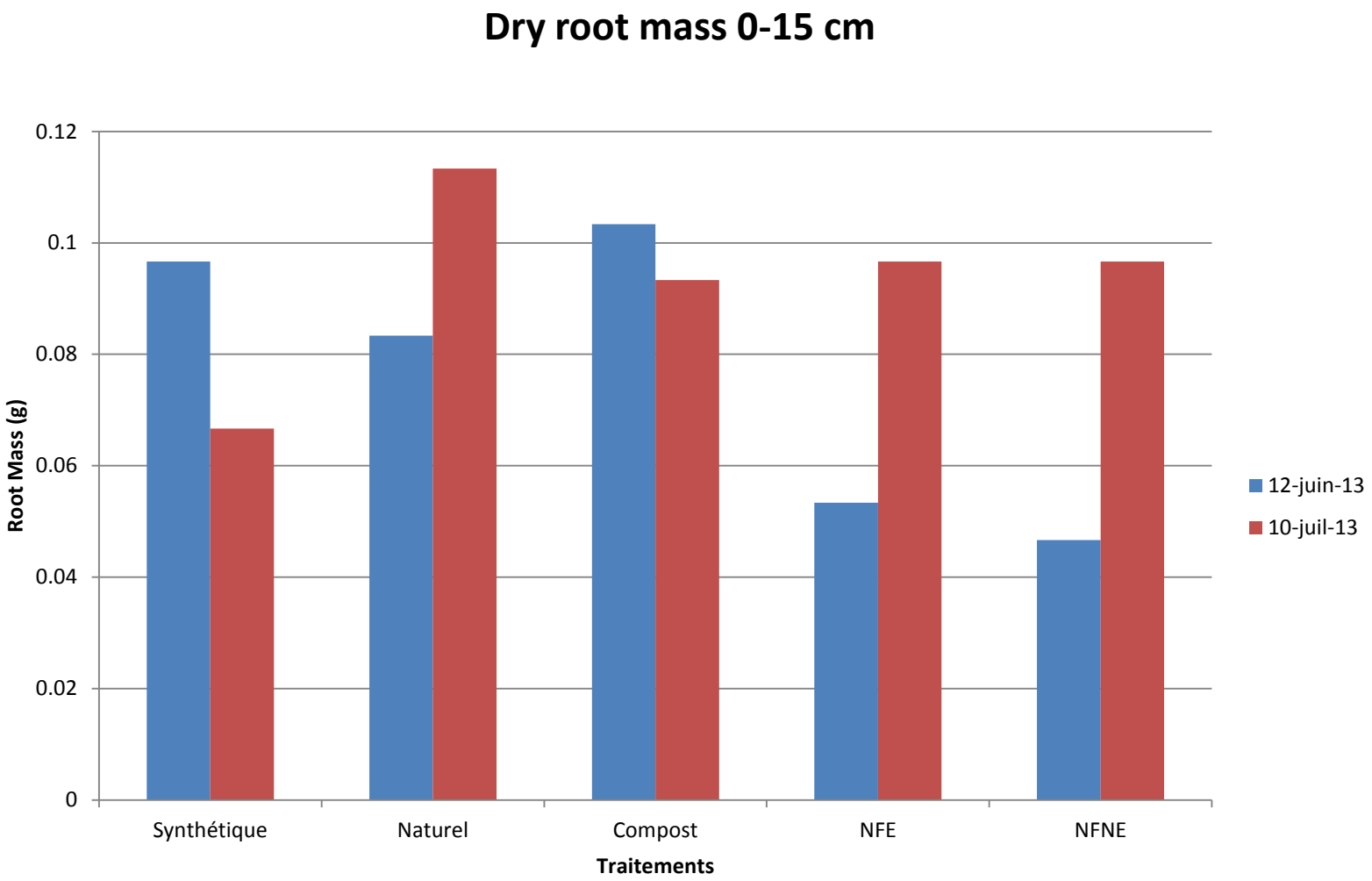
Soil water content – 30 cm



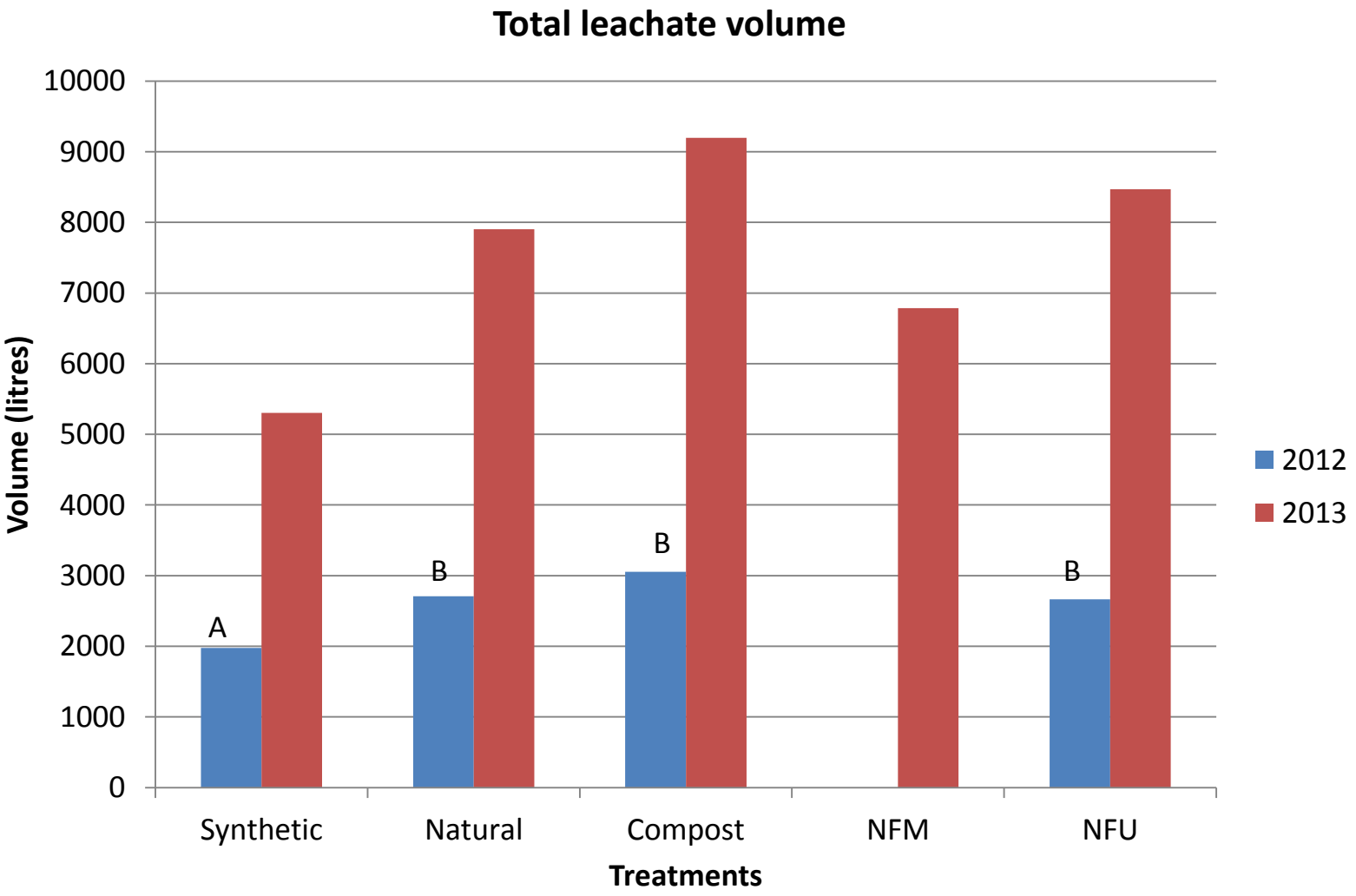
Root mass 2012



Root mass 2013



Results - Leaching



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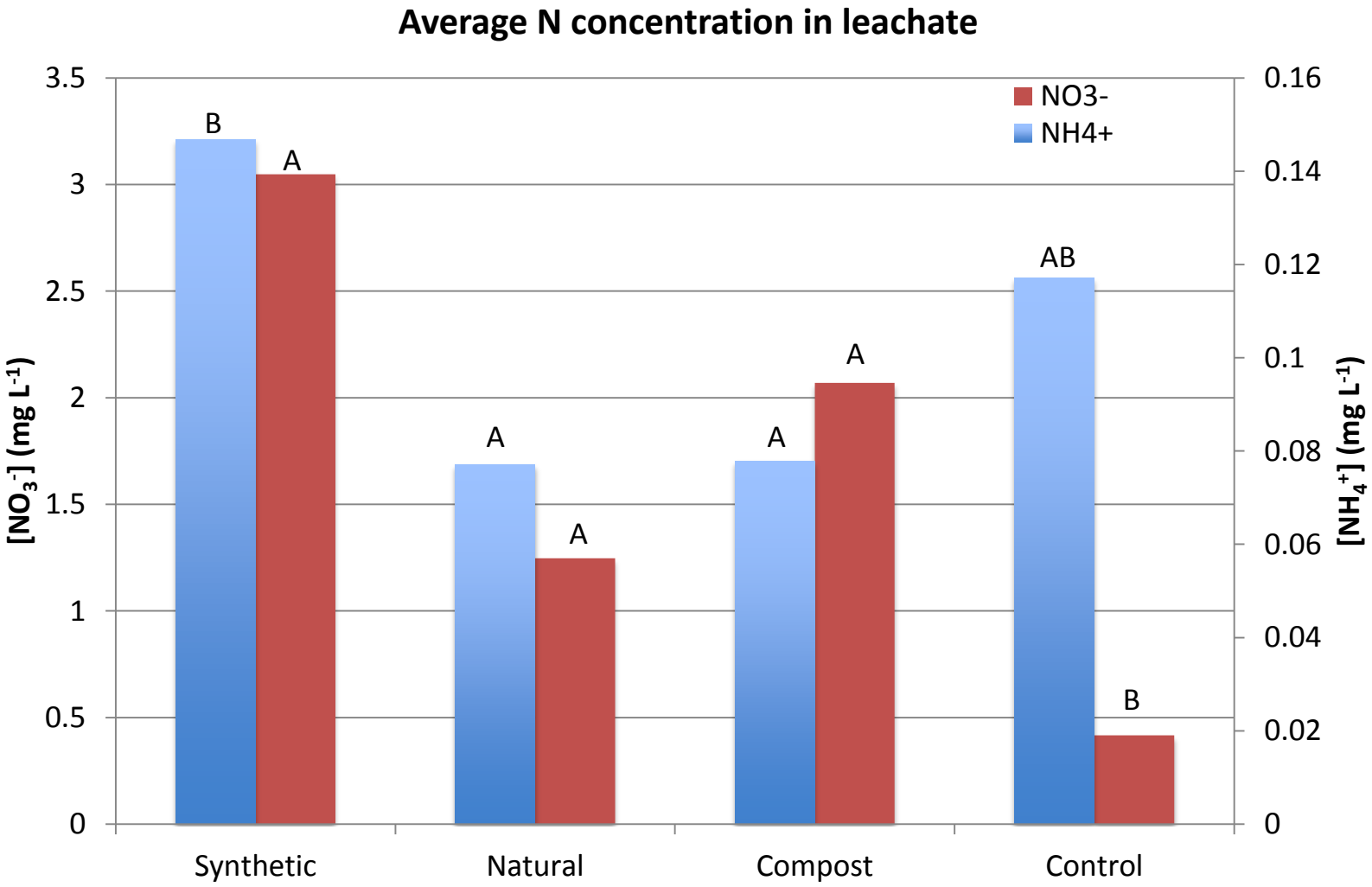

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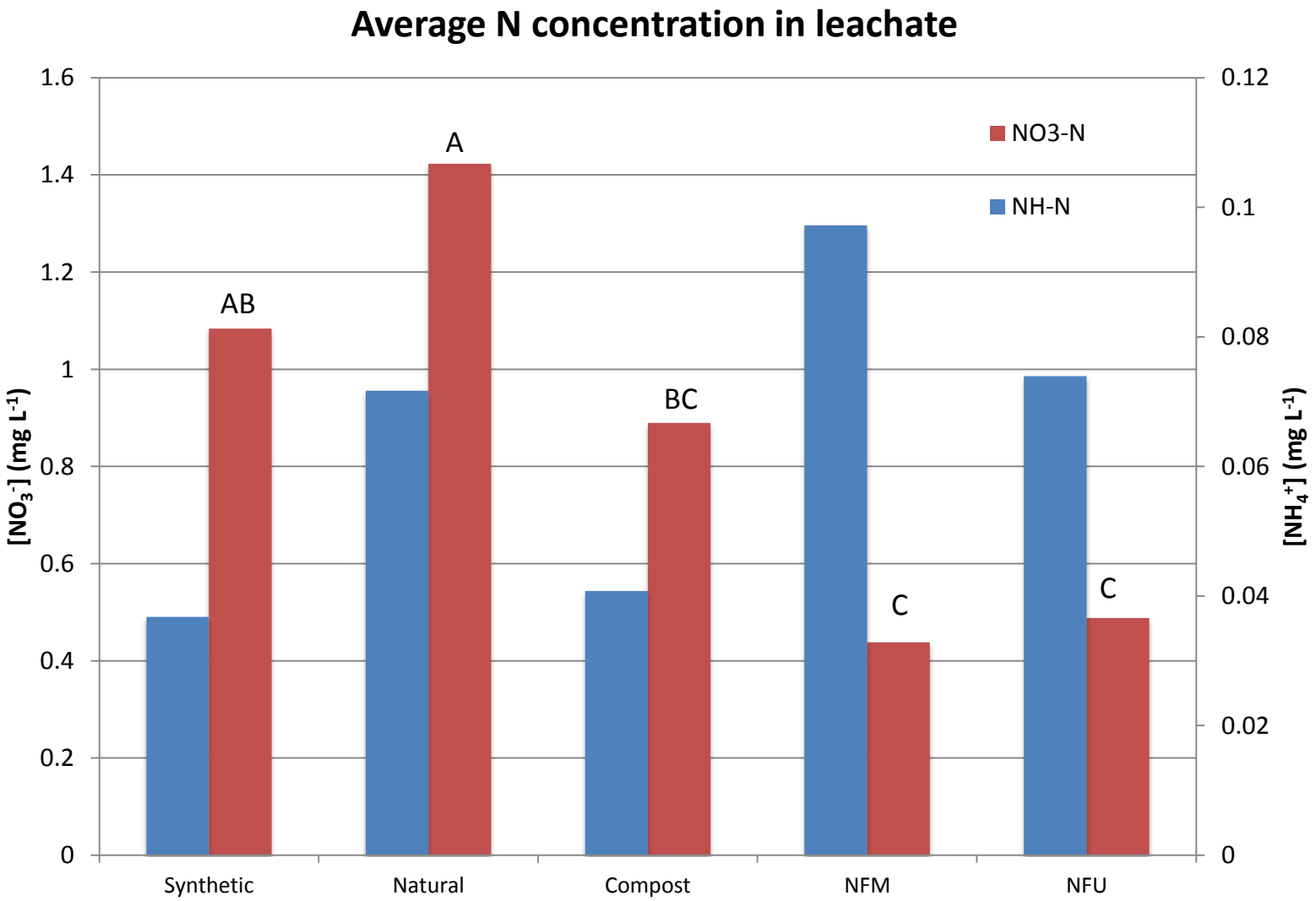

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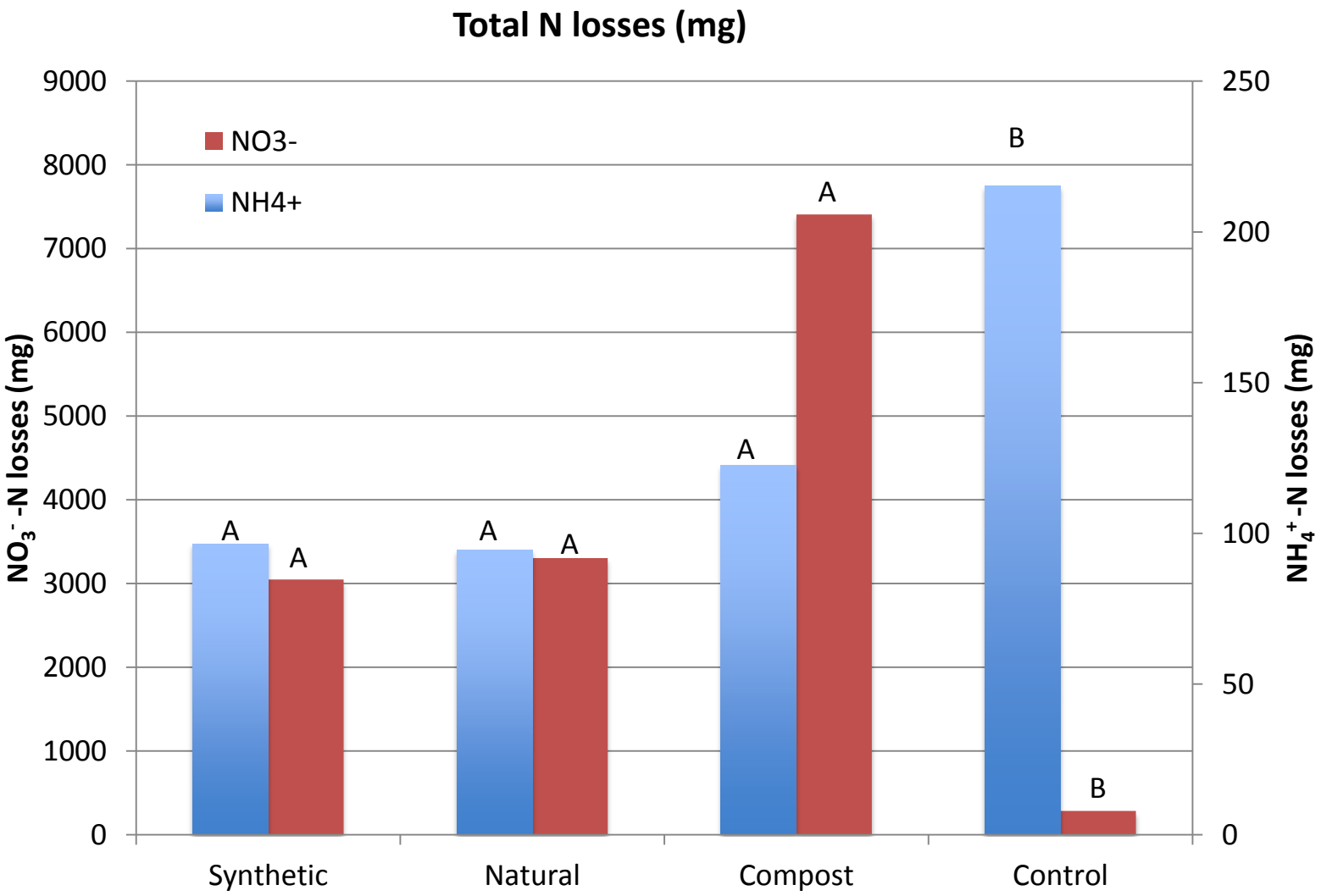
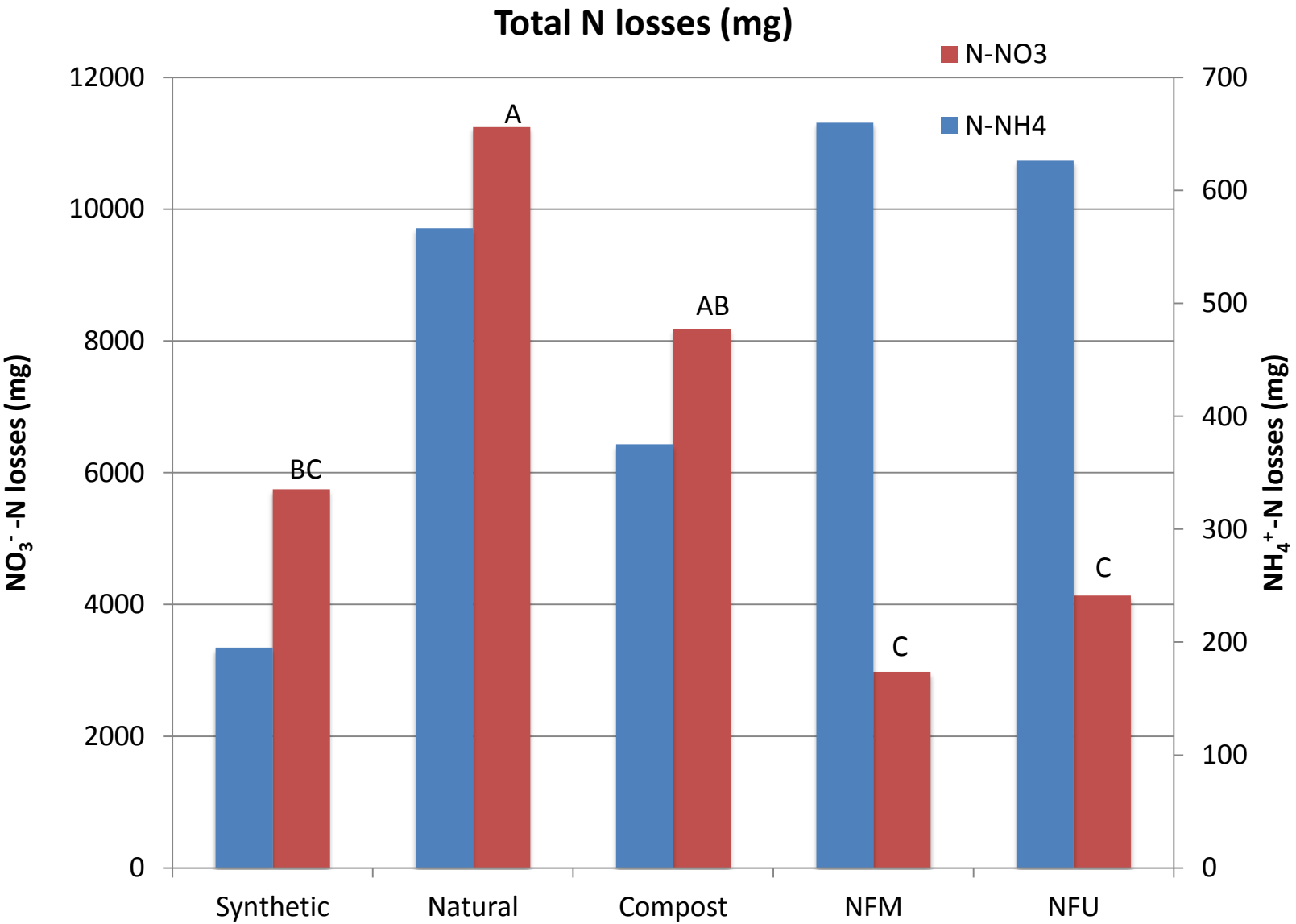
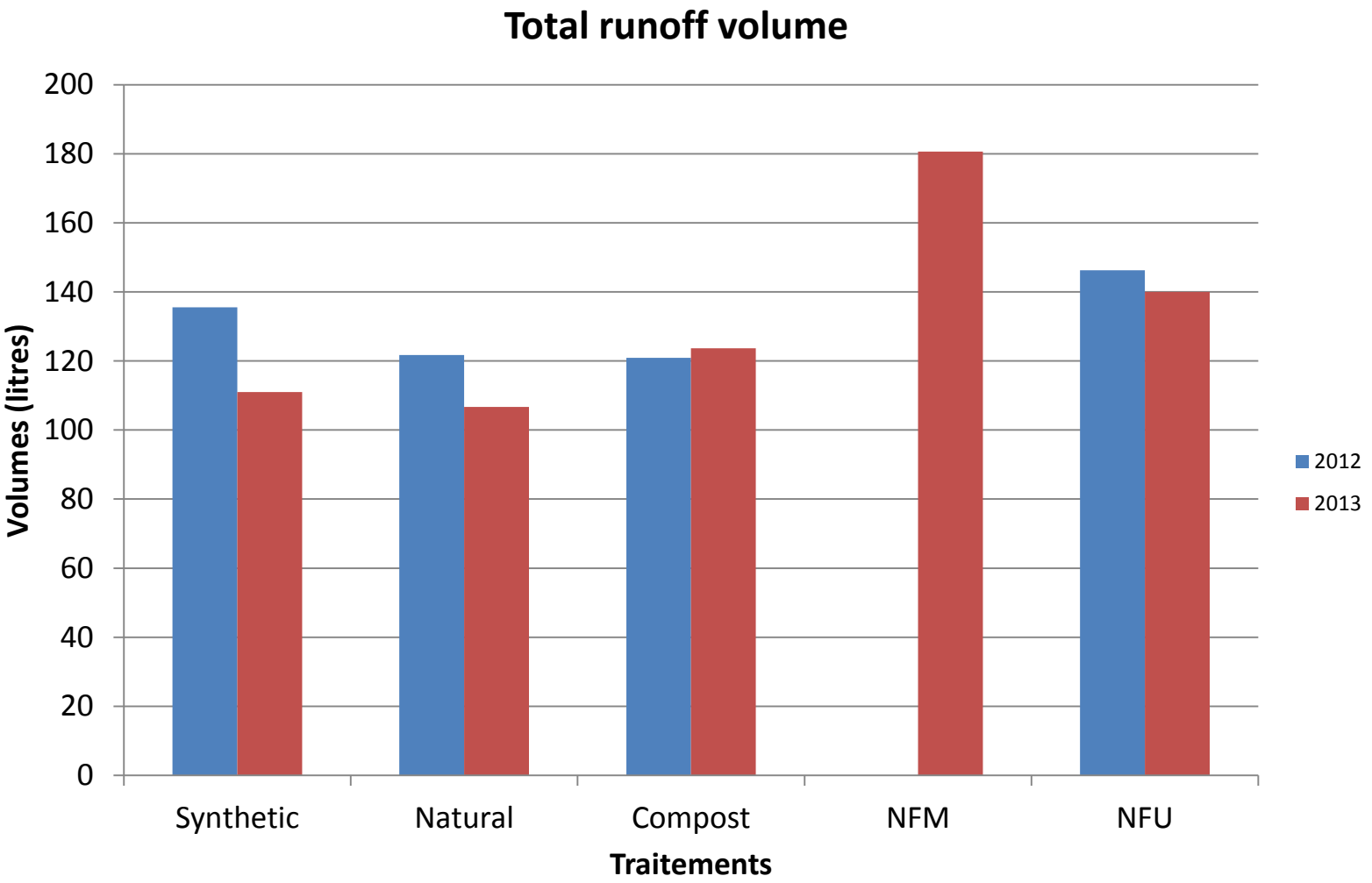


Results – Leaching 2013

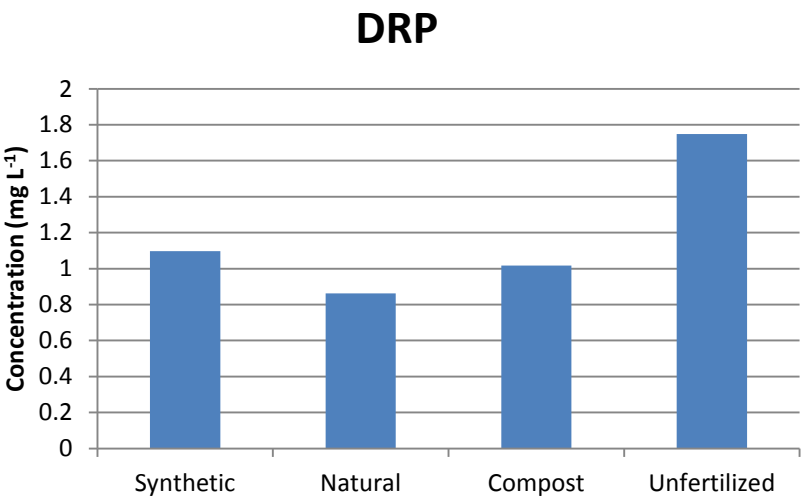


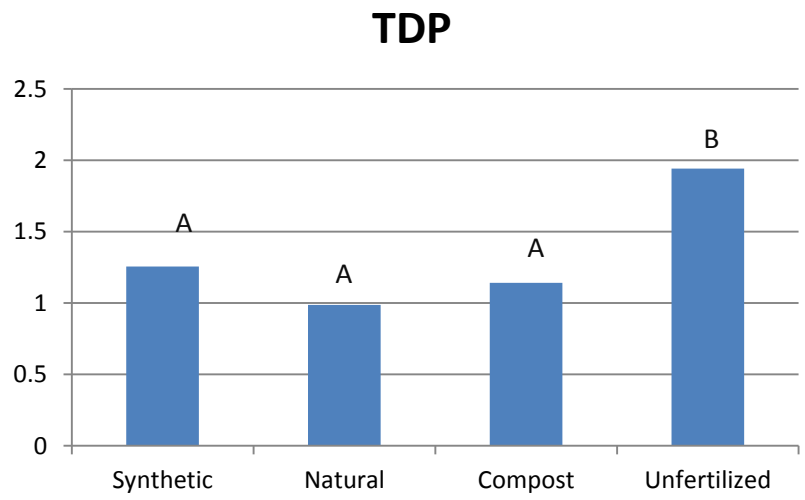
Results - Runoff

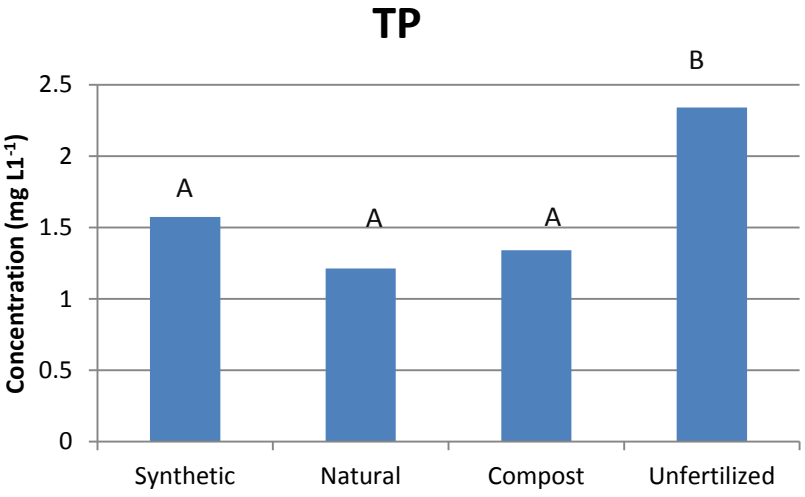


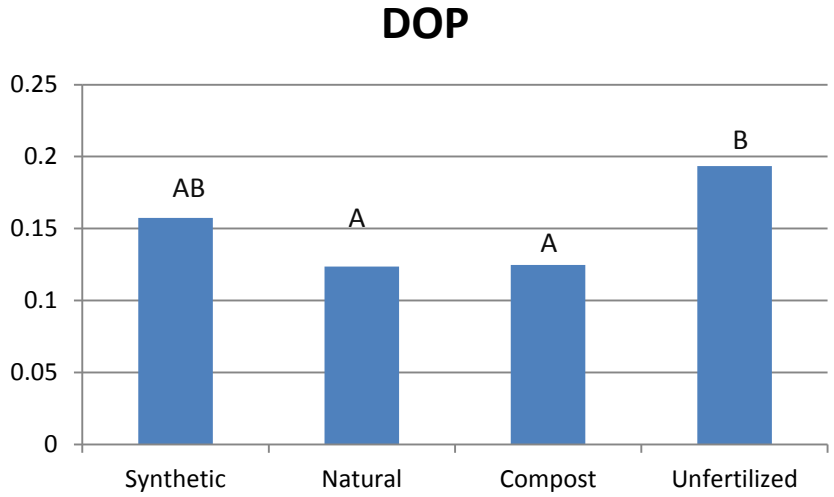
Results – Runoff 2012

Average P concentration in runoff









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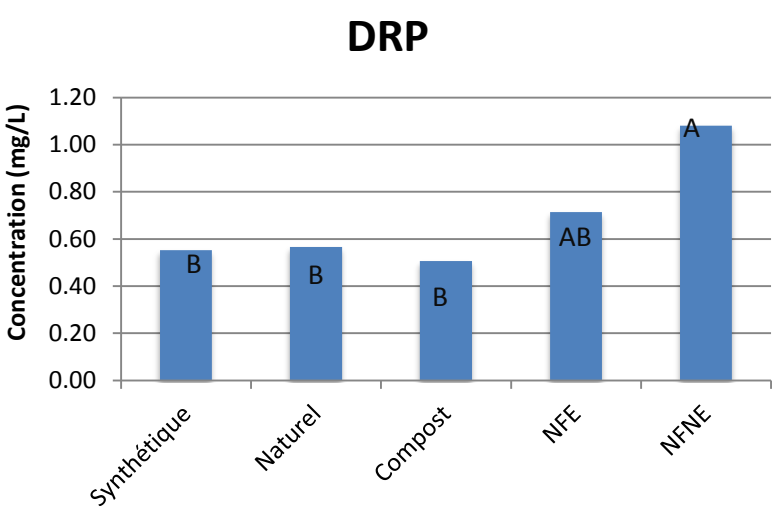
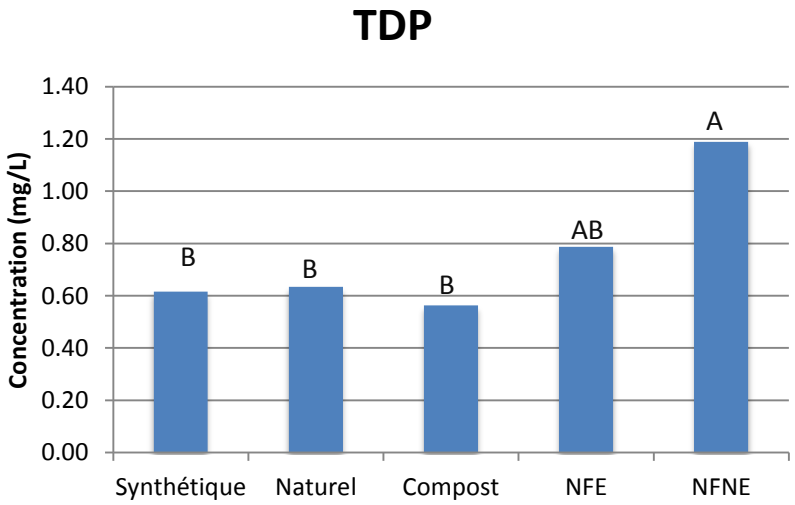
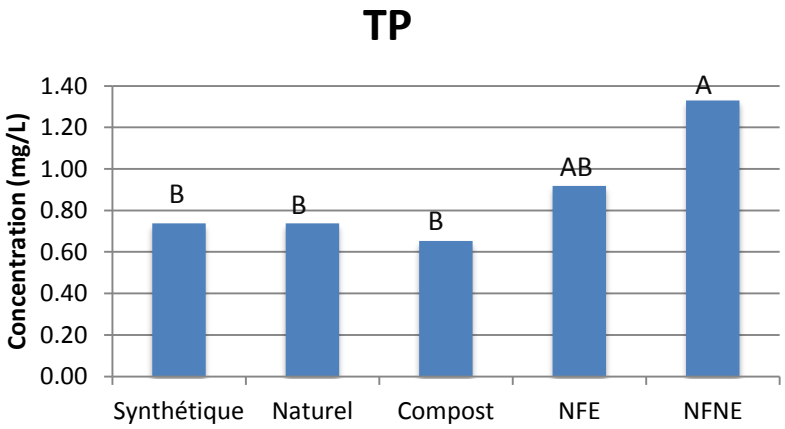
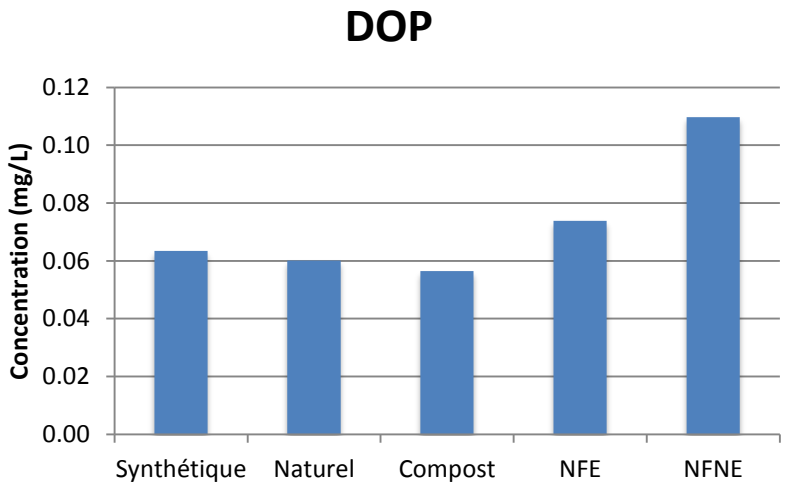


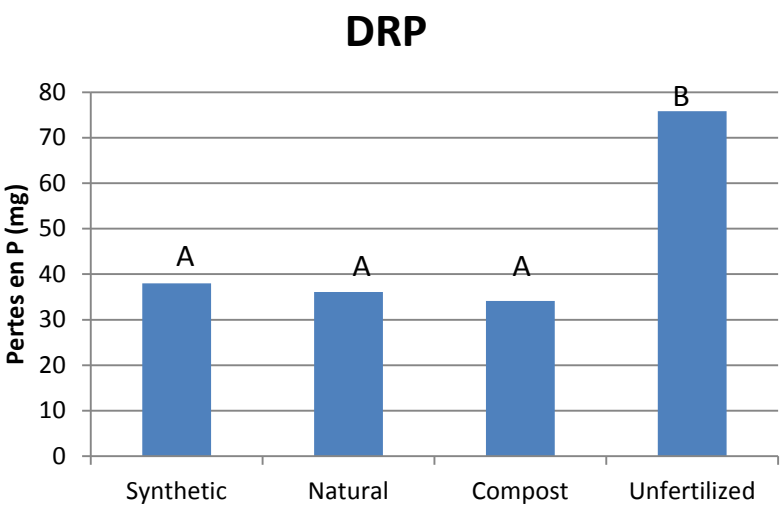


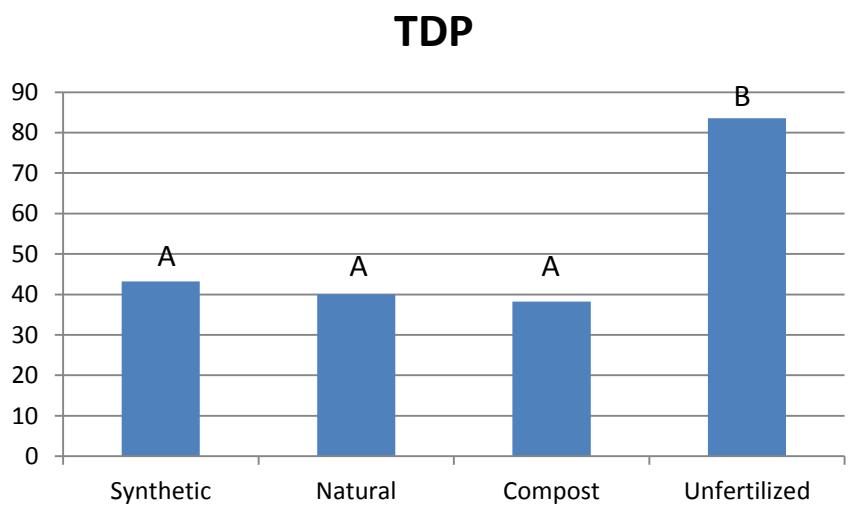


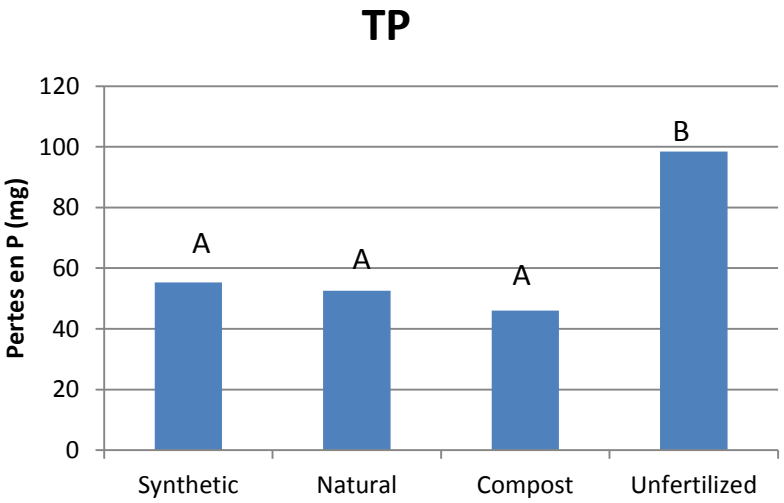


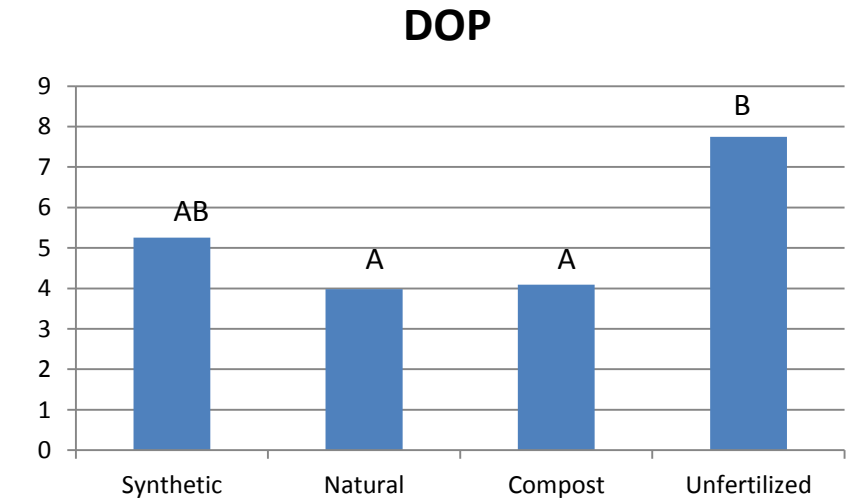
Results – Runoff 2012

Total P losses in runoff









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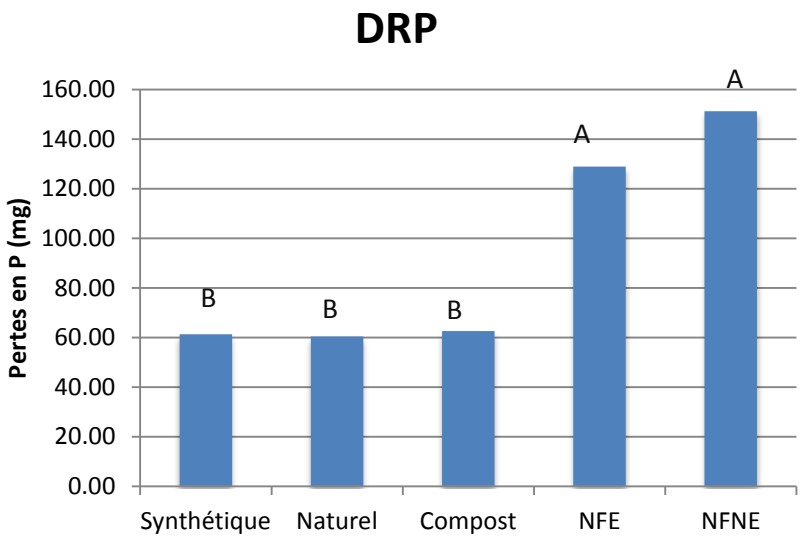

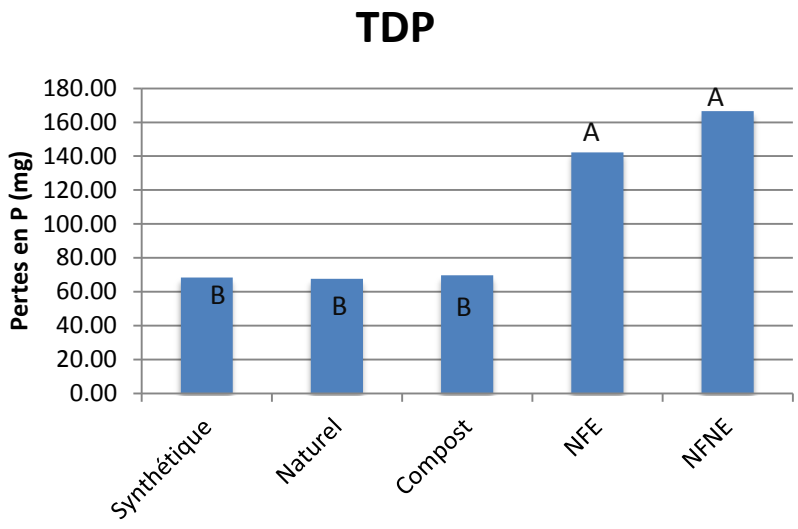

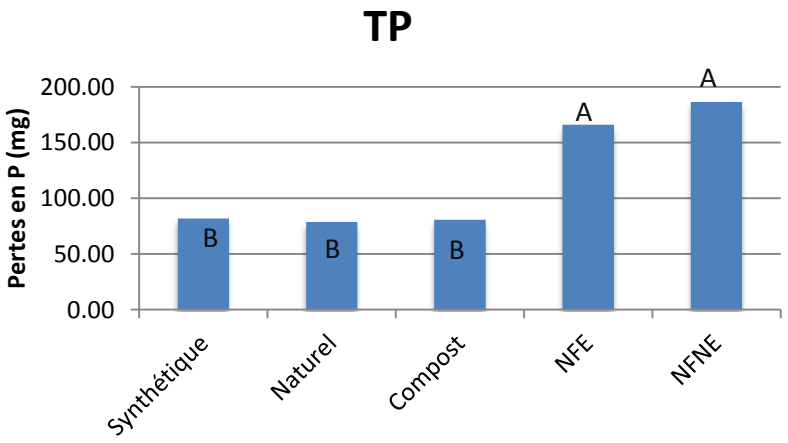

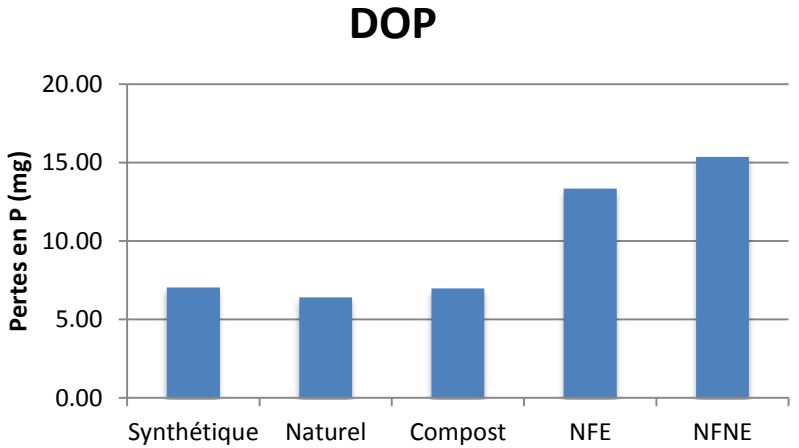


July 5th, 2013 – Synthetic treatment


July 5th, 2013 – Natural treatment


July 5th, 2013 – Compost treatment

Discussion

- Fertilized turf keeps more water in soil compared to unfertilized turf
  - Greater impact at 20 and 30 cm depths
  - Mixed cover root depth?
- Turf fertilized with synthetic fertilizer results in less leaching than other treatments
- Fertilized turf results in more NO_3^- losses, but less NH_4^+ losses through leaching compared to unfertilized

Discussion

- Fertilized turf results in lower [P] in runoff compared to unfertilized turf
- Fertilized turf results in less P losses in runoff compared to unfertilized turf
  - On average 50% less P losses when turf is fertilized (regardless of source)

Conclusion

- Project funded for an additional 4 years
- Raw data will be published on a website to be fully transparent

Questions?