Barriers to Scale: Algae Crop Protection Workshop

Session 1: The Current State of Crop Protection

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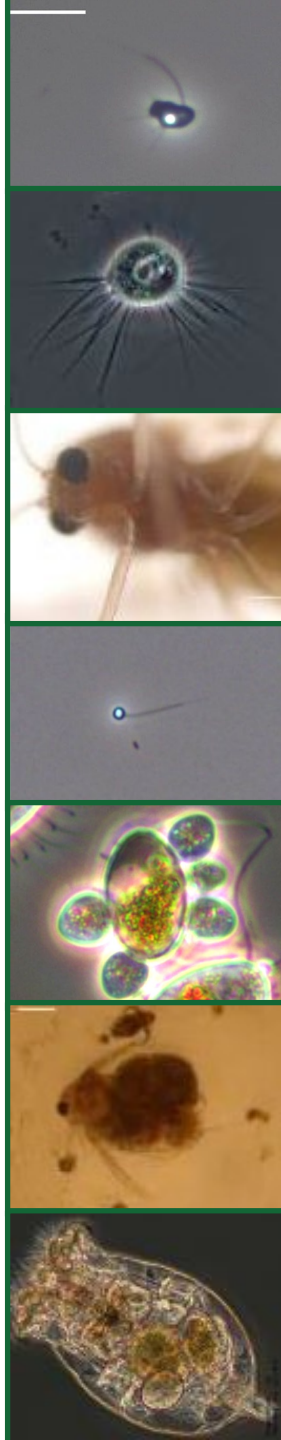
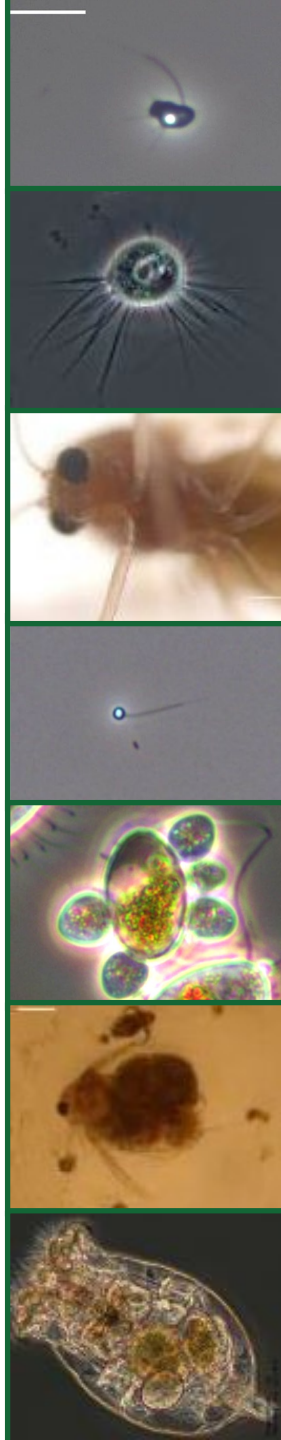


Current State of Crop Protection

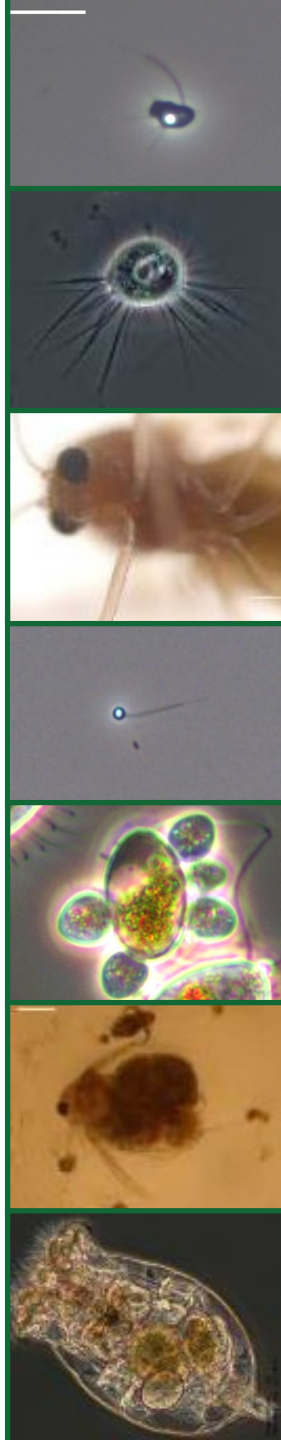
- What is Crop protection?
  - Crop protection is the science and practice of managing algal diseases, weeds and other pests that damage agricultural crops and forestry.
- What are pests?
  - Pests are any organism that reduces overall yield including
    - Pathogenic organisms e.g. bacteria, viruses, fungi
    - Grazers e.g. rotifers, daphnia, amoeba
    - Resource competitors (weeds)
    - Large animals e.g. damaging equipment



Current State of Crop Protection

BETO observations:

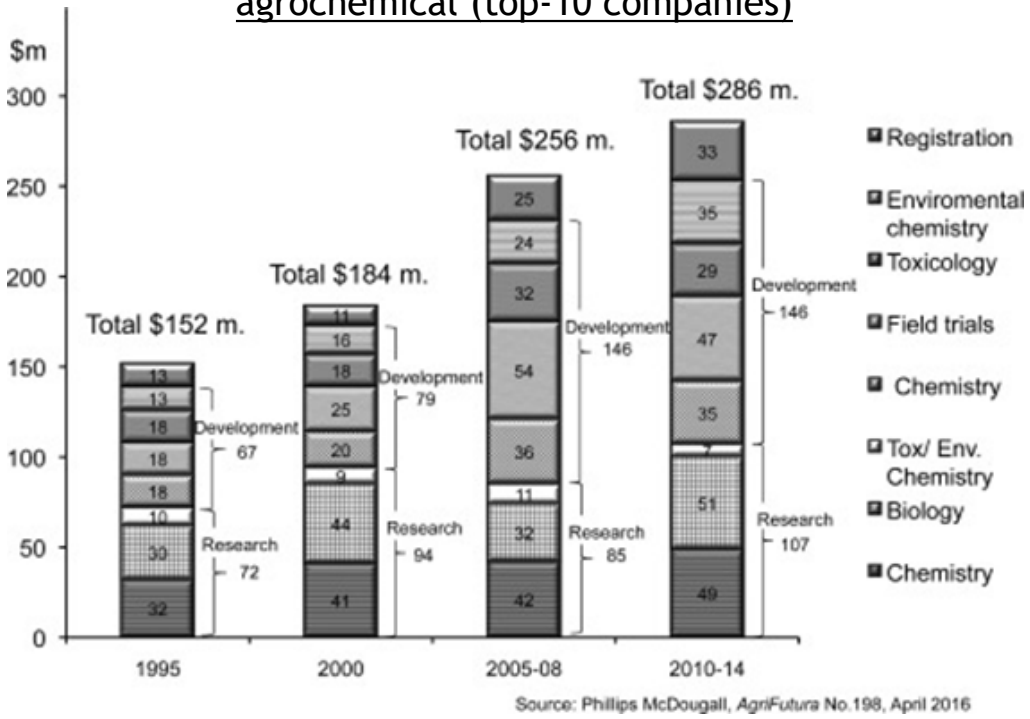
- New pests are still being discovered
  - New strains are being commercialized
- The industry is small (and relatively young)
  - Resources of terrestrial agriculture are greater
- Disincentives to share
  - Private solutions give personal advantage vs. common information lifts all boats
  - Admitting to having pests may have implications
- Cost implications not always addressed in models
  - Crop loss / downtime assumptions, cost of mitigation strategies



R&D spending in traditional agriculture

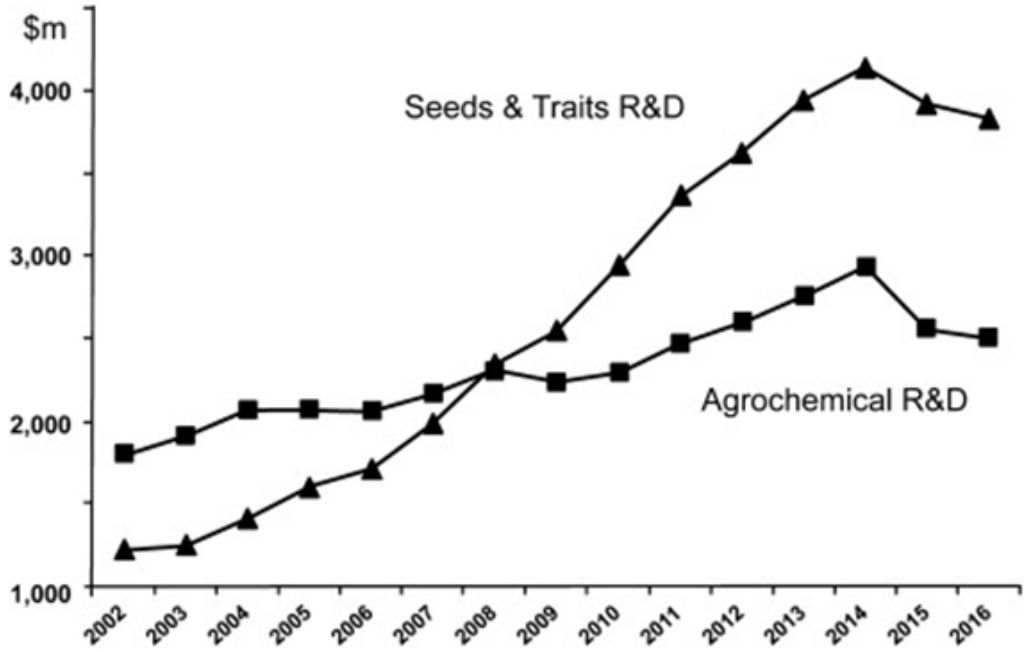
- "It takes over ten years and R&D expenditure of $100–350 million to develop and market a new agrochemical" (Nishimoto, 2019)

Average R&D expense for a new agrochemical (top-10 companies)



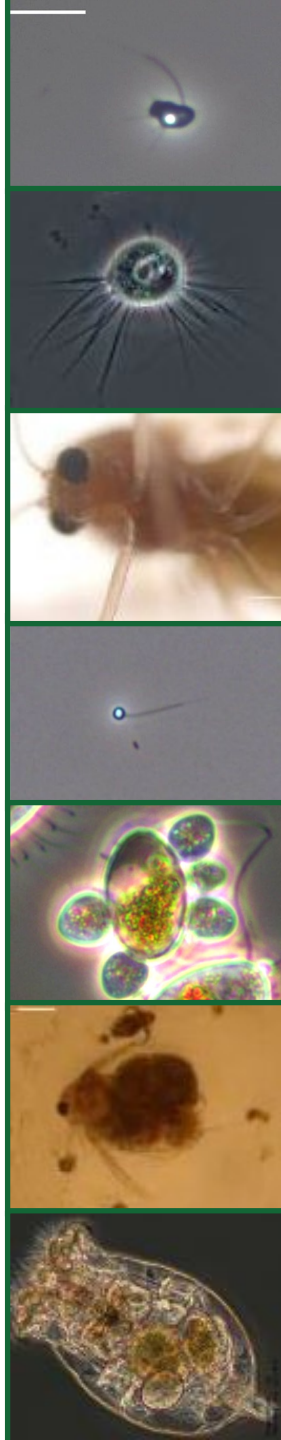
Source: Phillips McDougall, *AgriFutura* No.198, April 2016

R&D expenses for agrochemicals and seeds in the six major companies.



Source: Phillips McDougall, *AgriFutura* No.210, April 2017

Nishimoto, R., 2019. Global trends in the crop protection industry. J. Pestic. Sci. 44, 141–147. https://doi.org/10.1584/jpestics.D19-101

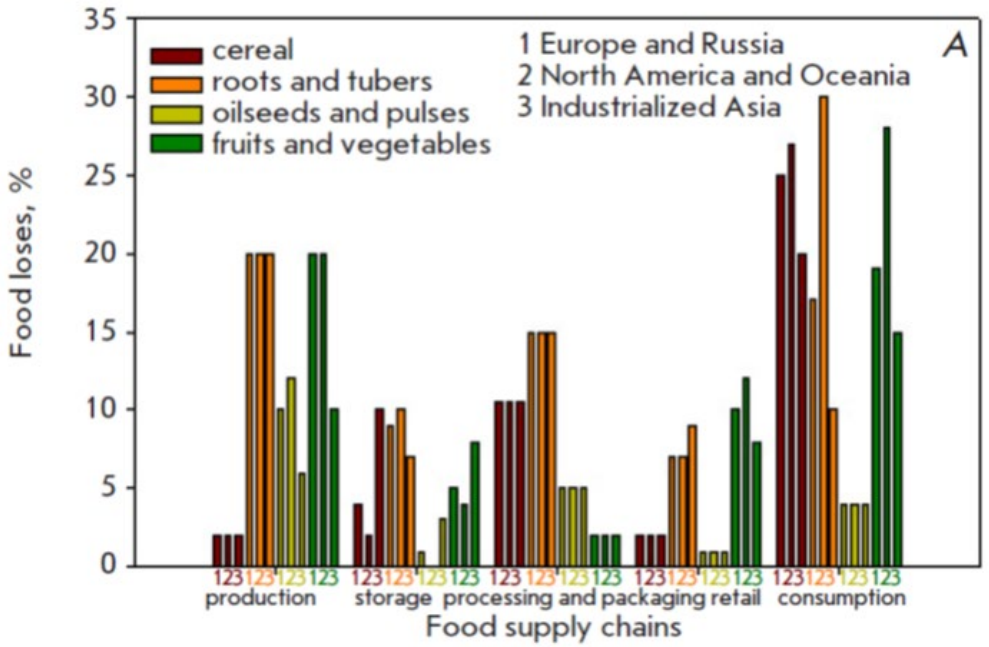


Crop losses in Agriculture and Macroalgae culture

Agriculture

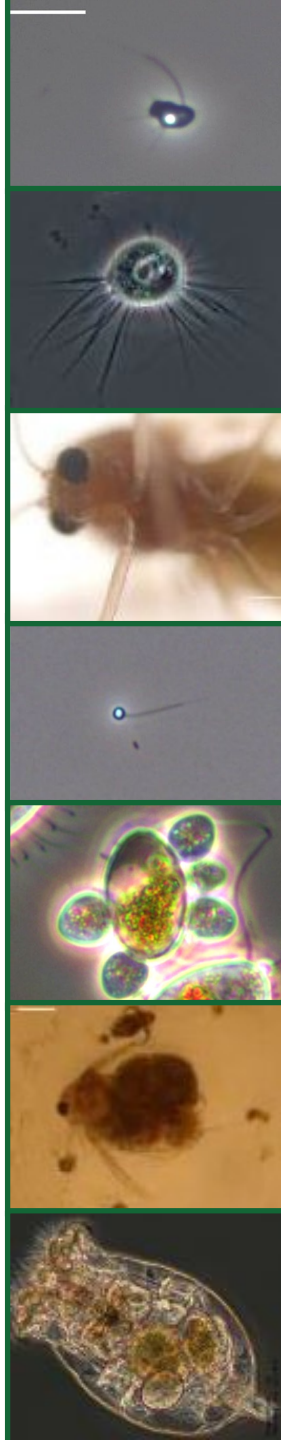
- Average global yield loss in food crops due to pests averages 20-30%

Crop losses in industrialized countries at each stage of production



Macroalgae

- "… diseases and pests results in losses of 25–30% of harvested volumes of Saccharina japonica at a regional scale in China" (Wang et al., 2014).
- "an outbreak of Olpidiopsis spp. disease resulted in approximately… 24.5% of total sales…" (Kim et al., 2014)



Kim, G.H. et al., 2014. A revaluation of algal diseases in Korean Pyropia (Porphyra) sea farms and their economic impact. ALGAE 29, 249–265.
Nazarov, P.A. et al., 2020. Infectious Plant Diseases: Etiology, Current Status, Problems and Prospects in Plant Protection. Acta Naturae 12, 46–59.
Wang, X. et al., 2014. Assimilation of inorganic nutrients from salmon (Salmo salar) farming by the macroalgae (Saccharina latissima) in an exposed coastal environment. Journal of Applied Phycology, 26(4), 1869–1878.

Panelists

- John McGowen
  - Director of Operations and Program Management for the Arizona Center for Algae Technology and Innovation (AzCATI) at Arizona State University (ASU)
- Charlie O'Kelly
  - Director of applied research, Cyanotech
- Jason Quinn
  - Director, Sustainability Research Laboratory, Associate Professor at Colorado State University (CSU)