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Iron fertilization can enhance the mass production of copepod, *Pseudodiaptomus annandalei*, for fish aquaculture

Guo-Kai Hong[1,2], Kwee Siong Tew[1,2,*]

[1]International Graduate Program of Marine Science and Technology, National Sun Yat-sen University, Taiwan
[2]Graduate Institute of Marine Biology, National Dong Hwa University, Taiwan
*tewks@mail.nsysu.edu.tw

International Doctoral Program of Marine Science and Technology

NSTC 國家科學及技術委員會 National Science and Technology Council

Abstract

Copepods are proven nutritious food sources for the mariculture/larviculture industry, however, unreliable methods for mass production of copepods are a major bottleneck. In this study, we modified a previously reported inorganic fertilization method (N: 700 μg L^{-1} and P: 100 μg L^{-1}) by the addition of iron (Fe: 10 μg L^{-1}, using $FeSO_4 \cdot 7H_2O$) (+Fe treatment) and compared its suitability for copepod culture (*Pseudodiaptomus annandalei*) to the original method (control). The experiment was conducted outdoors in 1000 L tanks for 15 days. The addition of iron prolonged the growth phase of the phytoplankton and resulted in the production of significantly more small phytoplankton (0.45–20 μm, average 2.01 ± 0.52 μg L^{-1} vs. 9.03 ± 4.17 μg L^{-1} in control and +Fe, respectively) and adult copepods (control: 195 ± 35 ind L^{-1}, +Fe: 431 ± 109 ind L^{-1}), whereas copepodid-stage was similar between treatments (control: 511 ± 107 ind L^{-1} vs. +Fe: 502 ± 68 ind L^{-1}). Although adding iron increased the cost of production by 23% compared to the control, the estimated net profit was 97% greater. We concluded that inorganic fertilization, with the addition of iron (Fe: 10 μg L^{-1}), could be an effective method for the mass production of copepods for larviculture.

Materials and Methods

Design:

Control, N=5; N: 700 g L^{-1} and P: 100 g L^{-1}

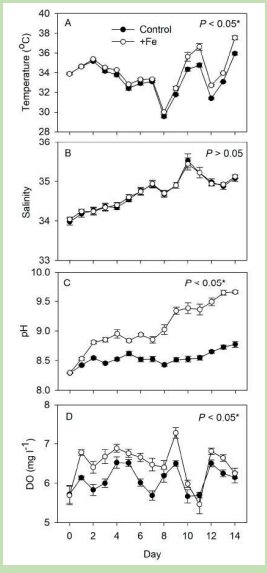
Treatment, N=5; N: 700 g L^{-1} and P: 100 g L^{-1} , +Fe

Inoculated *P. Annandalei* in each tank (10 ind L^{-1}) on day 1

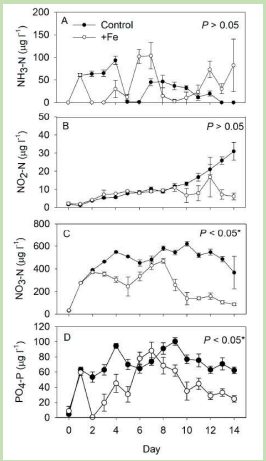
Did not inoculate monoculture algae

Duration: 15 days

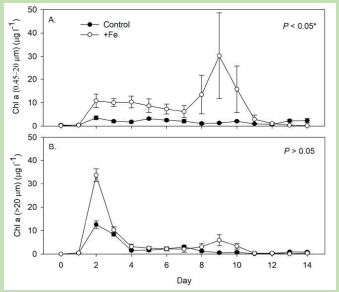
Results



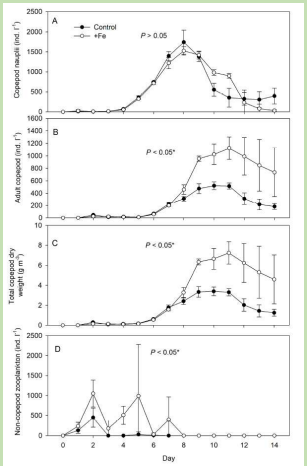
(A) temperature, (B) salinity, (C) pH, and (D) dissolved oxygen in the control (N=5) and +Fe (N=5) (mean±SD)



(A) NH_3-N, (B) NO_2-N, (C) NO_3-N, and (D) PO_4-P concentrations in the control and +Fe treatment tanks (mean±SD)



(A) smaller phytoplankton chlorophyll a concentration (0.45–20 m, g L^{-1}), and (B) larger phytoplankton chlorophyll a concentration (20 m, g L^{-1}) in the control and +Fe treatment tanks (mean±SD)



(A) copepod nauplii, (B) adult copepod, (C) total copepod dry weight, and (D) non-copepod zooplankton in the control and +Fe treatment tanks (mean±SD)

Conclusion

- By adding iron, the growth of phytoplankton lasted much longer
- Significantly higher density of copepodids and adult copepods
- Adding iron increased the cost, but the net profit was almost twice as high
- Adding iron to the inorganic fertilization method could be an effective way for the mass production of copepods as live feed for use in fish larviculture