The Effect of Nitrogen on the Growth Rate of the Invasive Species *Brassica nigra*

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Introduction

- *Brassica nigra* (**Fig. 1**) is an invasive species of mustard that is growing in California.
- Recent studies have shown that *B. nigra* is invading nitrogen (N) rich plots[1] displacing native shrubs.
- Similar studies have shown N addition increases plant productivity[2] and N uptake[3] of alien plants
- How does N addition affect the growth and reproductive output of the invasive species *Brassica nigra*?

https://www.cal-ipc.org/plants/profile/brassica-nigra-profile/

Fig. 1. Invasive mustard plant species *Brassica nigra*.

Methods

- The study was conducted in 10 x 10 m plots located at the Santa Margarita Ecological Reserve (**Fig. 2**) that are part of a long-term N addition experiment **(Fig. 3)**[1]

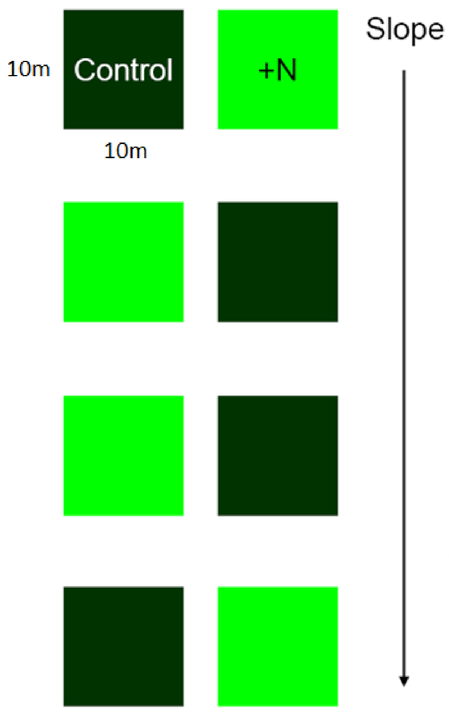

Fig. 3. Schematic of the field experimental design with 8-10 x 10 m plots and the control and N treatments plots arranged in a paired design along a S-SW facing slope. N plots have been fertilized since 2003 with 50 kgN/ha applied during the summer and fall of each year.[1]

- *Brasica nigra* was harvested from 5 randomly selected 20 x 20 cm quadrats in each plot (n = 4 control and 4 N plots).
- Plants were separated into shoots and reproductive structures, dried at 70°C, and weighed using a digital balance.
- Samples were analyzed for carbon (C) and N.

Fig. 2. Santa Margarita Ecological Reserve (SMER).

Results

- Plants exposed to N had higher total biomass than plants growing in control plots (Fig. 4).

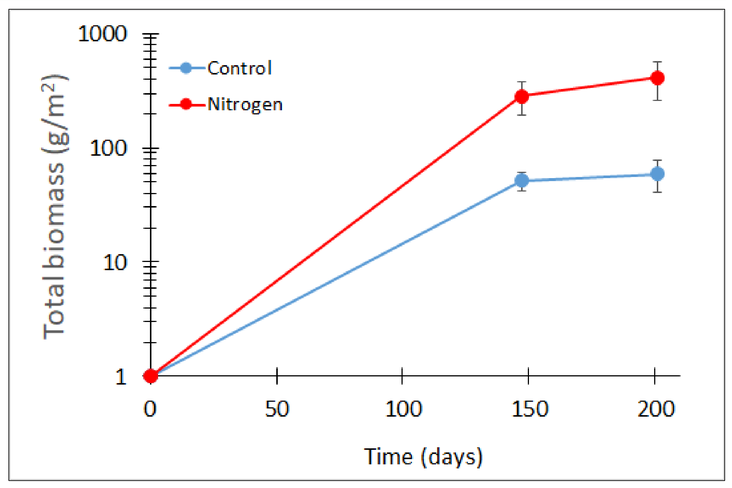

Fig. 4. Mean (±se; n = 4) total biomass of *Brassica nigra* plants growing in high N plots (blue symbols) and control plots (red symbols). Differences are significantly different ($p<0.05$) according to a paired t-test (df = 3).

- Plants exposed to N had a significantly higher reproductive output (Fig. 5)

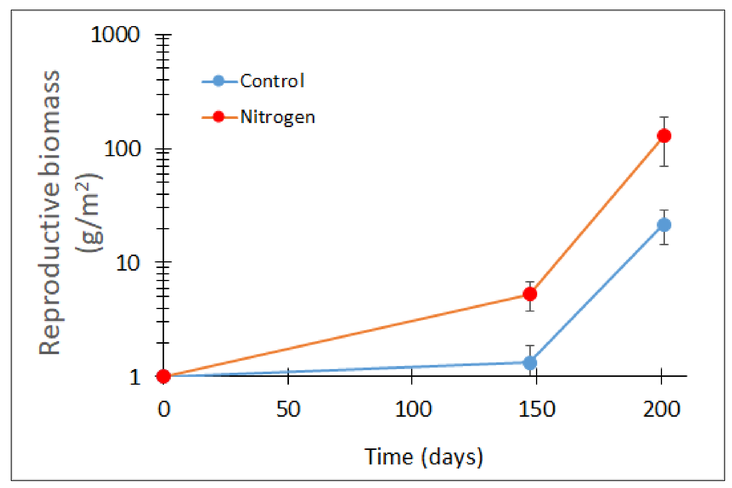

Fig. 5. Mean (±se; n = 4) reproductive (flowers + fruits) biomass of *Brassica nigra* plants growing in high N plots (blue symbols) and control plots (red symbols). Differences are not significantly different ($p<0.05$) according to a paired t-test (df = 3).

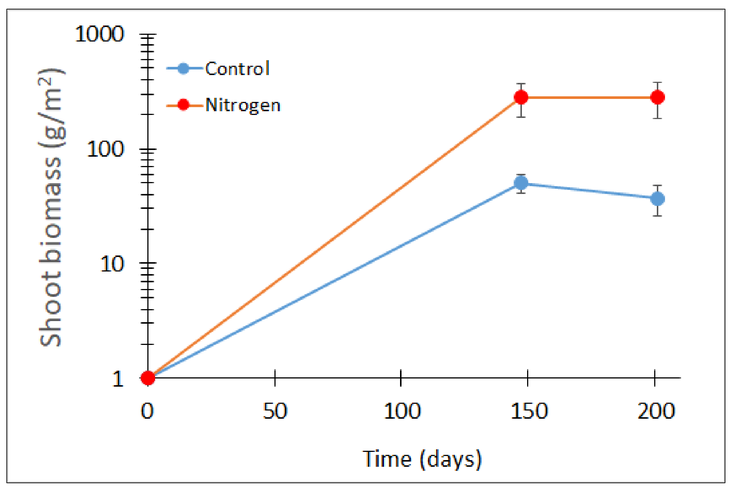

Fig. 6. Mean (±se; n = 4) shoot (stems + leaves) biomass of *Brassica nigra* plants growing in high N plots (blue symbols) and control plots (red symbols). Differences are significantly different ($p<0.05$) according to a paired t-test (df = 3).

- Plants exposed to N had significantly higher shoot production (Fig. 6).

- Plants exposed to N had significantly higher tissue N concentration during the growth phase, but by the end, the increase in shoot biomass (Fig. 5) cause N to be diluted in N plants (Fig. 7).

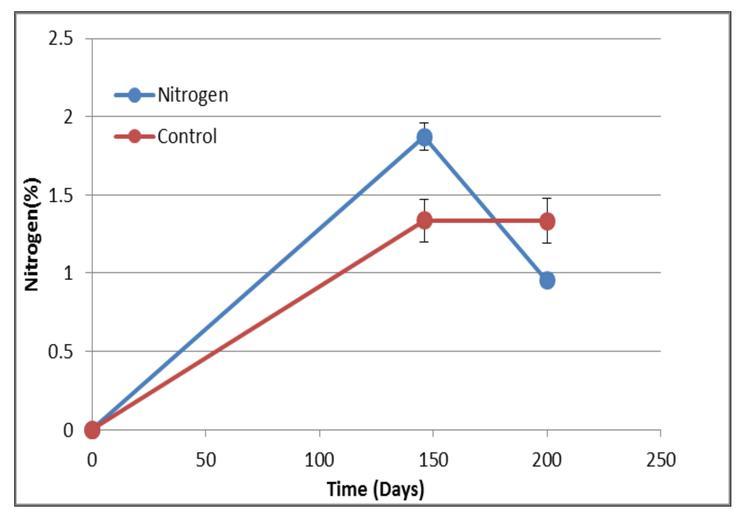

Fig. 7. Mean (±se; n = 4) tissue N concentration of *Brassica nigra* plants growing in high N plots (blue symbols) and control plots (red symbols). Differences are significantly different ($p<0.05$) during the first sampling (day 147) but not the second sampling (day 205) according to a paired t-test (df = 3).

Conclusions

- *Brassica nigra* exposed to high levels of N had higher biomass production than plants growing in low N (control) plots.
- The increase in biomass production was due to shoot growth and reproductive output in plants exposed to N.
- Plants exposed to N had higher tissue N concentration than control plants during the growth phase, but N resources became diluted at the end of the season by the higher shoot production.
- These data indicate that the invasive species, *Brassica nigra*, can become invasive in high N environments because of high shoot and reproductive biomass production.
- These results have important implications for species diversity in chaparral ecosystems exposed to high levels of N deposition.

Literature Cited

1. Vourlitis (2017) Oecologia DOI 10.1007/s00442-017-3860-1
2. Niu et al. (2018) Science of the Total Environment 618 (2018): 1529-538.
3. Liu et al. (2019) Science of the Total Environment 672 (2019): 634-42.

Acknowledgments

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