California weedy rice (*Oryza sativa spontanea*) emergence patterns under field conditions, implications for management

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Introduction

Weedy rice (*Oryza sativa* f. *spontanea* Rosh.), a conspecific to cultivated rice (*Oryza sativa* L.), is difficult to control in California due to agronomic constraints on growers including a lack of chemical control options and herbicide tolerant rice varieties, as well as biological components of weedy rice such as early maturation and competitive growth rate. Because of these factors, weedy rice should ideally be controlled as early as possible in the season to maximize crop yields and reduce manual labor required for plant removal. Early season growth and development of California weedy rice was studied by utilizing a field in west Davis that was seeded multiple times between 2018-2020 with weedy rice types 1, 2, 3 & 5 in order to simulate an infestation.

Purpose

Identify the emergence timing of California weedy rice types 1, 2, 3, and 5 under field conditions.

Materials and Methods

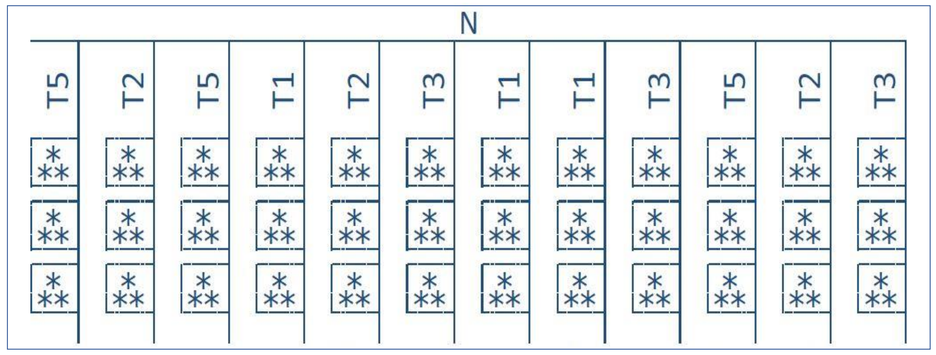

Figure 1. **Field Map** with 3 rows of each weedy type. "T" indicates the weedy rice type, either 1, 2, 3, or 5 , planted in the given row. Each ⁂ delineates a sampling plot

Experimental set-up

- In addition to previous infestation efforts, each sampling plot was seeded with 30 seeds to ensure opportunity for adequate data collection

Experimental Design and Data Analysis

- Cumulative emergence was counted daily after flooding was applied (DAF) by removing seeds from sampling plots (right);
  - Burial depth was noted during removal
- Water and soil temperature logged hourly for the duration of the experiment
- Experiments lasted for 28 days
- ANOVA to determine differences between weedy rice types and years
  - Water temperature was used to calculate thermal time

An emerged seedling removed from a sampling plot

Results and Discussion

- **The majority of seeds emerged from the top 1 cm;** 94% of total counted in 2019 and 80% of total counted in 2020. Emergence was not recorded from depths greater than 3 cm (<1%) in either year. This outcome coincides with previous experiments which indicated weedy rice types 1, 2, 3, & 5 would not emerge from depths at or below 2.5 cm (Galvin et al. unpublished).
- **It took 14 DAF in 2019 to reach max emergence of all weedy rice types and 21 DAF in 2020.** Switching to a thermal time scale, these calendar time points equate to **~300 °C days (growing degree days/ thermal time) in both years** (Figure 2 & 3)**.**
- **Type 2 and Type 3 had significantly more total emergence in 2019 than in 2020.** All California weedy rice types have been found to be sensitive to cold (Galvin et al. 2020) (Figure 4).

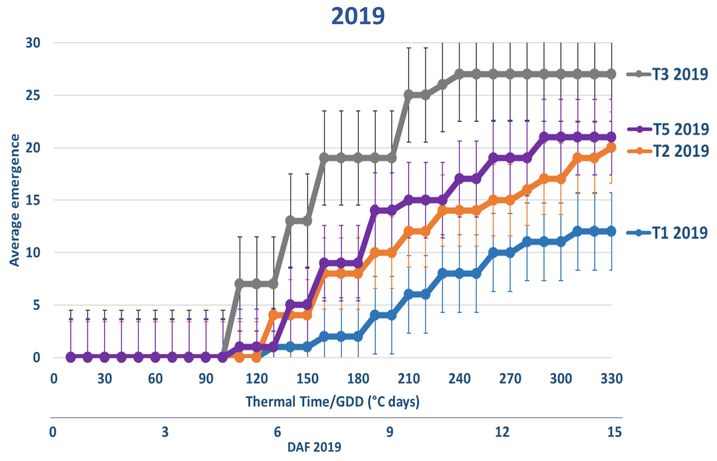

Figure 2. Average emergence of each weedy rice type across both calendar and thermal time points in 2019.

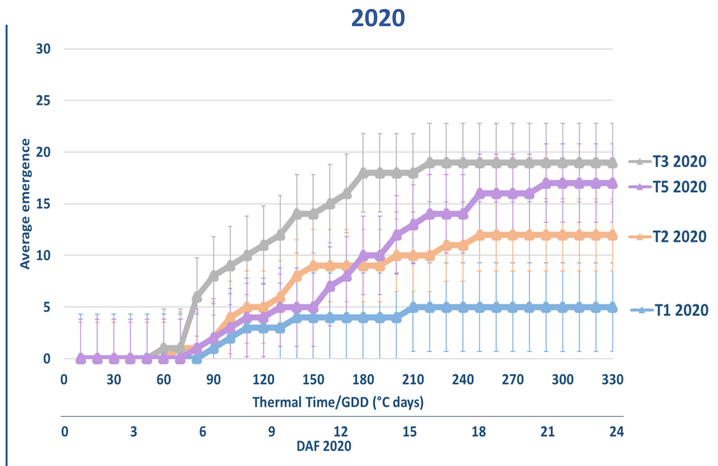

Figure 3. Average emergence of each weedy rice type across both calendar and thermal time points in 2020.

2019

- Average 24 °C days accumulated / 24-hours
- Warmer water temperatures in first 7 DAF

2020

- Average 14 °C days accumulated / 24-hours
- Cooler water temperatures in first 7 DAF

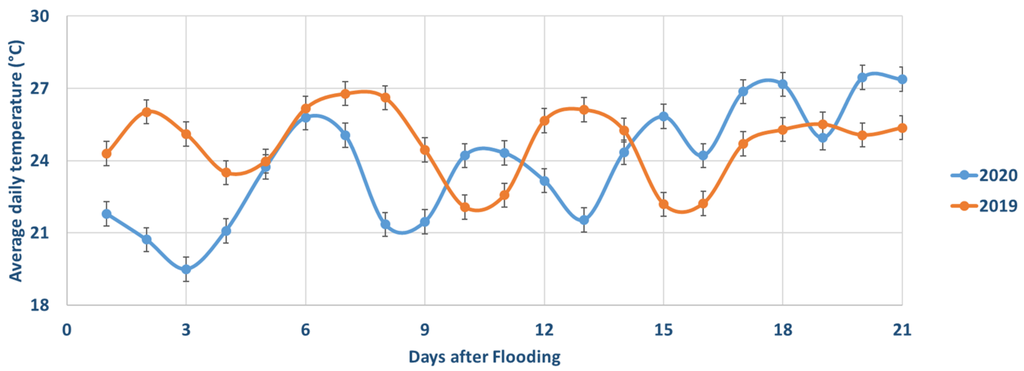

Figure 4. Average daily water temperature across time for both 2019 and 2020 season. Bars represent standard error for each day.

Conclusions

- Most seeds likely to emerge from the top 2 cm of the soil with the majority from the top 1 cm
- Emergence responses are different depending on weedy rice type and are influenced by water temperature
- Growers may be able to use water temperature to promote or inhibit early season weedy rice growth.

Future Research

- Conduct additional season of data collection in 2021 to greater elucidate the field effects on weedy rice
- Apply more rigorous statistical analysis to determine true differences between variables, e.g., years, weedy type
- Use data to validate thermal time models for predicting time to emergence in the field

Acknowledgements

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References

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- Galvin L B, Mesgaran M, Al-Khatib K (2020) Water potential and temperature effects on germination of weedy rice under controlled conditions. Page 19 in Proceedings of the 72nd annual conference of the California weed science society. Monterey, CA.