ABSTRACT

While renewable energy sources have become commonplace in almost every facet of the world’s energy infrastructure, scientists still struggle to find economically viable and mass-produced renewable alternatives to jet fuel. However, the cash-cover crop pennycress has the potential to fill this niche. Achieving germination in the fall is crucial for the successful pennycress harvest. Previous research demonstrated that greater germination in the fall is crucial for successful pennycress harvest. However, minimizing the planting, harvesting, and converting pennycress has a low fossil fuel use conversion are low when compared to other renewable jet fuel feedstocks.

INTRODUCTION

Development of renewable sources of feed stock and aviation fuel is a priority for the US agricultural sector. However, minimizing the replacement of important food crops is an important concern when promoting widespread adoption of oilseed crops. One solution to this problem is the implementation of the cash cover crop, pennycress. With its short winter growing season, pennycress allows for a full season planting of corn or soybeans on the same acreage immediately after harvest, with no negative impact on soybean or corn yield (Bishop, 2019). Pennycress itself suggests that intercropping with pennycress may have advantageous effects on seed yield for crops such as sweet corn (Moore, 2020).

Utilization of pennycress for feed stock and aviation fuel has been proven economically viable (Mousavi-Avval, 2020). Pennycress seeds have a relatively high oil content (25-30% wet basis) which is of sufficient quality for conversion to renewable jet fuel and biodiesel (Mousavi-Avval, 2020; Moser, 2009). The cost of production and logistics for this conversion is low when compared to other renewable jet fuel feedstocks such as canola, camellia, and curcuma. Likewise, the entire process of planting, harvesting, and converting pennycress has a low fossil fuel use ratio and less nitrogen demand compared to other oilseed crops such as canola (Mousavi-Avval, 2020).

One obstacle to pennycress implementation is its non-uniform emergence. For similar oilseed plants like canola, treatment with gibberellic acid (GA) has been proven to cause more consistent germination and higher seed yield (Nizamani, 2018). However, the effectiveness of such treatment is uncertain for wild pennycress and there is not enough evidence to determine whether GA treatment is necessary for genetically edited golden pennycress, which does not suffer from the same non-uniform germination.

RESULTS

Anova tests were used to analyze the data (Figure 3). It was found that the 2022 ‘AVR1’ sample exposed to GA for 0.5, 1, and 12 hours had significantly less days until germination (P = 2x10–16) compared to the wild samples exposed to GA for 30 seconds or not at all. The 2021 wild sample had a significantly decreased germination time for each successively longer treatment (P = 3.9x10–1). The emergence time of the 2022 ‘AVR1’ variety was not significantly impacted by different levels of GA treatment. In contrast, the 2021 ‘AVR1’ variety emerged significantly faster with GA treatment compared to without (P = 9.7x10–10). GA application did not significantly affect seed yield for both 2022 varieties but did significantly increase seed yield for the wild 2021 variety (P = 3.23x10–1) and ‘AVR1’ (P = 3.39x10–1) (Figure 4).

PENNycress SEED YIELD FOR CROPS SUCH AS SOYBEANS (PHIPPEN, 2012). PENNYCRESS ITSELF SUGGESTS THAT INTERCROPPING WITH PENNYCRESS MAY HAVE ADVANTAGEOUS EFFECTS ON SEED YIELD FOR CROPS SUCH AS SWEET CORN (MOORE, 2020).

LITERATURE CITED


RESEARCH FUNDING

Funding for this project was provided by Western Illinois University and the Agriculture and Food Research Initiative Competitive Grants No. 2016-67012-25907 from the USDA National Institute of Food and Agriculture. Any opinions, findings, conclusions, or recommendations expressed in this publication are those of the author(s) and do not necessarily reflect the views of the U.S. Department of Agriculture.