Soybean Yield Interference of Palmer amaranth and Waterhemp in North Dakota: 2022 Mid-Year Progress Report

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Objectives: The objectives of this research are to 1) quantify the influence of Palmer amaranth and waterhemp densities on soybean yield loss in North Dakota and 2) determine the economic threshold for controlling Palmer amaranth and waterhemp in North Dakota soybeans.

Deliverables: This research measured the soybean yield loss due to Palmer amaranth and common waterhemp interference in North Dakota. The waterhemp field trial was demonstrated at the NDSU Weed Science Field Day in 2022.

Materials and Methods: Research was conducted at two experimental sites: a Palmer amaranth-infested field near Valley City, ND and a waterhemp-infested near Fargo, ND. The experiment was a randomized complete block design with four blocks and six Palmer amaranth/waterhemp densities (i.e., treatments): 0, 0.5, 1, 2, 4, and 8 plants m^{-1} of row. The experimental areas were cultivated prior to planting, and soybeans were planted with a 76-cm row spacing. Plots were four rows wide by 7.6 m in length. Soybean variety AG09XFO was planted to a 4 cm depth at 156,000 seeds $acre^{-1}$ on 24 May 2022 and 6 June 2022 at the waterhemp (Fargo) and Palmer amaranth (Valley City) locations, respectively.

Due to unfavorable waterhemp germination conditions, waterhemp seed were planted into research plots on 16 June 2022, and existing waterhemp plants were allowed to grow. Using puff plugs, Palmer amaranth transplants were initiated in the greenhouse on 10 June 2022 and then transplanted into research plots on 30 June 2022. The waterhemp and Palmer amaranth seed used for this experiment was collected from their respective research sites in 2021. Throughout the growing season, plots were hand weeded weekly, and the heights of eight random soybean and weed plants per plot were measured fortnightly. Total waterhemp biomass was collected on 4 Oct. 2022, and soybeans from the waterhemp site were harvested using a Zurn combine on 5 Oct. 2022. Twelve Palmer amaranth plants were collected and sexed from each plot on 13 Oct. 2022, and soybeans from the Palmer amaranth site were harvested using a Zurn combine on 18 Oct. 2022.

Preliminary Results: Preliminary yield data (adjusted to 13% moisture) from the Palmer amaranth site is displayed in Figure 1. Please note, yield data still need to be fit to a rectangular hyperbola model as described by Cousens (1985).
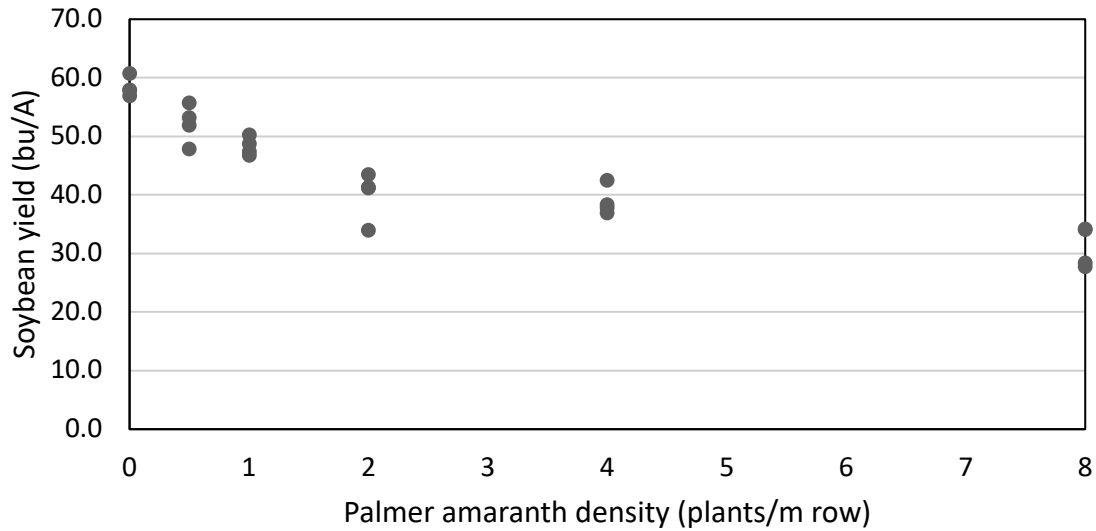
Figure 1. Soybean yield (adjusted to 13% moisture; bu/A) as influenced by Palmer amaranth density (expressed as plants per m row). Each dot represents a single experimental plot. Soybeans were planted on 6 June, Palmer amaranth was transplanted on 30 June, and soybeans were harvested on 18 October in 2022.

Ongoing Efforts: Waterhemp and Palmer amaranth biomass samples have been collected and will soon be processed (weighed, threshed, weed seeds quantified). Once all data have been collected, it will be statistically analyzed. Waterhemp results will be presented at the NCWSS annual meeting in December 2022 and Palmer amaranth results will be presented at the WSWS annual meeting in February 2023. This research will be also discussed at NDSU's Wild World of Weeds Workshop on 1/17/23.