Soybean Yield Interference of Palmer amaranth and Waterhemp in North Dakota: 2023 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.

Materials and Methods: Research was conducted at two experimental sites in 2023: 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. An additional treatment, which included an early transplant of the 4 plants m^{-1} row weed density, was also included. 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 May 22 and June 12 at the waterhemp (Fargo) and Palmer amaranth (Valley City) locations, respectively. Waterhemp and Palmer amaranth plants were initiated in the greenhouse and then transplanted into research plots using 36 mm Jiffy-7 peat pellets. Waterhemp was transplanted on May 26 (early) and June 22. Palmer amaranth was transplanted on June 16 (early) and July 12. The waterhemp and Palmer amaranth seed used for this experiment was collected from their respective research sites in 2022. Throughout the growing season, plots were hand weeded weekly.

Eight random soybean plants were collected to measure yield components (pods $plant^{-1}$ and seeds pod^{-1}) from the waterhemp site on September 28 and Palmer amaranth site on October 20. Waterhemp biomass was collected on September 28, and soybeans from the waterhemp site were harvested using a small-plot combine (Zurn Harvesting, Werther, Germany) on October 2. Palmer amaranth biomass was collected on October 20, and soybeans from the Palmer amaranth site were cut using a walk-behind sickle bar mower and threshed using a mobile thresher (ALMACO, Nevada, Iowa) on October 25. Data were analyzed using PROC GLIMMIX in SAS (version 9.4).

Preliminary Results: Soybean yield varied by treatment at both the waterhemp ($P = 0.0250$) and Palmer amaranth sites ($P = 0.0009$). In both cases, the early-transplanted 4 plants m^{-1} pigweed density reduced yield compared to the 0 plants m^{-1} pigweed density (Figures 1 and 2). This research emphasizes the influence of waterhemp and Palmer amaranth emergence timing on soybean yield, with a 24% and 67% yield loss associated with early-emerging waterhemp and Palmer amaranth, respectively.

In Process: Soybean yield components are still be counted; waterhemp and Palmer amaranth biomass data is still being processed.

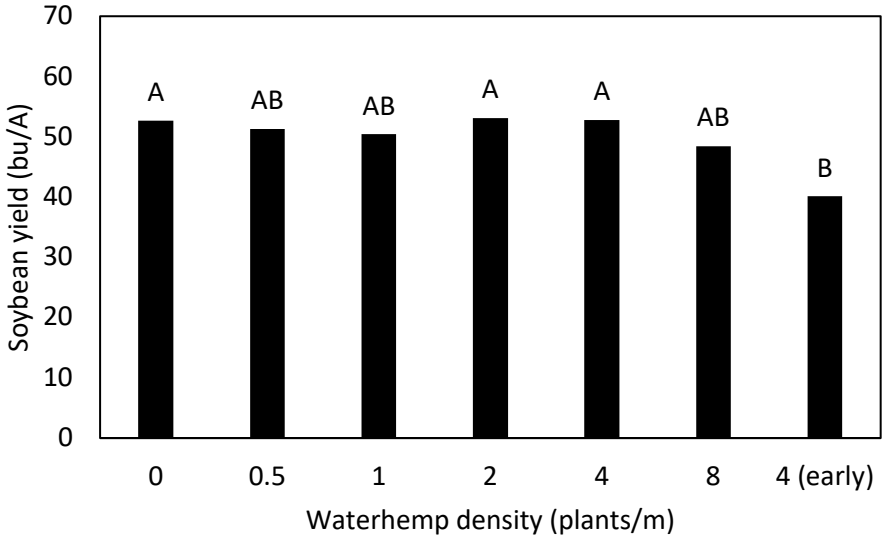

Figure 1. Soybean yield (adjusted to 13% moisture) as influenced by waterhemp density (expressed as plants per m row). Bars with the same letters are not significantly different according to Tukey's HSD (α = 0.05). Soybeans were planted on May 22, waterhemp was transplanted on May 26 (early) and June 22, and soybeans were harvested on October 2 in 2023.

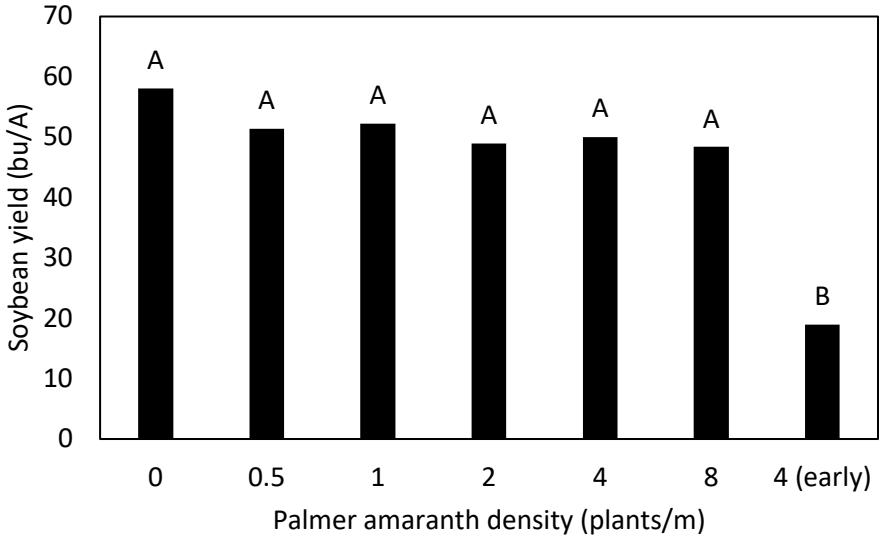

Figure 2. Soybean yield (adjusted to 13% moisture) as influenced by Palmer amaranth density (expressed as plants per m row). Bars with the same letters are not significantly different according to Tukey's HSD (α = 0.05). Soybeans were planted on June 12, Palmer amaranth was transplanted on June 16 (early) and July 12, and soybeans were harvested on October 25 in 2023.