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The influence of nozzle type and application speed on sicklepod control with cadre and butyrac

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Figure 1, Sicklepod seedling in Georgia peanut.

Sicklepod, also colloquially known as coffeeweed, is one of the most common and troublesome weeds in Georgia peanut production systems. Spray chamber/greenhouse studies were conducted to evaluate the effects of application speed (8 and 12 MPH), nozzle type (XR, TTI, and AIXR), and herbicide treatment on sicklepod control.

Figure 2*, Mature sicklepod in Georgia peanut.*

Sicklepod [*Senna obtusifolia* (L.) H.S. Irwin & Barneby], also colloquially known as coffeeweed, is one of the most common and troublesome weeds in Georgia peanut production systems (Figures 1 and 2). In fact, a 2019 survey of more than 1,700 Georgia growers indicated that sicklepod was the fifth most challenging of all agricultural pests, including weeds, insects, and diseases (Culpepper et al., 2020). Sicklepod has also been reported to be a problematic weed in many other states, including Alabama, Arkansas, Florida, Louisiana, Mississippi, North Carolina, South Carolina, Tennessee, Texas, and Virginia (Teem et al., 1980).

Sicklepod can be very difficult to control in peanut partly because they are both members of the same plant family (Fabaceae). Thus, sicklepod is tolerant of many of the herbicides used for weed control in peanut. Additionally, sicklepod can germinate/emerge under a wide range of environmental conditions and produce large amounts of seed (up to 14,000 seed/plant) that persist in the soil seedbank (Boza et al., **1989**; Egley & Chandler, **1978**). From a competition viewpoint, sicklepod populations of 6.7 plants/33 row ft have reduced peanut yields by as much as 27% (Barbour & Bridges, **1995**).

Current control strategies for sicklepod in peanut are based upon the use of narrow row spacing and herbicides. Previous research has shown that sicklepod control was 9% greater when peanut was seeded in a twin-row pattern compared with a single-row pattern (Lanier et al., **2004**). The two mostly commonly used postemergence herbicides for the control of sicklepod in peanut are Cadre 2AS (imazapic) and Butyrac 175 (2,4-DB). According to a recent USDA-NASS survey, these herbicide active ingredients are used on 59 and 34% of the peanut acres in Georgia (USDA-NASS, **2019**). Frequently, these herbicides are tank-mixed together to broaden the spectrum of control.

In recent years, some growers have anecdotally observed less control of sicklepod with Cadre and/or 2,4-DB. Potential causes for this perceived reduction in sicklepod control could be related to many factors including environmental conditions, weed height/stage of growth, application speed, and nozzle type. Cadre resistance, or more specifically, ALS resistance, in Georgia sicklepod populations has not yet been identified (Carter, **2018**). Potential sicklepod resistance to Butyrac has not been investigated.

New Research

Spray chamber/greenhouse studies (Figure **3**) were conducted at the Pesticide Application Technology Laboratory located at the West Central Research and Extension Center in North Platte, NE in 2019 to evaluate the effects of application speed (8 and 12 MPH), nozzle type (XR, TTI, and AIXR), and herbicide treatment on sicklepod control. Herbicide treatments included Cadre 2AS at 4 oz/ac + COC (R.O.C) at 1% v/v, Butyrac 1.75SL at 24 oz/ac + COC at 1% v/v, and Cadre 2AS at 4 oz/ac + Butyrac 1.75SL at 24 oz/ac + COC @ 1% v/v.

***Figure 3**, Herbicide spray chamber at the University of Nebraska Pesticide Application Technology (PAT) Laboratory, North Platte, NE.*

The study was arranged as a randomized complete block design with factorial arrangement of treatments with five replications and two independent experimental runs. Postemergence herbicide applications were made using a three-nozzle research track sprayer with nozzles spaced 20 inches apart and 20 inches above the plants applied at 15 GPA and at 40 PSI to sicklepod plants that were either 3 or 6 inches tall. Nozzles with the same spray angle (110°) but different orifice sizes (04 and 06) were used to keep the application volume consistent when changing the application speed.

Aboveground dry weight biomass reductions were calculated at 28 days after treatment (DAT). Data were subjected to ANOVA using a generalized linear mixed model (PROC GLIMMIX) in SAS (Statistical Analysis Software, version 9.4, Cary, NC) with mean separations made at the α= 0.05 level using Fisher’s protected LSD test and the Tukey adjustment. Data were pooled over experimental runs.

Results and Discussion

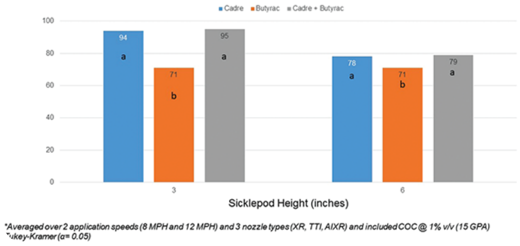

***Figure 4**, Sicklepod biomass reduction (%) with Cadre and Butyrac in the greenhouse 28 days after treatment. Averaged over two application speeds (8 and 12 MPH) and three nozzle types (XR, TTI, and AIXR) and included COC at 1% v/v (15 GPA).*

There were no interactions among main effects of herbicide, nozzle type, and application speed; thus, data are presented by main effects.

When averaged over application speed and nozzle type, Cadre reduced sicklepod biomass by 94% when applied at 3 inches and 78% when applied at 6 inches (Figure 4). Butyrac tank mixtures with Cadre did not significantly improve sicklepod biomass reductions. In more than 50 field trials conducted in the Southeast, postemergence applications of Cadre provided 86% control of sicklepod (Grey et al., 2003). Sicklepod biomass was reduced 71% with Butyrac alone, regardless of height. In prior peanut field research, 2,4-DB provided 69% control of sicklepod (Lancaster et al., 2005).

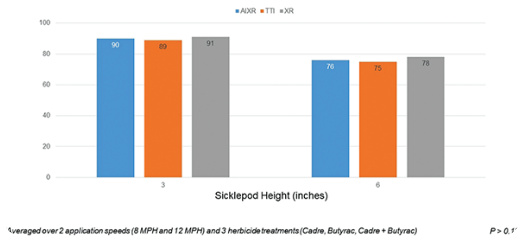

***Figure 5**, Sicklepod biomass reduction (%) as influenced by nozzle type (AIXR, TTI, and XR) in the greenhouse 28 days after treatment. Averaged over two application speeds (8 and 12 MPH) and three herbicide treatments*

(Cadre, Butyrac, and Cadre + Butyrac).

When averaged over application speed and herbicide treatment, nozzle type had no effect on sicklepod biomass reduction (Figure 5). Nozzle type did not influence Palmer amaranth (*Amaranthus palmeri* S. Watson) control in other peanut weed control research (Carter et al., 2017). Additionally, Palmer amaranth control with Cobra (lactofen) was not influenced by nozzle type (Berger et al., 2014). However, nozzles that produce coarser droplets have been reported to reduce the control of many weed species in other studies (Carter et al., 2017; Meyer et al., 2016). Optimum nozzle type, water carrier volume, and spray pressure is herbicide and weed species specific (Sikkema et al., 2008).

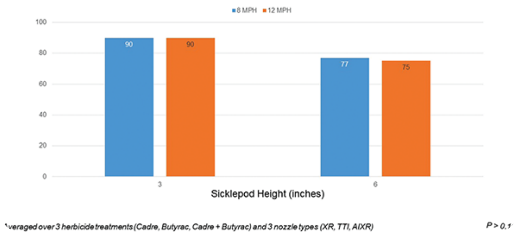

Figure 6, *Sicklepod biomass reduction (%) as influenced by application speed (8 or 12 MPH) in the greenhouse 28 days after treatment. Averaged over three herbicide treatments (Cadre, Butyrac, and Cadre + Butyrac) and three nozzle types (XR, TTI, and AIXR).*

When averaged over herbicide treatment and nozzle type, application speed had no effect on sicklepod biomass reduction (Figure 6). Previous research has shown that application speeds of 5, 10, or 15 MPH did not influence weed control with a combination of Clarity (dicamba) + Roundup PowerMax (glyphosate) (Rodrigues et al., 2018). In contrast, sprayer speed was highly negatively correlated with spray coverage, which in theory, could reduce weed control (Nansen et al., 2015).

Summary

1. Sicklepod can be a difficult weed to control in peanut.

2. Sicklepod height at the time of application is critical for optimum postemergence control.
3. Cadre is the most effective postemergence herbicide for the control of sicklepod in peanut.
4. Nozzle type and application speed did not influence the control of sicklepod when applying Cadre and/or Butyrac.

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