Waterhemp: A 'friendly' native evolved into the Cornbelt's worst weed problem

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Waterhemp's rise to the Cornbelt's worst weed is one of the Cornbelt's more fascinating weed-related events over the past 40 years. Waterhemp (*Amaranthus tuberculatus*) is native to the United States but is a relative newcomer to crop fields. Prior to waterhemp's ascent, redroot pigweed (*A. retroflexus*) and smooth pigweed (*A. hybridus*) were the pigweed species most commonly found in crop fields. Pammel (1913) described redroot pigweed as abundant in every Iowa county, whereas he stated waterhemp (*A. tuberculatus*) was found along water courses and marshes, and concluded the plant was "not long present in well cultivated fields". This paper will briefly describe the history of the pigweeds in the region, and discuss the management and genetic factors that accompanied the change in waterhemp's behavior as a weed. I use the term 'weedy waterhemp' to describe the biotypes that currently plague agricultural fields.

Background. Worldwide there are more than 60 species in the *Amaranthus* genus, many are considered weeds. The Vascular Plants of Iowa (Eilers and Roosa, 1994) lists nine *Amaranthus* species in Iowa. Among Iowa's pigweeds were two waterhemp species, *A. tuberculatus* and *A. rudis*. Historically, *A .tuberculatus* was found east of the Mississippi River, whereas the native range of *A. rudis* was west of the Mississippi River (Sauer 1957). Pratt and Clark (2001) concluded there was no evidence for the two waterhemps to be considered separate species, and proposed a single, highly variable species - *A. tuberculatus*. Currently, the western population is referred to as *A. tuberculatus* var. *rudis* and the eastern population as *A. tuberculatus* var. *tuberculatus*. In this paper, I will refer to the two varieties of waterhemp as the western (var. *rudis*) and eastern (var. *tuberculatus*) biotypes.

Rise to prominence. Waterhemp was not considered a significant agricultural weed until the early 1990s. At the 1982 NCWSS annual meeting no abstracts referenced waterhemp, whereas in 2003 there were 29 citations. Only a few papers in agronomic or weed science journals investigated waterhemp prior to 1980 (e.g. Burnside 1972). While weed scientists paid little attention to waterhemp until the 1990s, J.D. Sauer, an authority on *Amaranthus* taxonomy, stated the western bioype of waterhemp was invading crop fields as far east as Indiana as early as the 1950s (Sauer 1957). It is likely that waterhemp was present in crop fields prior to the 1980s, but rarely reached economic infestations and thus was not a focus of weed science research.

In 2003 I asked extension weed scientists in the North Central region to estimate when waterhemp became a significant problem for farmers in their state (Figure 1). I recently did the same for colleagues in the eastern Cornbelt in order to complete the map. Ground zero for 'weedy' waterhemp was central MO and west-central IL, and the weedy biotype seems to have radiated across the region from that area.

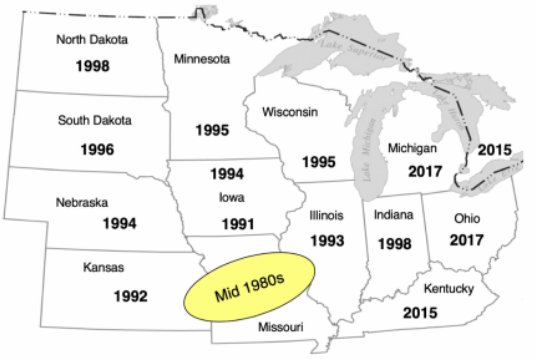

Figure 1. Spread of weedy waterhemp based on University weed scientists' estimates. Hartzler 2003. Updated 2019.*

Agronomic reasons for increased weediness. The 1980s were a period of rapid change for agriculture in the region, and several factors likely contributed to waterhemp's evolution into a serious agronomic weed. Increases in farm size, fuel prices, and concern over soil erosion resulted in the adoption of conservation tillage. Waterhemp is best adapted to systems with less aggressive tillage where the majority of its seed remains near the soil surface. In Iowa, farmers continued to use interrow cultivation on the majority of corn and soybean acres until the mid-1980s. Layby cultivation is an excellent control strategy for late-emerging weeds such as waterhemp. The reduction in tillage, both pre- and post-plant, created a better environment for waterhemp than existed previously, and likely contributed to an increase in waterhemp populations.

In addition to changes in tillage, the 1970s and 80s were the golden era of herbicide discovery. Farms became much more reliant on herbicides during the 1980s, and waterhemp is extremely well adapted to this control tactic. In Iowa and Illinois, the arrival of weedy waterhemp coincided with the widespread adoption of Group 2 herbicides (ALS inhibitors) in the late 1980s. Within five years of introduction of these herbicides the majority of waterhemp in the two states was resistant to Group 2 herbicides. Waterhemp became a problem in southern Iowa about three years prior to northern Iowa. Mike Owen and I attributed the arrival of weedy waterhemp in southern Iowa to the popularity of Extrazine (cyanazine + atrazine) in that part of the state. In northern Iowa, farmers relied more on Group 15 herbicides and dicamba than Extrazine, and those products were more effective on pigweeds.

While reductions in tillage and changes in herbicide use undoubtedly contributed to the increased problems posed by waterhemp, they don't explain the expansion pattern of weedy waterhemp across the Cornbelt. Waterhemp is native to the entire region, thus if changes in production practices were the sole cause of the weedy biotypes it seems they would have appeared randomly across the region, rather than the observed migration pattern. In addition, no-till is much more common in the eastern part of the Cornbelt than Iowa. If reduced tillage was a major factor in the weediness of waterhemp, it seems weedy waterhemp would have appeared earlier in Indiana and Ohio than in the west.

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