

***Verbena hastata*: A native plant ideal for prairie gardens and harsh landscapes**

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EXECUTIVE SUMMARY

With germplasm adapted to every growing region and climate in the United States, the native *Verbena hastata* is uniquely positioned to become highly successful as a commercialized cultivar. While it fits into natural gardens as a native addition, it also has the genetic resources to grow in harsh areas, and withstand any climate or pest pressures. Little research has been done into this species, so an investment must be made to take this plant from seed to product, but the large market and incredible genetic resources available make it worthwhile.

I. INTRODUCTION

A. Study Species.

Verbena hastata, or Blue Vervain, is a tall, wild plant boasting half a dozen spikes of purple flowers that bloom throughout the summer. It is native to North America, found in all 50 States and parts of Canada. The purple flowers and the square stem are reminiscent of Lamiaceae flowers such as Anise Hyssop. However, its tall stature distinguishes it and makes it more suited for wild or native prairie landscapes. In addition, this plant does well in harsh areas, such as disturbed ground or swampy regions, and is often found near rivers. There are no known breeding initiatives current or past, but it is an excellent candidate for breeding, as the available germplasm represents a range of resilient, widely adapted, and low maintenance accessions. Some breeding goals which could make this plant more popular are to make the plant shorter and more compact or to make the flowers bigger and bloom in closer succession. Without breeding, this plant can be marketed for use in prairie gardens or in harsh areas. It is already sold as a wild type through dozens of nurseries across the States, which indicates that there is already demand and it may be profitable for a nursery to simply collect local accessions and sell the seed as is.

B. Taxonomic Classification and Geographic Distribution in the Wild.

Verbena hastata, synonymous with *Verbena hastata* var. *scabra* Moldenke, is in the family Verbenaceae. It is known by the common names Blue Vervain, Swamp Verbena, Swamp Vervain, Simpler's Joy, and Wild Hyssop. However, the name Wild Hyssop can also refer to *Verbena officinalis*, or *Agastache cana*.

Verbena hastata is native to North America, found in all 50 states and several Canadian provinces (USDA, 2012). It has 14 chromosomes, a diploid, which means that hybridization with closely related species such as white vervain (*Verbena urticifolia*) likely played a role in its development (Yuan & Olmstead, 2008). *Verbena* species may have originated in South America, but if this is the case the ancestral species from which it is descended are extinct (Yuan & Olmstead, 2008). In North America, *Verbena hastata* is known to hybridize in nature with *Verbena urticifolia* to produce *Verbena xengelmannii* (Poindexter, 1962). The species *Verbena xrydbergii* is also considered close to *Verbena hastata* (Poindexter, 1962).

Verbena hastata flowers from June to September and is long day flowering (USDA, 2011). It is both cold and heat tolerant but prefers "moist conditions and full to partial sun" (USDA, 2011). It does well in disturbed sites and is commonly found in "moist meadows, thickets, and pastures, as well as riversides, marshes, ditches, and river-bottom prairies" (USDA, 2011). For these reasons, it is a low maintenance native addition to any north American landscape. Possible uses include planting in disturbed areas after construction, use as a barrier between rivers or marshy areas and backyards, or as a native addition to prairie gardens as are becoming popular for homeowners in the great plains.

Verbena hastata is a tall, upright biennial or perennial herb at 35-150 cm tall, with 9-15 cm leaves (Wilken, 2012). The leaves are lanceolate, serrate (lobed), rough-puberulent, and have acute bases with 1-2.5 cm petioles (Wilken, 2012). The inflorescence consists of clusters of 1-8 spikes. The flower bracts are 2-3 mm, the calyx 2.5-3 mm, and the corolla 2.5-5 mm, blue to violet in color (Wilken, 2012). The spikes flower over time, starting at the base and proceeding to the top (Fig. 1). When the

flowers go to seed, the fruit is 2 mm (Wilken, 2012). It has no notable underground storage organs. It grows in clusters of several plants, creating a bush.



Figure 1 *Verbena hastata* juvenile (OSU)



Figure 2 *Verbena hastata* square stem (OSU)



Figure 3 *Verbena hastata* spike inflorescence (Keir Morse)



Figure 4 *Verbena hastata* plant OSU



Figure 5 *Verbena hastata* size comparison vs human hand

Verbena hastata has known medicinal qualities. According to the USDA, “Blue vervain is used internally to treat depression, fevers, coughs, cramps, jaundice, and headaches. Externally, it is used for acne, ulcers, and cuts” (USDA, 2011). It contains level of flavonoids which account for its anti-inflammatory qualities, and may also indicate anticancer qualities (Edewor & Usman, 2012). It was also tested for cytotoxicity when passing regulation for use as a body product and is considered a safe antimicrobial agent (Edewor & Usman, 2012). It is sold as teas, extract, and advertised in some body care products.

II. CROP SPECIES

A. History and Potential Uses.

Verbena hastata is sold by dozens of nurseries around the United States, but only generically as a wild species under the name “Blue Vervain”, or other common names. According to my knowledge, there have been no breeding initiative. Because the best information on *Verbena hastata* is available through the USDA, it seems the bulk of research has been funded publicly. *Verbena hastata*'s strengths are in its wide adaptability and native status. While it could be bred for more favorable characteristics such as larger flowers, concurrent blooming, shorter stature, etc., there are similar plants such as Loosestrife, or Anise Hyssop which are already developed for these types of qualities. However, Loosestrife is an invasive and *Verbena hastata* has similar flowers without posing an environmental risk. It may even be able to compete with Anise, which is very popular, but perhaps has become boring to some gardeners. However, it seems most favorable to focus on *Verbena hastata*'s tall stature as a distinguishing feature, rather than attempting to develop a phenotype more similar to existing garden varieties. Another potential use would be to breed *Verbena hastata* to emphasize medicinal qualities.

A party interested in commercializing *Verbena hastata* could follow the production distribution chain depicted in Figure 1. Any production effort would have to start with collection of germplasm, either from local wild source or from nurseries that already sell *Verbena hastata*. Then, the plants could either be bred for improved traits, or not bred. If the plant is not bred, the seeds would be handed over to a producer. If the plant was put into a breeding program, this could yield seeds, seed products, or vegetative products, which would in turn be handed over to producers. Producers would increase seed or vegetative stock to supply distributors and brokers. Producers would also work with an advertiser to brands and market the product to brokers, growers, retailers, and consumers. Brokers and distributors would supply products to commercial growers, who would supply retailers, who would deliver the plants to consumers. Packet seed

companies would acquire seed from distributors and supply retailers, who would in turn supply consumers. Packet seed companies may also sell to landscape companies and contractors, who sell directly to consumers. Some companies could do multiple steps. For example, producers could also be growers and retailers, or distributors could also package seed and retail to consumers.

Product Distribution Chain

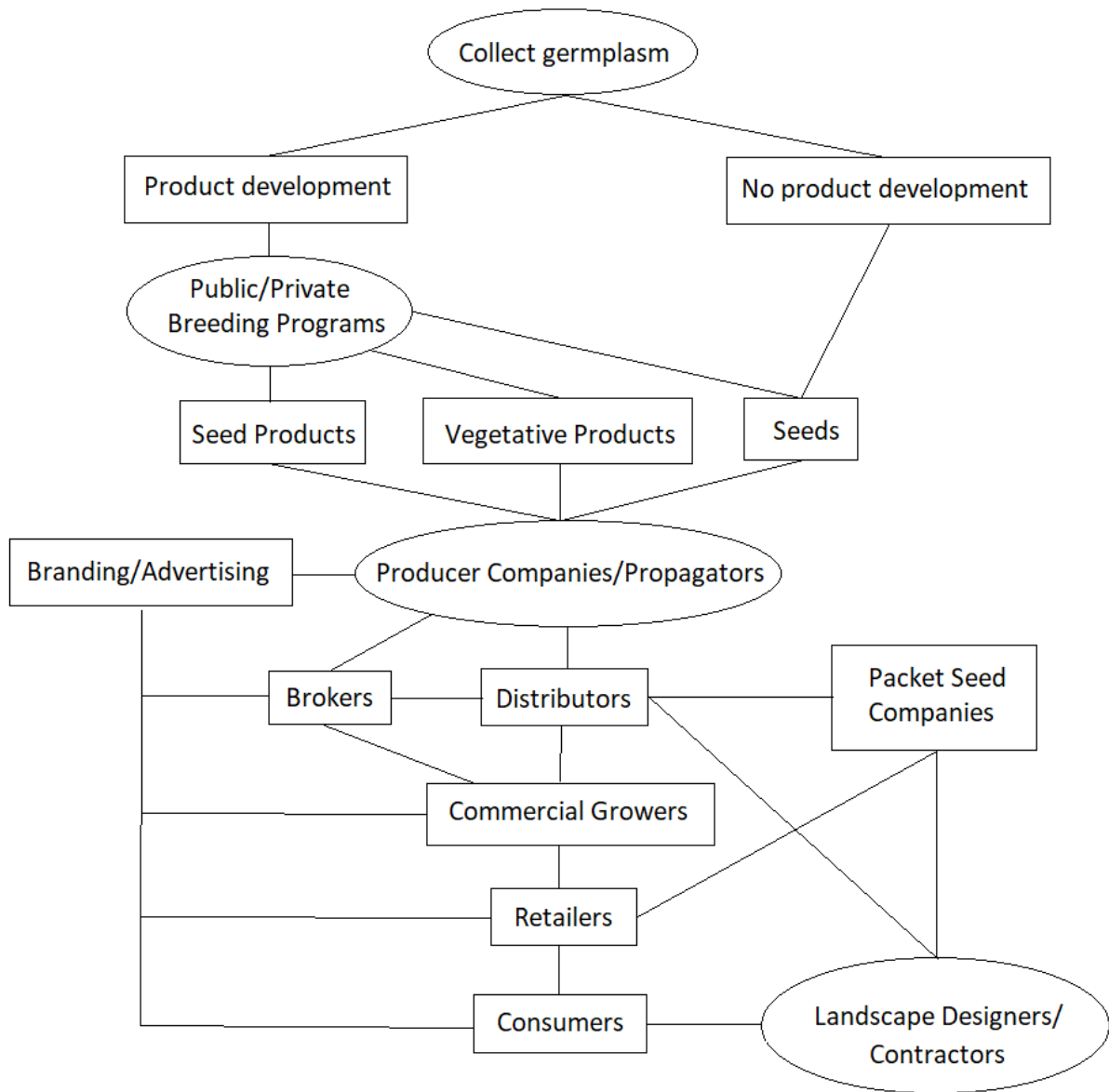


Figure 1. Prospective Product Distribution Chain

The nurseries that currently sell *Verbena hastata* sell local accessions collected from the wild. Therefore, the most common production chain is as follows; germplasm is collected, seeds are grown by the nursery to create a consistent supply of seed, then they grow seeds for sale and sell directly to local consumers. Some nurseries also sell seed. The only difference in the production

chain to sell seed is that after growing up a supply of seed from the wild germplasm, the nursery would then package the seed rather than growing it for sale.

However, breeding could be very beneficial to making this plant more marketable. Following the breeding track, it would be necessary to first develop specific breeding goals. Then, germplasm could be collected based on what populations would be more likely to have desirable traits, or an aggregate sample of germplasm could be taken from across the country. It could take several years to breed a cultivar, at which point the product could progress down the production chain. Assuming a developed cultivar is more marketable, it would be possible that rather than one party taking the plant from seed to product, unique vendors would be involved in the stages of propagation, distribution, commercial growing, and retail. For example, distributors may be able to market the plant product to growers from multiple states, and growers may be able to market to multiple retailers in their local area.

These are only a couple possible paths to commercialize *Verbena hastata*. The production chain should be thoroughly thought through before collecting germplasm. The decision whether or not to breed a cultivar drastically impacts selling price, marketability, and who must do the work to get the plant in the hands of consumers. It's also necessary to note that the general growth habit of *Verbena hastata* does not lend itself well to pot production. These plants get very tall and spindly, with large leaves at the base of the plant. They are not easy to handle in pots, nor are they particularly aesthetically pleasing. While breeding may be able to address this to improve potted production, the simplest solution is to sell bred cultivars as seed packets.

I. PRODUCTION INFORMATION

A. Anticipated Cultural Requirements.

Verbena hastata is an herbaceous perennial adapted to USDA zones 3-9. It can be propagated by seeds or by cuttings, though seed propagation is preferred. According to the USDA (2011), seeds must be stratified in wet sand or peat moss at 38-40 F for three months. Some nurseries

only recommend 4 weeks of stratification. This may depend on what climate the accession was taken from. Seeds can be sown “in a soil mix of one-third sand and two-thirds commercial plug mix” and should be kept between 60 and 80 F (USDA, 2011). When propagating with cuttings, 3- to 4-inch-long stem tip cuttings should be taken in early spring and rooted in sand and perlite rooting medium (USDA, 2011). Transplant can occur in 4 to 5 weeks (USDA, 2011). Plant growth regulators may be useful to shorten the plant or manipulate flowering, but research has not been conducted. There is also no research into disease/insect impacts on this plant. It is likely that if accessions are gathered and planted locally, and in typical environments for this plant to be found in the wild, disease and insect pressures will be minimal because the plants are already adapted. If plants are marketed to a larger growing region, it may be necessary to develop wider disease and insect resistance.

The first step to develop this plant for sale would be to grow it out and verify the information from the USDA, and then to test how different stratification/vernalization periods impact germination and growth. Because it can take three months to prepare this seed for germination, it may be worthwhile to eventually propagate this species primarily from cuttings, but it will still be necessary to initially stratify seeds when collected from the wild to establish a production stock. It will also be worthwhile to test how different daylengths impact flowering. Information about stratification, light requirements, and disease resistance may vary widely depending on where the seed is collected from, but in any case, it is worthwhile to have this information for growth and for breeding.

B. Market Niche.

This plant is in a unique position for commercialization. Because it is native to all portions of the United States, it is adapted to all climates represented in the US and invasive to none. Because it thrives in swampy and disturbed areas, it is a low maintenance addition to a garden or

wild landscape. There is huge potential for this plant as part of prairie gardens or for use in harsh environments. Breeding initiatives could make it more appealing by combining the best traits from different growing regions to develop a more widely adapted cultivar, to shorten the stature and make it more appropriate for gardens, to develop larger flowers, and the list goes on. Wild *Verbena hastata* is already sold in many nurseries across the US, thus there is already a customer base. A nursery interested in selling *Verbena hastata* could harvest local accessions and have seed packets or potted plants ready in a year. After the initial time investment to germinate seed, plants could quickly be vegetatively propagated. A breeding program would likely take a few years to release a cultivar but would be able to draw on a huge gene pool and would likely benefit from the established customer base for *Verbena hastata*.

II. PRODUCT INFORMATION GUIDE (PIG) & CROP SCHEDULE

This plant will be grown in a greenhouse to control the environment. The initial step of stratification will require a refrigeration unit to maintain a constant temperature of 3-5 degrees Celsius. Stratification can take from 4 to 12 weeks, so the appropriate amount of time will need to be determined for the specific seeds being grown. The seeds can then be planted in 288 or larger plug trays. Once plants are established, they can be transplanted to larger pots. Because the growth pattern of these plants is fairly tall, and open, with large leaves near the base, they do not lend well to pot production. They should be direct seeded as soon as possible. Table 1 outlines production from seed to transplantable potted plants. Vegetative cuttings can be taken from well established plants and be ready to leave the greenhouse in 4-5 weeks. Overall production of potted plants for sale will take 8-16 weeks. The time to produce seed is at least 16 weeks.

TABLE 1. Product information guide and crop schedule for seed production

Production step	Time	Environmental requirements	Other notes
Stratification	4-12 weeks	3-5 C	In wet sand or peat moss
Grow to transplant	4-5 weeks	16-27 C	soil, in plug trays
Plant outside or transplant to larger pots for sale		16-27 C	4 inch pots

B. Acknowledgements

The bulk of research conducted on this species is available through the USDA.

III. LITERATURE CITED

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