

# ***Sutherlandia frutescens*: A Woody Perennial that Packs a Medicinal Punch**

**Sarah Korth, Bachelor of Science in Plant Science  
University of Minnesota – Twin Cities, Department of Agronomy and Plant Genetics**

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## **EXECUTIVE SUMMARY**

*Sutherlandia frutescens* is a new crop ready to enter the horticulture market as a woody ornamental plant with exciting medicinal properties and a unique floral display. This exotic new species has unique, papilionaceous butterfly-shaped flowers that will stand out in any landscape setting. In warm climates, drought tolerant *Sutherlandia frutescens* would make an impressive new perennial for arid zones where homeowners are seeking beautiful, but water-conscious additions to their landscaping. In cooler climates, this new crop would make an interesting container plant as well as provide an exciting opportunity for gardeners to test out its medicinal qualities after the flowering season has passed. As a medicinal plant, *Sutherlandia frutescens* has been anecdotally shown to help with gastrointestinal ailments, stress, ulcers and has been described as potentially having anti-cancer properties, hence its common name “cancer bush”.

This paper provides an overview of *Sutherlandia frutescens*' taxonomy and history, as well as potential uses and commercial production guidelines. The paper also outlines the native range of this species, as well as its growth habits and use by the indigenous population. Hailing from South Africa, this new crop has a storied history in folk medicine. If introduced to the market, *Sutherlandia frutescens* could be propagated by seed or vegetatively in a controlled greenhouse environment. The plants could be sold in 4" pots for consumers to transplant at their own home for perennial usage. In cold climates, growers could put several plants into gallon pots for patio containers. Overall, *Sutherlandia frutescens* is a fast-growing crop with many exciting medicinal and ornamental features that make it a good choice for gardeners and professional growers too.

## I. INTRODUCTION

### A. Study Species.

The species under examination in this paper is *Sutherlandia frutescens*. This plant is being investigated as a new, easy to grow perennial or annual plant depending on the climate it is grown. For the purpose of this investigation, *Sutherlandia* was grown from seed under two treatments; one group of seeds was mechanically scarified before sowing, and the other group was sown without scarification as a control. The germination rates between treatments were compared to better understand the best way to cultivate *Sutherlandia frutescens* commercially. Both the scarified and control specimens are shown in **Figure 1** and **Figure 2** respectively. Overall, both treatments produced healthy plants, but the plant that received the scarification treatment germinated more rapidly and was able to grow about 3" taller in 8 weeks than the control plant.



**Figure 1.** Scarified *Sutherlandia frutescens* grown from seed after 8 weeks.



**Figure 2.** Non-scarified *Sutherlandia frutescens* grown from seed after 8 weeks.

## **B. Taxonomic Classification and Geographic Distribution in the Wild.**

*Sutherlandia frutescens* or *Lessertia frutescens* (Fabaceae), also referred to as Cancerwort, Cancer bush, or Balloon Pea, is a shrubby leguminous plant native to South Africa (Khare, 2007; Springfield E.P., 2004). The plant is a medium sized shrub that can grow up to one meter tall and its overall appearance ranges from upright to slack depending on its environment due to the wide genetic variation in the wild population (van Wyk & Albrecht, 2008). Often, the growth habit will include some combination of upright and prostrate growth, with some stems growing upright and others spreading along the ground (Campbell, 2012). The stems of the mature plant can be glabrous or have light pubescence (van Wyk & Albrecht, 2008). The leaves are pinnately compound with small, 2-4cm oppositely arranged leaflets, with one terminal leaflet. The leaves appear ovate to elliptical and can also range from glabrous to sparsely pubescent (van Wyk & Albrecht, 2008).

The potential ornamental value of *Sutherlandia frutescens* as a perennial comes from its striking red flowers, as shown in **Figure 3**. Like many members of the *Fabaceae* family,

*Sutherlandia frutescens* has distinct papilionaceous or butterfly-shaped flowers on a raceme inflorescence (Aboyade et al., 2014; van Wyk & Albrecht, 2008). The individual flowers are between 1 inch and 1.5 inches in length (Campbell, 2012). In its native environment, *Sutherlandia* can flower from spring through summer (M' Afrika Xaba & Notten, 2003). Like many other leguminous species, *Sutherlandia frutescens* fixes nitrogen using nodules on its root system by forming a symbiotic relationship with bacteria (M' Afrika Xaba & Notten, 2003).

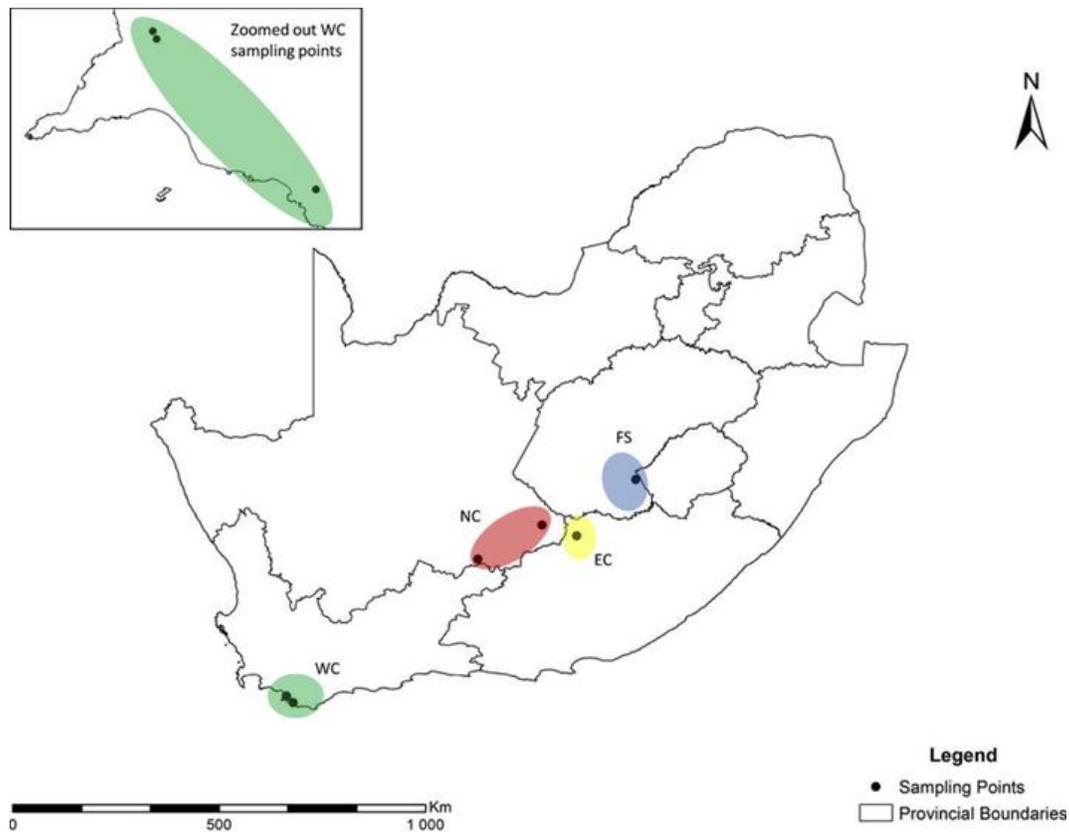


**Figure 3.** *Sutherlandia frutescens*' striking bright red papilionaceous flowers.

(Photo by Bernard Dupont via Wikimedia Commons)

*Sutherlandia frutescens*' native range is the dry regions of South Africa, but it is very tolerant of many environmental conditions, including drought, and it can be found throughout Southern Africa including in dry regions of Southeast Botswana and Southern Namibia (Aboyade et al., 2014; Campbell, 2012; M' Afrika Xaba & Notten, 2003). The geographical distribution is shown in **Figure 4** with colored regions that represent several sampling points for different wild populations in South Africa. (Zonyane et al., 2019). *Sutherlandia frutescens* has not been widely bred or cultivated up to this point, so there is some variation among the wild populations across environments that allows *Sutherlandia frutescens* to succeed in many circumstances (Aboyade et al., 2014). These variations within the species occur regionally, and have led to some

disagreement among scientists about whether the plant is a part of the genus *Lessertia* or *Sutherlandia* (Campbell, 2012). In this paper, both names refer to the same plant.



**Figure 4.** Geographic distribution of wild populations of *Sutherlandia frutescens* in South Africa. (Image via Zonyane et al. 2012)

### C. Invasiveness Potential as a New Crop.

As a new crop species, information on *Sutherlandia frutescens*' invasive potential has not been thoroughly studied, so no information has been published or made widely available yet. However, some criteria have been previously identified for traits that might lead to plants becoming invasive. Some of the physiological characteristics and adaptations that the USDA and U.S. Forest Service have identified as markers of potentially invasive or invasive species include: producing large quantities of seed, thriving on disturbed soil, having seeds favored by

birds that can be spread long distances, or having a root system that is particularly widespread or dense to compete with native species (*Invasive Plants*, n.d.). It is known that *Sutherlandia frutescens* can thrive in many soil types, which could include disturbed soils, and that it seeds itself readily (M' Afrika Xaba & Notten, 2003). It is also known that the plant is pollinated by birds, indicating that birds may prefer its nectar and fruit (Aboyade et al., 2014). *Sutherlandia* is also a leguminous species that fixes nitrogen in the soil; this could lead to higher production of surrounding plants thanks to more available nutrients, as well as increased productivity of *Sutherlandia* itself (Springfield E.P., 2004). Based on these factors, there is some cause for concern about *Sutherlandia frutescens*' potential as an invasive species if it enters the market as a new horticultural crop.

#### **D. Uses by Indigenous People and Medicinal Properties.**

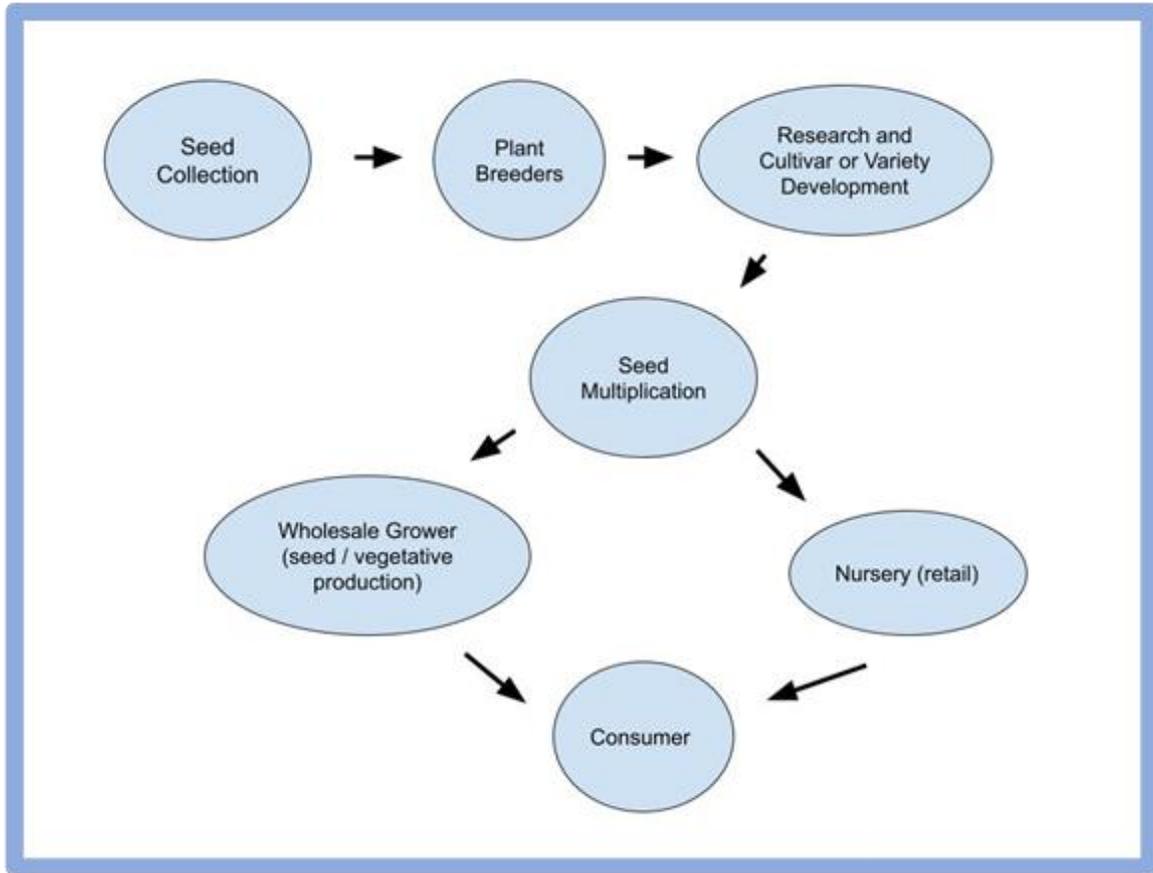
*Sutherlandia frutescens* was originally used as a medicinal plant by the indigenous people of South Africa, including the Khoi San and Nama tribes, who used it to wash wounds and also ingested it to help reduce fevers (M' Afrika Xaba & Notten, 2003). *Sutherlandia* has also been used to treat ailments of the respiratory system, nervous system, cardiovascular system and immune system (Campbell, 2012). The Dutch colonists on the Cape provided some of the first written accounts of the use of *Sutherlandia* as a medicinal plant. The colonists likely learned about its properties from the indigenous Khoi San and Nama tribes who were familiar with its properties (Aboyade et al., 2014). Traditional healers prepare different parts of the plant, including its leaves, roots, stems, and flowers to treat different ailments. These ingredients are typically dried and powdered, then mixed in customized proportions by the healer. The powder can be infused with hot water for the afflicted person to drink (Aboyade et al., 2014).

## **II. CROP SPECIES**

### **A. History and Potential Uses.**

Currently, there are no commercially available cultivars of *Sutherlandia frutescens*, so there are no formally documented historical methods of cultivation. The seeds that are on the market are generally harvested locally from wild species in South Africa and then packaged and sold directly to consumers. Silverhill Seeds is the South Africa-based retailer that the *Sutherlandia* seeds grown in this report were obtained from. They are a small business of plant explorers that harvest seeds directly from the landscape. If *Sutherlandia* were adopted as an ornamental plant

and it were being propagated and distributed on a large scale, the process may look something like **Figure 5**.



**Figure 5.** Potential Distribution chain of *Sutherlandia frutescens* from wild seed to consumer.

*Sutherlandia frutescens* has historically been grown by gardeners and herbalists who want to use the plant for its medicinal properties (Khare, 2007). In general, *Sutherlandia frutescens* is a very hardy plant that will tolerate all soil types, but it prefers a well-draining sandy loam and full sun for best results (M' Afrika Xaba & Notten, 2003). When growing *Sutherlandia* from seed, it is best to soak the seed in warm water for 4 hours prior to sowing. When seedlings emerge in 3-4 weeks, they are ready to be transplanted as soon as they are large enough to handle (M' Afrika Xaba & Notten, 2003). *Sutherlandia* is a relatively short-lived perennial species and it is not difficult to grow from seed. Seedlings do require some method of scarification to germinate quickly, but from a commercial growing perspective it would be most practical to propagate new plants from seed rather than from vegetative cuttings to start.

However, if a new cultivar is developed that a breeder wants to bring to market, vegetative cuttings would be a good option to ensure genetic and cultural uniformity.

An important step in the cultivation of *Sutherlandia frutescens* would include breeding more uniform varieties from wild seed for wholesale production. Another potential breeding opportunity could be developing varieties that are suited to different climates. *Sutherlandia* is naturally tolerant of a myriad of different growing conditions and soil types, so creating hybrids that are more cold tolerant, or sun and shade varieties could be an interesting path to explore, though perhaps easier said than done.

### **III. PRODUCTION INFORMATION**

#### **A. Anticipated Cultural Requirements.**

Depending on the region it is sold in, *Sutherlandia frutescens* would be best marketed as an annual or perennial foliage plant. Its native range in South Africa falls into USDA Hardiness Zone 9, so if introduced in the Southern U.S. or other regions with a similar warm, relatively arid climate, *Sutherlandia* could grow well as a woody perennial shrub. In cooler regions, *Sutherlandia* would be best enjoyed in a large container as a flowering annual during the summer months. In either scenario, the plant's medicinal properties could be highlighted, but the value of the medicinal foliage would probably be greatest in warm climates where *Sutherlandia* can grow all year. In zones where the plant would be an annual, the flowers would be a better selling point.

In terms of growing and production, not much published information is available on *Sutherlandia frutescens*. The seed has a very hard seed coat, so in order to encourage faster germination some form of scarification is recommended, though the seeds will germinate without. *Sutherlandia* has also been noted to prefer full sun and slightly acidic to neutral soil (M' Afrika Xaba & Notten, 2003). In the wild, *Sutherlandia* does not maintain a very uniform habit, so plant growth regulators and pinching could be used to maintain an aesthetically pleasing, bushy shape during production. Depending on the use and size of the transplant, *Sutherlandia* could be sold in a range of container sizes from six inches for container plantings to several gallons for shrub transplants.

In climates where *Sutherlandia frutescens* can be grown as a perennial, the seeds take about 2 weeks to germinate with no scarification. After they germinate, the seedlings grow very quickly and can develop into full sized bushes within one growing season of 2-3 months. Flowering

occurs in midsummer on mature plants, and the flowers persist on the plant for about 3 weeks. Once pollinated, the plant forms balloon-like seed pods that burst open and spread the seeds (M' Afrika Xaba & Notten, 2003).

## **B. Germination Trial in a Controlled Environment.**

To better understand the cultural requirements of *Sutherlandia frutescens*, especially when growing from seed, a trial of scarified versus non-scarified (control) seeds was conducted. For the purposed of this paper, 15 *Sutherlandia frutescens* seeds were mechanically scarified using a razor to crack the seed coat and 12 seeds were sown with no treatment. The seeds were all sown in 128 plugs with Berger “BM2” germination mix and placed in the mist house. After one week, 9 of the scarified seeds germinated along with 1 untreated seed. After two weeks, only one of the scarified seedlings was still living. During the second week, two of the control seeds also germinated, however only one survived. After two weeks, there was one scarified and one control seedling remaining. The germination results of the trial are highlighted in **Table 1**.

Overall, it was noted that the scarified seedlings germinated more rapidly than the control group, but the improved germination rate did not compensate for the issues that both treatment groups had with damping off disease. One possible explanation for why these damping off issues were so prevalent is that the mist house is a significantly more humid and wet environment than *Sutherlandia*'s native range, so the seeds may not be well-adapted to germinating in a damp environment. In the future, growers might experiment with the amount of time seeds spend in the mist house, or let seeds germinate on germination paper to minimize possible exposure to soil-borne disease or excessively moist substrate. Seed trays containing healthy seedlings and seedlings that experiences damping off disease problems for the scarified and control treatment groups are shown in **Figure 6** and **Figure 7** respectively. The remaining living seedlings were transplanted into 4 packs to continue growing and develop an outline for a potential product information guide and growing schedule for commercial production of *Sutherlandia frutescens*.



**Figure 6.** Scarified *Sutherlandia* seedlings germinating in a 128-cell tray. Some of the seedlings have black or brown stems that appear burnt from damping off.



**Figure 7.** Non-scarified *Sutherlandia frutescens* seedlings germinating in a 128-cell tray. The seedling that has germinated shows signs of a weak stem that is pale in color and narrower close to the soil line.

### C. Market Niche.

Since *Sutherlandia* flowers in warm weather, it would be most practical to sell plants that are ready to transplant in the spring. Growers who want to sell transplants of *Sutherlandia* could grow the plant from seed or propagate it vegetatively. Seed production would most likely lead to inconsistent growth among plants until a more uniform variety is developed for the commercial market, so vegetative propagation would be a more efficient method of production for growing uniform plants that are ready for transplanting. In warmer climates, once the plant is established, it can persist on the landscape for several seasons as a perennial bush. As a drought-tolerant species it could be ideal for adding interest to lawns and gardens in dry, arid climates where a traditional turfgrass lawn is expensive or impractical to maintain. As a new ornamental plant on the market *Sutherlandia* could offer an intriguing alternative to traditional drought tolerant plants like sedum or agave.

In cold climates like Minnesota, *Sutherlandia* could be sold in containers as a flowering plant for midsummer. The vivid orange flowers would add interest to patio containers, while also transitioning to a bushy foliage plant for late summer and early fall. Once flowering is done,

gardeners could harvest the plant's foliage to use for medicinal purposes or continue to enjoy the unique foliage until winter.

Consumers will be intrigued by the long and storied history of *Sutherlandia*'s use as a medicinal plant, while also being drawn to its unique flowers and practical appeal for water-conscious landscaping. Wild *Sutherlandia frutescens* could be available on the market as soon as next year with dedicated production, and cultivated varieties could be developed soon after with adequate funding for breeding programs based on consumer interest.

Aside from its ornamental value, *Sutherlandia frutescens* has long been prized for its properties as a medicinal plant. *Sutherlandia* is grown and sold by South African natives in local markets as a ground up powder, as tablets or as an extract to treat a variety of health issues (Gibson, 2011). It is used to treat ailments ranging from stress, arthritis, and ulcers to HIV and cancer (Gibson, 2011). There is some on-going debate about the effectiveness of *Sutherlandia* as a pharmaceutical and research and clinical trials are in progress. Research has confirmed that the stems and leaves of the plant do contain biologically active metabolites and amino acids that may contribute to its medicinal properties, although the exact mechanism of the biologically active components is not yet fully understood (Campbell, 2012). The discovery of the L-canavanine amino acid in the leaves of *Sutherlandia* has been proposed as a possible explanation for the anecdotally supported anticancer properties of plant – L-canavanine has been studied as an antiviral and anticancer ingredient in traditional medicine (Campbell, 2012). Consumers in warm climates where *Sutherlandia* could be cultivated as a perennial plant might be interested in the medicinal properties of the plant, so its healing properties could be an exciting selling point.

## GERMINATION RATES TABLE

TABLE 1. Two groups of *Sutherlandia frutescens* seeds were sown to test the germination rate of seed propagated plants. One group was mechanically scarified using a razor to break the seed coat, and the other group was untreated to use as a control.

Treatment Group	Scarified	Control
Number of Seeds Sowed	15	12
Percent Germination After 2 Weeks	60%	25%

#### IV. PRODUCT INFORMATION GUIDE (PIG) & CROP SCHEDULE

One possible production schedule for *Sutherlandia frutescens* based on the germination and growth observed over the course of the semester, as well as lifecycle sources in the literature is outlined in this section. *Sutherlandia frutescens* thrives in well-draining soil. It is drought tolerant and should be planted in full sun. The mature plant is an irregular bush with impressive orange flowers and unique foliage. Seeds must be scarified either chemically or mechanically prior to sowing for best germination and accelerated growth. The total crop time from seed to transplant is about 91 days or 13 weeks. If planted in the ground, 2 or 3 plants can be grouped together for a fuller appearance. In containers, the number of plants can be adjusted based on container size, with a general rule of 1 plant per 4” pot/quart and up to 4 plants per gallon. Plants can be grown on up to one year in greenhouse production if the grower intends to sell full one-meter bushes to transplant.

##### Propagation Guide

Tray Size (Cell/Tray)	Treatment	Propagation Method	Soil Type	Days to Germination	Comments
128	Mechanical or Chemical Scarification	Seed	Germination Mix	6	Seedlings are prone to damping off, so moisture levels must be closely monitored.

##### Crop Times and Finishing

128 Tray	4-pack	4-inch pot	6-inch/gallon pot	Total Crop Time	Comments
2 Weeks	2 Weeks	3 Weeks	4 – 5 Weeks	12 - 13 Weeks	For a fuller appearance 3-4 plants can be transplanted per gallon pot

Crops of *Sutherlandia* should be sold in bud because the unique flowers will be an important selling point for ornamental purposes. For more detailed requirements such as ideal light levels, soil pH, preferred fertilizer rates and ideal temperatures more research is needed. The production schedule outlined is based on an 8-week growing period in greenhouse conditions with day and night temperatures between 60F and 70F with 16-hour lighting at 500  $\mu\text{mol}/(\text{m}^2\text{s})$ . Fertilization was applied at a rate of 125ppm N CLF 15-5-15 with monthly fungicide drenches.

## **V. ACKNOWLEDGEMENTS**

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