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Scarlet Runner Bean: A Cover Crop for Hot and Humid Areas

From 2017 to 2021, NCAT's Subtropical Soil Health Initiative tested scarlet runner bean as a cover crop in the subtropical Rio Grande Valley of South Texas. This tipsheet was developed in part from the findings of those field trials.

Introduction

Scarlet runner beans (SRB) are closely related to common beans *(Phaseolus vulgaris)* and lima beans *(Phaseolus lunatus)*. They are similar in some regards but differ mainly in two areas. The first is size: scarlet runner beans are HUGE! The vegetative growth is larger, more vigorous, and more robust, and so are the seeds and flowers. The other difference is that the scarlet runners have a perennial starchy root. Some indigenous groups eat these roots, as well as the more commonly consumed beans and young pods (Cairns, 2015). However, some report that the tuber is poisonous and should not be eaten (Ashworth, 2002). It's likely that there are landraces that have been selected for edible tubers, or that the indigenous people employ various techniques to remove the toxins, as seen in cassava production and consumption (Kolawole et al., 2010) and with jicama, another leguminous vine that originated in an overlapping area and was selected for its edible starchy tuber. SRB use the same inoculant as common beans.

Scarlet runner bean growing on a trellis in San Antonio, Texas. Photo: Linda Rodriguez

Phaseolus species developed in the Americas and were integral to the lives of many native peoples. Scarlet runners' life cycle exactly matches that of corn; this was done by design. Their growth habit is suitable, and their harvest time is right, to be intercropped with corn. This is done throughout parts of Central and South America, at altitudes above 1,500 feet. Scarlet runners need a bit more support than common beans because of their larger size, so when scarlet runners are used with corn, the planting density of the beans is reduced to a ratio of 1 bean to 10 corn instead of 1 to 1 as with common beans (Cairns, 2015). Not all tall-growing plants may be used as companions with scarlet runner beans. As Hamburdă et al. (2014) found, there was a significant degree of yield lag (–70% from average) when SRB was planted with Jerusalem artichokes, but, when they were planted with sunflowers in Romania, SRB performed 20% higher than the average. In another experiment, SRB grown with corn in Wisconsin significantly improved dry-matter yield, almost doubling it over mono-cropped corn (Armstrong et al., 2008). The Romanian group concluded that runner beans were economical to intercrop with both corn and sunflowers, and that the beans created an ideal microclimate for their intercrop (Hamburdă et al., 2014).

Because most SRB are adapted to higher elevations in the tropics (much like coffee), it's important to look for locally adapted varieties. In Central America and Mexico, there are landraces of scarlet runner that have been selected for many situations, including hot and dry climate areas

(Delgado Salinas et al., 1988). Some varieties are day-length dependent and may not set fruit the first year, but that's okay because some producers report that SRB can live as long as 20 years. So, if no varieties are specifically adapted to your area and you decide to select for your own adaptation, patience is key.

During NCAT's cover crop accession trial of SRB in the Rio Grande Valley, we got good early-season growth.The vines were robust, vigorous, and strong. As the season progressed, water became scarce and heat became intense, and the scarlet runners didn't run so fast. Few accessions survived, and fewer flowered and fruited. The accession trial was, by design, the worst possible growing scenario, so we could better understand which cover crops could handle the dryland conditions in the Rio Grande Valley. This also gave me an indication of which cover crops needed less inputs and labor on the part of the farmer; Fire-and-Forget! Scarlet runner beans weren't one of these varieties, but they are still a variety that has great potential in an irrigated setting. They weren't bothered by pests and effectively climbed over everything else in a satisfactory manner.

Usually, when beans are planted, the cotyledons rise out of the soil and open to catch light. SRB don't do this at all. Their cotyledons stay beneath the soil surface (hypogeal germination) and are thus protected from harm. Another difference between scarlet runners and other beans is that they twine clockwise around poles, trellises, or other supports (Ashworth, 2002).

SRB are a bit of an anomaly with regard to the rest of the cover crops in this series. The others are tried-and-true cover crops according to research, but scarlet runners have the potential to be cover crops, based on their indigenous use. Our future studies will use more favorable growing conditions to get a better understanding of SRB's weed suppression potential in Texas, but note that among Indigenous peoples in Central and South America, this is already well known. In India, researchers found that by interplanting corn and SRB, they achieved 81% grass weed suppression, which was superior to chemical controls (Divya et al., 2020).

Soil Nutrients

Like the other legumes, SRB can be effective nitrogen fixers, averaging about 125 pounds of nitrogen per acre. For comparison purposes, tomatoes, onions, and cabbage each need about this much per season. Scarlet runner beans can also perennialize in the right conditions (see Appendix A) and have deep tap roots that can mobilize minerals from the sub-soil back to the surface.

Organic Matter

Not much is known about the amount of organic matter SRB produce. About 14,000 pounds per acre of fresh biomass have been recorded in low saline conditions (Gutierriez et al., 2009), which is comparable to lima beans, *Phaselous lunatus.*Also like lima beans, SRB shed their leaves continuously, especially in dry conditions. These shed leaves can act as a mulch and thus help protect the soil from moisture losses, plus eventually leading to organic-matter accumulation.

Soil Moisture

Scarlet runner beans need more water than the other cover crops included in our study. While a few accessions set seed under drought conditions in South Texas, in order for SRB to be a successful cover crop, it would have to do more than just survive; it would have to crush weedy competition without further support. Although Wang et al. (2006) see scarlet runner beans as a potential cover crop in Southern Florida, without significant irrigation or more rainfall they aren't suitable for the Lower Rio Grande Valley or other areas with similar low rainfall patterns.

Pest Reduction

Scarlet runner beans are mildly susceptible to weevil-like Bruchid beetles, which feed on the bean developing inside the pod, but not more so than *Phaseolus vulgaris,* the common bean (Moreira et al., 2013). In the course of our study, we didn't see pests bothering the fruit or leaves in our research plot.

Weed Suppression

Although we didn't see much actual weed suppression in our test plot, SRB has the potential to be a very good weed suppressor when it has adequate irrigation, as seen by Native peoples and others using intercropping methods (Hamburdă et al., 2014; Divya et al., 2020).

Cost of Implementation

To achieve weed suppression, SRB can be planted at a density of 35,000 plants per acre. SRB have a very good germination rate, but seed costs are relatively high when compared with more established cover crops in the industry, especially since it takes about 150 pounds of seed to plant an acre, due to the seeds' large size. However, unlike many cover crops, SRB is also a food crop, and, if the beans are harvested and sold, they can be quite profitable. Some producers report doubling their investment.

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Notes

Appendix A: Scarlet Runner Bean Agronomic Data

USDA hardiness zone	7-11
Soil pH	6.6-7.5
Soil type	Any
Seeding rate (lb/acre)	~150
Nitrogen fixed (lb/acre)	125
Dry matter (tons per acre)	7
Erosion reduction	High
Weed supression	Low
Provides hay?	No
Provides secondary product?	Yes: food, ornamental
Grazing?	Yes

Soil compaction	Relieves
Seed size	2cm
Salinity	Moderately susceptible
Beneficial insects	Pollinators
Response to mycorrhizae	Positive
Germination rate	94%
Germination time	7 days
Inoculant group	Bean group
Water use stage	Intermediate
Water use in max. use stage	Medium

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