The Effects of Seed Steam Treatment on Dry Bean Yield and Presence of Pests & Disease

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The dry bean varieties, seed sources, relative maturity, and seed size are listed in Table 2.

Table 2. Varieties, seed sources, relative maturity, and seed size used in the steam treatment trial, Alburgh, VT, 2018.

Variety	Seed Source	Relative Maturity	Seed Size
Black Turtle	Saved seed, Borderview Research Farm, VT	Late	Small
King of the Early	Saved seed, Borderview Research Farm, VT	Medium	Large
Kenearly Yellow Eye	Saved seed, Borderview Research Farm, VT	Early	Medium

On 8-Jun, populations and vigor were assessed. Populations were taken by counting each of the two rows per plot to determine population per plot. Vigor was ranked on a 0-5 scale, where 0 was poor vigor and 5 was high vigor. Plots were scouted for severity of root rots, ascochyta, anthracnose, bacterial brown spot, common bacterial bean blight, and halo blight on 2-Jul, 12-Jul, 19-Jul, and 31-Jul. Plots insect pests included potato leaf hoppers, thrips, and aphids. Scouting data were recorded on a 0-5 severity scale, where 0 was none and 5 was severely damaged. The presence of other insects during scouting and plant growth stages were noted. Biomass samples were collected on 31-Jul in order to calculate dry matter yield per acre. Biomass samples were taken by pulling up 5 plants per plot and measuring biomass yield.

Root rot can be caused by pathogens like *Fusarium*, *Rhizoctonia*, or water molds in saturated conditions.

Anthracnose (*Colletotrichum lindemuthianum*), is a foliar fungal disease. Symptoms include dark or black lesion lines along leaf veins, and circular lesions on pods that are surrounded by reddish brown to black borders with a grayish black interior. White fungal growth can also be visible. These pod lesions begin as small brown spots, then grow to become sunken and necrotic. Anthracnose thrives in cool, humid weather.

Ascochyta fungi (*Ascochyta spp*.) include pathogens of several species of *Ascochyta*. Ascochyta thrives in cool, moist conditions, and can be identified by small circular brown spots on leaves in early growth stages, and larger, dark grey lesions in later growth stages. Leaf tissue around the lesions may turn black.

Bacterial brown spot is caused by the *Pseudomonas syringae* bacterium. Symptoms on plants include small circular, brown, necrotic lesions that are sometimes surrounded by yellow. Lesions may join to form linear streaks between veins on the leaf, and the centers of old lesions fall out, leaving strips or holes in the plant's leaves. Bacterial brown spot thrives in warm, humid conditions.

Common bacterial blight *(Xanthomonas campestris pv. Phaseoli)5wi12 (t)-0wg0450 1 192.4226.25(s)9(p in b0 (-)]ET Q000000*

the Least Significant Difference (LSD) procedure where the F-test was considered significant, at $p < 0.10$. Variations in genetics, soil, weather, and other growing conditions can result in variations in yield and quality. Statistical analysis makes it possible to determine whether a difference between treatments is significant or whether it is due to natural variations in the plant or field.

At the bottom of each table, a LSD value is presented for each variable (i.e. yield). Least Significant Differences (LSDs) at the 0.10 level of significance are shown. This means that when the difference between two treatments within a column is equal to or greater to the LSD value for the column, there is a real difference between the treatments 90% of the time. Treatments that were not significantly lower in performance than the highest value in a particular column are indicated with an asterisk. In this example, treatment C was significantly different from treatment A, but not from treatment B. The difference between C and B is 1.5, which is less than the LSD value of 2.0 and so these treatments were not significantly different in yield. The difference between C and A is equal to 3.0, which is greater than the LSD value of 2.0. This means that the yields of these treatments were significantly different from one another. The asterisk indicates that treatment B was not significantly lower than the top yielding treatment, indicated in bold.

RESULTS

all dates (Table 4). The number of plots infected with anthracnose, bacterial brown spot, and common bacterial bean blight increased from the first to the last date. Overall plot severities forthe last date.

Table 6. Dry bean populations, vigor, and biomass moisture and yield

31-Jul	Steam	0.00	0.42	1.33	1.67	0.67
	None	0.00	**0.25**	**1.00**	**1.17**	0.33
	LSD (0.10)	NS	NS	NS	NS	NS
	Date Mean	0.00	0.33	1.17	1.42	0.50

*Scouting data were ranked on a 0-5 scale where 0 was none and 5 was severely damaged.
Top performers are in **bold.**
LSD – Least significant difference.
NS- Not significant.

DISCUSSION

Bacterial brown spot was the most common foliar disease across all sampling dates. The last two scouting dates indicate that the 'Black Turtle' dry bean variety may be more resistant to common bacterial blight, and may be correlated with higher yield. However, 'King of the Early' also performed well in terms of populations and vigor.

It is important to remember this trial only represents one season of data. In July 2018, when the scouting was conducted, there was 1.72 inches less than average of precipitation. The overall warm and dry growing conditions resulted in low levels of foliar and root diseases. Warmer and drier conditions during seed germination and early plant growth resulted in the absence of root rot.

While the dry beans did not show significant differences by treatment, all disease and pest severities were low, so it is possible a difference by treatment may be detectable in a year with greater disease and pest levels. More research needs to be done to determine the effects of steam treatment on dry bean yields, quality, and pest and seedborne disease severity.

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