

EFFECT OF STEM AND FOLIAGE SCAB DISEASE ON THE GROWTH AND YIELD OF VSP-1 SWEET POTATO VARIETY

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ABSTRACT

Sweet potato plants inoculated with scab at 2 and 4 weeks after planting (WAP) were severely infected as shown by deformation of leaves and stunted plant growth. Scab infection also caused early death of main vines. However, this was not observed in plants inoculated at 6 and 8 WAP.

Significant differences in disease severity ratings, leaf area and number and weight of marketable roots were observed among the different treatments but not in fresh vine weight, and number and weight of non-marketable roots. Total root yield of plants inoculated with scab at 2 and 4 WAP was reduced relative to the control by 27.8% and 24.5%, respectively. Eight-week old inoculated plants had a yield reduction of only 4.4%.

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KEY WORDS: VSP-1. Sweet potato. Stem and foliage scab (*Sphaceloma batatas* Saw.). Disease severity ratings.

INTRODUCTION

The stem and foliage scab disease caused by *Sphaceloma batatas* Saw. is one of the most prevalent and destructive diseases of sweet potato. It mainly affects the above-ground parts particularly the vine tips making them unacceptable as human food. The disease is charac-

terized by the presence of scabby lesions on the lower surface of the leaf laminae as well as on the petioles and stem. The affected parts may die or tuber production may be greatly reduced (Chupp and Sherf, 1960).

The effect of the stem and foliage scab disease on the growth

and yield of sweet potato has not been thoroughly studied. Divinagracia and Mailum (1975) reported that the scab disease could reduce sweet potato yield by 35%. However, it was not clear at what level of disease severity or at what stage of plant growth is the crop most susceptible. Such information is important in determining the economic threshold level of the disease, and the growth stage at which the pathogen will most adversely affect crop yield. The presence of the scab pathogen in most fields and the probable increase in the incidence of the disease with the current expansion of sweet potato production could become threats to the sweet potato industry.

This study was conducted in the greenhouse of the Department of Plant Protection of ViSCA to determine the effect of the scab disease on the growth and yield of the VSP-1 sweet potato variety. VSP-1 is a high yielding variety of sweet potato which was developed in ViSCA. However, it is susceptible to the scab disease, thus it was used in this study.

MATERIALS AND METHODS

Planting and Care of Test Plants

Healthy 30 to 35 cm long cuttings of VSP-1 sweet potato variety were gathered and planted in clay pots 35.56 cm in diameter and filled with sterilized soil. To protect the plants from weevil infestation, each pot was covered with nylon tulle held in place by means of

a rubber band. The stem of a plant was allowed to come out through a slit made at the center of the nylon tulle and the opening was sealed with masking tape.

Complete fertilizer (14-14-14) at the rate of 16.55 g per pot, equivalent to 60-60-60 kg NPK/ha was applied at planting time. The potted plants were kept relatively insect-free either by spraying with Parapest insecticide or by hand-picking insects that were observed. Plants were also watered whenever necessary.

Treatments and Experimental Design

A completely randomized design (CRD) with 10 replications per treatment was used in this experiment. Fifty potted plants were arranged in rows of 10 plants in the experimental area. Spacing was 30.48 cm between plants and 100 cm between treatments. The treatments used were the different times of inoculation, i.e. at 2, 4, 6 and 8 weeks after planting (WAP), and the uninoculated control.

Preparation of Inoculum and Inoculation of Test Plants

A 2-week old culture of the sweet potato scab pathogen (*Sphaeloma batatas*) was used in further mass-culturing the organism. Ten ml sterile water was added to a test tube slant culture and spores were scraped from the agar medium with a wire loop. A loop of the suspension was then transferred aseptically

by the streak method (Paningbatan, 1983) to previously prepared test tube slants of sweet potato stem decoction agar medium. This medium was prepared using a decoction of 200 g sweet potato young stems with 1000 ml water and 20 g agar, and then sterilizing the mixture in an autoclave at 15 psi for 15 minutes. Two- to 3-week old cultures of isolated pathogen were used as the source of inoculum at a concentration of approximately 5×10^4 spores per ml of sterile water. Inoculum concentration was determined by counting the number of spores in the suspension under a compound microscope with the aid of a hemacytometer.

The spore suspension was spread uniformly on the leaves and stems of the test plants with a hand atomizer. Inoculation was done late in the afternoon and the test plants were then individually covered with plastic bags overnight to maintain high relative humidity necessary for inducing infection.

Data Gathered

Disease Severity. Disease severity ratings were taken biweekly after each inoculation until harvest. The disease severity rating scale used was: 1 = no symptoms on leaf and stem; 3 = occasional lesions on either stem and leaf, less than 10 lesions per 30 cm of vine from the tip; 5 = scattered lesions on the stem and leaves, 10-20 lesions per 30 cm of vine; 7 = more than 20 lesions per 30 cm of vine, slight leaf deformation; and 9 = more than 20

lesions per 30 cm of vine, severe leaf deformation.

Weight of Vines. All vines of the test plants (inoculated and uninoculated control) were weighed separately during harvest.

Leaf Area. The leaf area served as an indicator of the expected effect of the disease on the plant and was taken 1 week before harvest. Starting from the tip, 10 leaves were taken at random from one 30-cm vine per test plant. Since there were 10 replications per treatment, there was a total of 100 leaf samples per treatment. The leaf area was calculated as follows:

$$\text{Leaf Area (LA)} = \text{width of widest portion} \times \text{length} \times \text{correction factor of 0.797.}$$

Harvesting. All plants were harvested 4 months after planting. The pots were carefully turned upside down and the roots were then removed and placed separately in plastic bags.

Number and Weight of Marketable and Non-Marketable Roots Per Pot. The number and weight of marketable and non-marketable roots from each test plant were taken separately. Roots that were at least 2.5 cm in diameter and 6.5 cm in length were considered marketable and all others with sizes below this requirement were considered non-marketable.

Tuber Yield Reduction (%). This was determined using the following formula with the total weight of

marketable and non-marketable roots from uninoculated control plants as basis;

ease severity ratings than those in the other treatments.

$$\text{Yield reduction (\%)} = \frac{\left[\text{Yield of uninoculated control} \right] - \left[\text{Yield of treatment} \right]}{\text{Yield of uninoculated control}} \times 100$$

RESULTS AND DISCUSSION

Symptoms and Disease Severity at Different Growth Stages

Sweet potato plants inoculated with the scab pathogen (*Sphaceloma batatas*) showed leaf deformation, curling and cupping (Fig. 1). The severity of leaf deformation depended upon the growth stage at which the plants were inoculated. Plants inoculated at 2 and 4 WAP were severely infected as shown by deformation of leaves and stunted plant growth.

Lesions appeared 4-5 days after inoculation in the unopened leaf, youngest stem and petioles, and progressed thereafter. Scab infection also caused early death of the main vines especially in plants inoculated at 2 and 4 WAP. Death of the main vines was observed 1 month after inoculation. As a result of this, lateral branches were produced by the plants. However, death of main vines was not observed in plants inoculated at 6 and 8 WAP.

Severe scab disease rating of 8.8 was obtained in plants inoculated at 2 and at 4 WAP, respectively (Table 1). Plants inoculated at 6 and 8 WAP had respective ratings of 7.7 and 6.0. Plants inoculated at 2 and 4 WAP had significantly higher dis-

Gapasin (1984) observed that susceptibility of V3-158 sweet potato cultivar to scab was greatest at 2 to 4 WAP. This agrees with the high initial disease severity ratings obtained in this study for plants inoculated at 2 and 4 WAP. The high initial ratings could also be attributed to the prevailing wet and cool condition in ViSCA when the experiment was conducted. Chupp and Sherf (1960) observed that scab infection is favored by wet and cool weather. Furthermore, incidence of the disease has been reported to be lower during the dry than during the wet months of the year (Lao, 1978).

Effect of Scab Disease on the Growth of Sweet Potato

Fresh Vine Weight. The fresh vine weights of sweet potato inoculated with the scab pathogen at different stages of growth are presented in Table 1. Statistical analysis revealed no significant differences in fresh vine weight among the treatments.

Average Leaf Area. As expected, the uninoculated control gave the highest mean leaf area among the treatments (Table 1). No significant differences in leaf area were obtained among the plants inoculated at 2, 4, 6, and 8 WAP.



Figure 1. Severe sweet potato scab infection at early stage of plant growth. Note curling, cupping and leaf deformation, and lesions on leaf, stems and petioles.

Regardless of the time of inoculation, inoculated plants had smaller leaf area probably due to more lesions on leaves and petioles, especially on the youngest portion of vines. The affected parts later

became wrinkled, cupped and deformed resulting in reduction not only in the size of leaves but also in the total effective leaf area for photosynthesis. These conform with the finding of Chupp and Sherf

Table 1. Scab disease severity ratings, leaf area and fresh vine weights of VSP-1 sweet potato inoculated at different growth stages with *Sphaceloma batatas*.¹

Treatment	Initial Disease Severity Rating ²	Average Scab Disease Severity Rating ³	Fresh Vine Weight (g/plant)	Average Leaf Area (cm ²) ⁴
Uninoculated	1.0 d	1.0 d	1325	38.5 a
Inoculated at 2 WAP ⁵	8.4 a	8.8 a	1375	22.6 bc
Inoculated at 4 WAP	8.6 a	8.8 a	700	23.4 bc
Inoculated at 6 WAP	6.8 b	7.7 b	1150	24.1 bc
Inoculated at 8 WAP	5.4 c	6.0 c	1050	25.4 b

¹Means followed by a common letter or without any letter are not significantly different at 5% level, DMRT.

²Taken at 2 weeks after inoculation.

³Average of disease severity ratings taken biweekly after inoculation until harvest.

⁴Based on 10 leaves/plant and 10 plants/treatment.

⁵WAP - weeks after planting

(1960) that infected sweet potato leaves were usually deformed.

Effect of Scab Disease on Yield and Yield Parameters

Number and Weight of Marketable Roots. The number and weight of marketable roots from inoculated and uninoculated plants are presented in Table 2. The control plants gave significantly higher number and weight of marketable roots than plants inoculated at 2, 4 and 6 WAP. The lowest weight of marketable roots was obtained from plants inoculated at 2 WAP. The reduction in the number and weight of marketable roots in inoculated plants could be attributed to disease

damage on the petioles, stem and most especially on the leaves. The wrinkling and deformation of leaves in plants inoculated at 2 WAP could have reduced the photosynthetic efficiency of the plants, ultimately affecting tuberization. Moreover, greater damage was inflicted on plants inoculated at 2 and 4 WAP since they were exposed to the disease for a longer time.

Number and Weight of Non-Marketable Roots. Although the number and weight of non-marketable roots were lowest in the uninoculated control, no significant differences in these parameters were observed among the different treatments (Table 2). The slightly more

Table 2. Yield and yield components of VSP-1 sweet potato as affected by scab disease caused by *Sphaceloma batatas*.¹

Treatment	Marketable Roots		Non-Marketable Roots		Total Root Yield (g/plant)	% Yield Reduction
	Number	Weight (g)	Number	Weight (g)		
Uninoculated	5.9 a	700.3 a	0.90	0.5	700.8	—
Inoculated at 2 WAP	2.9 d	491.5 d	1.20	14.5	505.7	27.8
Inoculated at 4 WAP	3.5 cd	513.7 cd	1.40	13.8	529.0	24.5
Inoculated at 6 WAP	4.3 bc	610.1 bc	1.10	14.9	618.7	11.7
Inoculated at 8 WAP	5.1 ab	659.8 ab	1.10	10.6	670.0	4.4

¹ Means within a column followed by a common letter are not significantly different at 5% level, DMRT.

and heavier non-marketable roots produced by the inoculated plants might be due to root proliferation at later stages. The roots thus produced have apparently been affected by the disease.

Percent Yield Reduction. Table 2 shows the percent reduction in the total yield of plants inoculated with the scab pathogen at different growth stages. Yield of tuberous roots was reduced by 27.8% when the plants were inoculated at 2 WAP. However, yield reduction was only 4.4% when plants were

inoculated at 8 WAP. Divinagracia and Mailum (1975) reported that the scab disease could reduce sweet potato yield by 35%. Although they did not specify the stage at which the plant was most affected by the disease, present results confirm the ability of the disease to reduce yield of sweet potato by as much as 27.8% when infection occurs early. When infection sets in during the first 2 to 4 weeks of growth, yield reduction is expected to be high. But with infection occurring at 6 weeks or later, only low to slight yield reduction may be expected.

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