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Identification of the Effect of Sulfur Spray on Okra (*Abelmoschus esculentus L.* var. MI 5) Seedlings

DDPBD DEHIGASPITIYA, AG MAYURI DHANANJANIE, NILANTHI DAHANAYAKE*, AGKMWS ATAPATTU AND PCD PERERA

Department of Agricultural Biology, Faculty of Agriculture, University of Ruhuna, Mapalana, Kamburupitiya, Sri Lanka

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ABSTRACT

The study investigated that the effect of sulfur solutions as foliar spray with different concentrations on some selected growth parameters of ladies fingers plants. Pot experiment was conducted with six treatments (2g/L, 4g/L, 6g/L, 8g/L and 10g/L sulfur solutions) and three replicates. For each pot,two plants were maintained throughout the experiment. After seedling emerging, sulfur solutions were sprayed in every week using OSATU sprayer (5 L), until all the leaves got wet. After 30 days physiological features (Number of leaves, leaf length andleaf width) were recorded. Pest and disease incident also recorded at the mean time. Completely Randomized Design (CRD) with five replicates was used. Statistical analysis was performed with Duncan's multiple range test using SAS software (version 9.1.3). Result showed that the highest significant values in number of leaves (26), leaf length (21cm) and leaf width (24cm) were observed that in 10g/L solution of sulfur applied as foliar spray. With the increasing concentration of sulfur solutions the values for the selected physiological features also increased. Pest and disease incidence was significantly higher in control experiment while all the other treated plants don't showed any physiological damage or symptom. The results revealed that the application of sulfur as a foliar spray can be effectively use in increase the net photosynthetic area and to reduce the pest and disease incidence.

Keywords: Foliar application, Ladies fingers, Sulfur, physiological features

INTRODUCTION

Okra (*Abelmoschus esculentus* L.), is an economically important vegetable crop grown in all around the world. 70% of the world total production of okra is from India with 3.5 million tons over 0.35 million ha land. Okra has become popular as a vegetable crop due to its seasons of cultivation, dependable yield and adaptability to varying moisture conditions. According to taxonomical classification, okra comes under family Malvaceae and genus Abelmoschus (Tyagi *et al*., 2006). Insect and pest attacks are highly influenced on the yields of the okra cultivation since they lead to decrease the productive leaf area of the okra plant and cause fruit damage. Various insects, fungi, nematodes and viruses are the pathogens that attack okra. Sulfur is identified as a low acute toxic element in plant disease control (Singh *et al*., 2012). Basically, it prevents fungal infections including powdery mildew, black spots, and rusts. Since sulfur has the ability to prevent spore germination, it would be advantageous in the application at seedling stage sulfur is available in the market in the form of powder, liquid and wettable powder (Bilal, 2008). The present study was focused on identification of the effect of sulfur spray on okra seedlings. The objective of this study is to study the effect of sulfur for ladies fingers as a foliar spray. Some selected morphological characters of ladies fingers under application of sulfur foliar spray were observed in this study.

*Corresponding Author Email:nilanthi@agbio.ruh.ac.lk

MATERIALS AND METHODS

Protected poly house of the Faculty of Agriculture, University of Ruhuna was selected as the experimental site. The experimental design was randomized complete block design (RCBD) with six treatments (2, 4, 6, 8, 10 g/L sulfur solutions and control- without sulfur solutions) and three replicates.

Ladies fingers were selected as planting material. The reasons for selecting ladies fingers were they have comparatively short life cycle, proper vegetative and reproductive stages can be observed. And also they can be planted in pots and easy to maintain and apply the treatments. For the pot preparation, equal sized (3 L) 36 plastic pots were selected. Two equal sized holes were punched to each pot. Pots were labeled as control and as according to treatment. Pots were filled with the prepared potting mixture (Sand 1: Topsoil 1: compost 1). Basal Dressing was added to the pots (Urea, MOP, and TSP) as recommend by the department of Agriculture.

Three days after the pot preparation, the seeds were introduced into the pots. Five seeds were incorporated to a pot maintaining equal spaces. After the plant emergence, excess plants were thinned out (2 plants per pot). Ten days after seeding emergence, treatment application was started.

Preparation of Sulfur solutions

Commercial S powder (98.9%) was taken as a source of sulfur. Five concentrate solutions were prepared (2g/L, 4g/L, 6g/L, 8g/L and 10g/L). Using an OSATU sprayer, the each solution

was sprayed into specified plant until all the leaves got wet from the spray. Everyday afternoon, an equal amount of water was added to the plants. Spraying was conducted in every week (7-day intervals).Weekly, the physiological features (Total height, Number of leaves, leaf length, leaf width, Insect attack)of the each plant were measured.

Fig. 1: Observation of the growth of the plants a, Experimental design; b and c, fungus effected leaves from control; d, Measure the growth parameters

RESULTS AND DISCUSSION

Results showed that with the increasing concentration of sulfur solution, the number of leaves has been increased. The highest number of leaves (26) was observed in the highest concentration of sulfur solution. All the treatments are significantly different compared to the control for number of leaves (Table 1 and Fig. 1).

Table1: Number of leaves 30 days after sawing

Treatment	Number of leaves
Control	10^{a}
2g/l	15^{b}
4g/l	18^{cd}
6g/l	20^{de}
8g/l	22^{e}
10g/l	26^{f}

Means fallowed by the same lower case letters in each column are not significantly different at 5% level with Duncan's Multiple Range Test.

Table 2 shows that spaying sulfur solutions to ladies fingers plants cause significant effect on leaf length and leaf width compared to control treatment. The leaf length was increased with the increasing concentration of sulfur solution (Table 2 and 3) (Figure 2).

Table 2: Leaf length after 30 days of sawing

Treatment	Leaf length (cm)
Control	12^{a}
2g/l	15^{b}
4g/l	17^{bc}
6g/l	19^{cd}
8g/l	20^{d}
10g/l	21^{d}

Means fallowed by the same lower case letters in each column are not significantly different at 5% level with Duncan's Multiple Range Test.

Table 3: Leaf width after 30 days of sawing

Treatment	Number of leaves
Control	14.0^{a}
2g/l	17.0^{b}
4g/l	22.0^{c}
6g/l	22.5^{d}
8g/l	23.0^{d}
10g/l	24.0^{d}

Means fallowed by the same lower case letters in each column are not significantly different at 5% level with Duncan's Multiple Range Test. After 30 days of sawing time, leaves were subjected to insect and pest damages in control treatment. But in treatments which are applied sulfur solutions were not affected by them and the leaves were bright green colour and clear to observe under naked eye (Figure 2 and Table 4).

Table 4: Level of insect damage after 30 days of sawing

Treatment	Level of damage due to insects and pests (%)
Control	22.5^{a}
2g/l	12.5^{b}
4g/l	08.0^{b}
6g/l	00.0^{b}
8g/l	00.0^{b}
10g/l	00.0^{b}

Means fallowed by the same lower case letters in each column are not significantly different at 5% level with Duncan's Multiple Range Test.

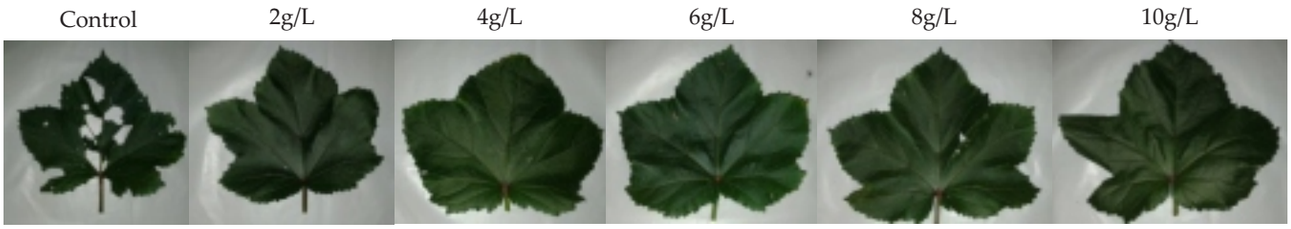

Fig.2: Leaf length, leaf width and insect damage of okra leaves.

It is observed that application of sulfur foliar spray to the leaves of ladies fingers caused an upsurge in a number of leaves, leaf length and leaves width compared to control (Table 1,2 and 3). The results of the experiment conducted by the Jasim (2015) prove that the application of agricultural sulfur to the soil may cause to increase the given parameters.The findings of Schonhof*et al.* (2007) proved that crop yield will be influenced by sulfur supply which is a crucial importance in terms of crop management.

According to Bilal (2008) sulfur prevents the spore germination, so it can be used as apreventive fungicide for powdery mildew, black spots, rusts and other diseases. In this experiment also there was zero damage due to fungal pathogens.

CONCLUSION

Sulfur can be used as a foliar spray to achieve high photosynthetic leaf area and to obtain less damage caused by insects and pests.Plant growth rate also significantly increased due to sulfur application.

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