Germinability of Sclerotia of Sclerotiumrolfsii in Soils Amended with Sugarcane Bagasse Ash

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ARTICLE DETAILS

Article History
Received: 22 February 2017
Accepted: 26 February 2017
Published Online: 23 March 2017

Keywords
SclerotiumrolfsiiSacc., Ash amendment, Sclerotia, soil pH, Saccharumofficinarum L., g ash 100g⁻¹ soil, Days of Incubation, Management strategy, Germination.

INTRODUCTION

Soil pH has long been recognised as an important characteristic which influences the growth of soil microorganisms. On the basis of such a view a number of workers performed various experiments to observe the effect of change in soil pH on soil borne phytopathogenic organisms. One of the Simple and popular method that modify the soil pH is management of soil by mixing plant ash residues.

Ash residues are generally enriched by alkali and alkaline earth metals and highly reactive in soil. Wetting of ash results in hydrolysis of the contained basic cations and formation of an alkaline residue which may have pH exceeding 12.0 (Raison, 1979). Addition of wood ash leads to an increase in soil pH and pore water electrical conductivity and in concentrations of nutrients like K, S, B, Na, Ca, Mg etc. (Ohno and Susan Erich, 1990).

while studying quantitative and some qualitative changes in soil microbes from the 0.8cm soil horizon of an ash bed Renbuss et.al.(1973) reported that modified fungal population reappeared in 3 weeks but although showing rapid recovery in numbers initially, had still not returned to the pre-burn state after 66 weeks. Raison (1979) suggested that ash may change soil microbial activities by altering pH, adding microbial substrates or by improving availability of inorganic nutrients.

A study was, therefore undertaken to determine the effect of soil amendment with sugarcane bagasse ash on percentage germination and germinability of sclerotia of S. rolfsii.

MATERIALS AND METHODS

The experiment was conducted in petri-Dishes in completely randomized design with five replications.

The soil collected were air-dried, passed through2mm sieve and transferred in quantities of 30 gm each of the 25 petri-Dishes taken for 5 replications.

For preparation of ash, Sugarcane bagasses which are the fibrous residue of sugarcane (Saccharumofficinarum L.) stalks left after crushing and extraction of juice were dried at 85°C and ashed in muffle furnace at 55°C for 6 hours. Samples were bulked. Ashes at 5 levels-A0.0 (no ash), A1.0(0.3g ash, i.e.,1%w/w), A2.5(0.75g ash, i.e. 2.5%w/w), A5.0 (1.5g ash, i.e,5%w/w) and A10.0(3.0 g ash, i.e. 10% w/w) were mixed in 30g soils kept separately in 25 petri-Dishes. Water was added as needed to keep the soil moist. Now the petri-Dishes filled with soil were autoclaved at 15lb in⁻² for two consecutive days.

These sterilized petri-Dishes were further covered with autoclaved cotton to avoid any contamination from the surroundings.

Now sclerotia of S. rolfsii produced on PDA were collected and washed with sterile water. Known numbers (25) of viable and non-contaminated sclerotia were mixed with in the autoclaved soils of all the petri-Dishes. These petri-Dishes were incubated for 21 days at 30°C. After incubation the sclerotia were observed daily with the help of dissecting microscope and percentage germination and new sclerotia formation at various ash treatments were recorded and tabulated.

RESULTS AND DISCUSSION

The data mentioned in Table-1 exhibited that amendment of soil with different dosages of ash caused a purportive increase in soil pH. The soil treated with higher dosages (10%, w/w) of ash residues maintained higher pH values of alkaline

ABSTRACT

Germination of sclerotia of Sclerotiumrolfsii were determined in soil amended with different levels (0.1%, 25%, 5.0%& 10.0%) of sugarcane bagasse ash.

Addition of ash reduced the percentage germination and lengthened the days of commencement of formation of new sclerotia. Being alkaline in nature ash residue appreciably raised soil pH from 6.4 to 9.2.
range. It was evident from analysis of variance that this significance in soil pH was due to treatments (P<0.001). However the LSD test showed that the treatment A5.0 and A10.0 differed significantly from all the other treatments as well as control whereas the treatment A2.5 differed significantly only from control.

Ohno and Susan Erich (1990) reported that addition of wood ash leads to an increase in soil pH, electrical conductivity and nutrients. Tejasvi and Kumar (2012) analysed the different physico-chemical properties of fly ash amended soil and observed that fly ash altered the soil texture, decrease bulk density and increase soil pH, porosity, electrical conductivity. These findings support such increase in soil pH.

It is obvious from data given in table-2 that the germinability of sclerotia was significantly reduced due to soil amendment with sugarcane bagasse ash. The germination of sclerotia was most reduced in soils having 10% (w/w) of ash but the soils treated with 1% (w/w) of ash favoured germination of sclerotia.

Sclerotia after germination grew profusely for few days to form fluffy mycelial mat before producing new sclerotia. In the soils having 10% ash, new sclerotia were formed in 8 days after inoculation whereas in non-amended soil new sclerotia formation took 5 days. In soil samples with 1%, 25% and 5% of ash, new sclerotia were formed in 7-8 days. Thus new sclerotia formation was delayed in ash amended soils and was more delayed in 10% ash treated soils.

It is also revealed from table-1&2 that germination of sclerotia in ash amended soils exhibited a significant negative correlation where as new sclerotia formation followed a significant positive correlation with soil pH.

A number of workers had reported that change in soil pH alters the soil microbes in several ways. Henis& Chet (1967-1968) observed a significant decrease in germinability of sclerotia of S. rolfsii due to amendment of soil with 2%(w/w) ammonia which caused the soil pH exceeding 9.8 for a period of 24 hour They further observed that pH values of various treatments remained within a tolerable range of 7.7-8.7. Davey & Danielson (1968) also stressed that loss of viability of sclerotia of S. rolfsii was caused by high alkalinity rather than toxicity of ammonia. Their conclusion was based on the observation that loss of viability of sclerotia occurred when they were exposed to solutions adjusted to pH 9.8 or higher, whether or not ammonia was present. Henis& Chet (1968) also reported that in ash treatments exhibiting lower pH values, decrease in germinability of sclerotia of S. rolfsii could be attributed to increased antagonistic activity of the microorganisms at the soil sclerotum interface. In the present investigation it is likely that high alkalinity to the extent of pH value above 9.0 resulting from addition of sugarcane bagasse ash may be an important factor in limiting the germinability of sclerotia of S. rolfsii.

**Table 1 : Change in soil pH (1:5 H2O) following ash amendment**

<table>
<thead>
<tr>
<th>Ash Level (g ash 100g-1 soil)</th>
<th>Days of Interval</th>
<th>15 DAI</th>
<th>30 DAI</th>
<th>45 DAI</th>
<th>Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>A 0.0</td>
<td></td>
<td>6.5</td>
<td>6.4</td>
<td>6.4</td>
<td>6.43</td>
</tr>
<tr>
<td>A1.0</td>
<td></td>
<td>6.8</td>
<td>7.5</td>
<td>6.2</td>
<td>6.83</td>
</tr>
<tr>
<td>A2.5</td>
<td></td>
<td>6.8</td>
<td>7.5</td>
<td>7.2</td>
<td>7.17</td>
</tr>
<tr>
<td>A5.0</td>
<td></td>
<td>7.8</td>
<td>8.4</td>
<td>8.6</td>
<td>8.27</td>
</tr>
<tr>
<td>A10.0</td>
<td></td>
<td>8.9</td>
<td>9.1</td>
<td>9.2</td>
<td>9.07</td>
</tr>
<tr>
<td>LSD 0.5</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.704</td>
</tr>
<tr>
<td>Significance by F test</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Treatments – 27.02 ***</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>DAI – 01.72 ( NS )</td>
</tr>
</tbody>
</table>

Each value is the mean of 5 replications.

*** = significance at P < 0.001

NS = Not significant

**Table 2 :Germinability of sclerotia in S. rolfsii infested soil amended with sugarcane bagasse ash**

<table>
<thead>
<tr>
<th>Ash Level (g ash 100g-1 soil)</th>
<th>Percentage germination of sclerotia</th>
<th>Commencement of new sclerotia formation (in days)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A 0.0</td>
<td>90</td>
<td>05</td>
</tr>
<tr>
<td>A1.0</td>
<td>94</td>
<td>07</td>
</tr>
<tr>
<td>A2.5</td>
<td>45</td>
<td>07</td>
</tr>
<tr>
<td>A5.0</td>
<td>30</td>
<td>08</td>
</tr>
<tr>
<td>A10.0</td>
<td>07</td>
<td>08</td>
</tr>
</tbody>
</table>

r value with soil pH

0.9340 *** +0.9206 **

Each value is the mean of 5 replications.

*** = Significance at P<0.001

** = Significance at P<0.01
REFERENCES