Strategies of maintaining sweetpotato nurseries free from insect vectors that spread sweetpotato virus disease


1College of Agriculture and Veterinary sciences, University of Nairobi, P. O. Box 29053, Nairobi Kenya; mutuphy@yahoo.com
2Institut des sciences Agronomiques du Rwanda, B. P 73, Musanze, Rwanda;
3Department of Horticulture, Jomo Kenyatta University of Agriculture and Technology, P.O Box 62000, Nairobi Kenya;
4Kenya Agricultural Research Institute; P. O. Box 22274, Mtwapa;
5International Potato Centre, P. O. Box 22274, Kampala, Uganda
6Regional Network for Improvement of Potato and SweetPotato in Eastern and Central Africa (PRAPACE), P. O. Box 22274, Kampala, Uganda

Abstract: Sweetpotato is a food security crop for smallholder farmers in East Africa especially during natural disasters, civil unrest or severe economic hardships. Pest and disease constraints are the most important biotic stresses and viral diseases are the most limiting diseases. Lack of clean planting sweetpotato vines is a major constraint in sweetpotato production and most farmers establish a new crop from virus infected volunteer plants or an old sweetpotato crop hence high initial disease inoculum levels. An experiment was set up in order to identify a package that would be sustainable in maintenance of healthy planting vines. Experimental design used was randomised complete block design. Treatments included polythene, net, maize, spray, rouging and control. It was found that there was a significant different (P=0.05) among different means in entire sampling period. Net and polythene managed whiteflies successfully. Polythene use was termed as the appropriate technique to manage whiteflies. The reason is because polythene is relatively cheap compared to chemical sprays with insecticides and net.

Key words: Aphids, Sweetpotato Chlorotic Stunt virus, Sweetpotato Feathery Mottle virus, Whiteflies,

Introduction

The main sweetpotato producing regions of Kenya are western, eastern, central and coastal areas (MoA, 1999). The most devastating virus disease affecting sweetpotato encountered in Africa and elsewhere is the sweetpotato virus disease (SPVD) (Geddes, 1990). The disease is a complex caused by dual infection and synergistic interaction by the aphid-borne sweetpotato feathery mottle virus (SPFMV) and the whitefly-borne sweetpotato chlorotic stunt virus (SPCSV) (Gibson et al., 1998). Virus diseases alone can cause yield reductions ranging from 56 to 98% (Mukasa et al., 2003). The crop is perpetuated through planting contaminated material and has led to its persistence in the farmers’ fields (Ateka, 2004). Improved phytosanitation offers considerable benefits for SPVD control.

Materials and Methods

Site and plant material

The experiment was set at Jomo Kenyatta University of Agriculture and technology farm at Juja in November-April 2005/2006. The experimental plant material was SPK004 -a moderately susceptible Kenyan improved sweetpotato. Healthy planting vines were obtained from the International Potato Centre (CIP) and Kenya Agricultural Research Institute (KARI). The planting material was initially multiplied in a screen house. Land was ploughed and harrowed. The vines were planted in experimental plots measuring 3m by 2m and 5 treatments namely spraying with systemic insecticide (alternating dimethoate and karate) after every two weeks, netting, use of polythene to act as a barrier to vectors, maize plant as a guard row around sweetpotato plot and the control whereby there was no treatment applied. The field experiment was laid out as randomized complete block design replicated thrice. Stem cuttings of 40 cm with more than four nodes were planted and spaced 10 cm apart. Normal agronomic practices such as weeding and irrigation were carried out regularly.

Assessment of vector populations (whiteflies) was done early in the morning when the insect vectors were less active. The number of adult whiteflies underneath the leaves was counted to obtain the whitefly population, whereas the number of aphids on the same plants gave the aphid population. Ground cover was determined using a beaded string as explained by Brown (1954) and Klingman (1971).
Data was analysed using genstat 9th package and least significant differences (LSD) at 5% level of significance used to separate means.

Results and Discussion

Ground cover assessment

There was no significant difference (P=0.05) between treatment means for the whole sampling period (Table 1). Ground cover was increasing steadily in all treatments at 8-10 weeks after planting (Fig. 1). This could be attributed to optimum environmental conditions hence the vigorous growth (Agrios, 1988). At 10 to 12 weeks after planting, ground cover reduced slightly in all treatments except in spray. This could be attributed to lack of irrigation during this period. Ground cover for spray treatment increased gradually. Probably, chemical spray had an effect on growth of the crop. At 12 to 14 weeks after planting, there was steady increase probably due to the favourable weather. At 14 to 16 weeks after planting, there was drastic decrease in cover in all treatment (Fig. 1). This could be attributed to the crop factors that the crop sheds off leaves due to senescence. At this time, polythene had detrimental effects on growth of the vines. The polythene barrier initially enhanced rapid vine growth but later etiolation was also observed which could be attributed to poor ventilation in the plots and possibly increased temperatures (Jules et al., 1974). At 16 to 18 weeks after planting, there was slight increase in cover except in netting (Fig. 1). The vines grown under the net had larger dark green leaves. This indicates that the species compensate in the shade to some degree by increasing the leaf area of individual leaves (Johnston et al., 1998). In shaded situations increased chlorophyll content per unit area of leaf is beneficial in harnessing the very limited incident light (Johnston et al., 1998). Generally, ground cover for rouging treatment decreased gradually with time. This may be attributed to the fact that all plants showing SPVD symptoms were removed from the plots.

Table 1. Percentage ground cover and whitefly population in different treatments 8-18 weeks after planting (WAP)

<table>
<thead>
<tr>
<th>Treatment</th>
<th>8 WAP</th>
<th>10WAP</th>
<th>12 WAP</th>
<th>14WAP</th>
<th>16 WAP</th>
<th>18WAP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control</td>
<td>79.4</td>
<td>5.33</td>
<td>86.3</td>
<td>5.33</td>
<td>89.2</td>
<td>7.33</td>
</tr>
<tr>
<td>Maize</td>
<td>83.3</td>
<td>4.67</td>
<td>88.2</td>
<td>4.67</td>
<td>87.3</td>
<td>9.67</td>
</tr>
<tr>
<td>Net</td>
<td>84.3</td>
<td>0</td>
<td>85.3</td>
<td>0</td>
<td>84.3</td>
<td>0</td>
</tr>
<tr>
<td>Spray</td>
<td>85.3</td>
<td>6.67</td>
<td>86.3</td>
<td>6.67</td>
<td>89.2</td>
<td>9</td>
</tr>
<tr>
<td>Polythene</td>
<td>86.2</td>
<td>0</td>
<td>91.2</td>
<td>0</td>
<td>81.4</td>
<td>0</td>
</tr>
<tr>
<td>Rogue</td>
<td>80.4</td>
<td>8</td>
<td>88.2</td>
<td>8</td>
<td>88.2</td>
<td>7</td>
</tr>
<tr>
<td>Mean</td>
<td>83.2</td>
<td>4.11</td>
<td>87.6</td>
<td>4.11</td>
<td>86.6</td>
<td>6.39</td>
</tr>
<tr>
<td>P=0.05</td>
<td>0.767</td>
<td>0.026</td>
<td>0.8</td>
<td>0.026</td>
<td>0.441</td>
<td>0.016</td>
</tr>
<tr>
<td>LSD</td>
<td>12.1</td>
<td>5.217</td>
<td>9.84</td>
<td>5.217</td>
<td>9.66</td>
<td>4.377</td>
</tr>
</tbody>
</table>

Fig. 1. Ground cover trend over time in different treatments during short rains 2006 at Juja
**Whitefly assessment**

There was a significant difference (P=0.05) among different means for the whole sampling period (Table 1). At 8 weeks after planting, whitefly population was constant. Probably, weather was not conducive for the vector’s development. From 10 to 12 weeks after planting, there was a steady increase in vector’s population in different treatments except in rogue. This could be attributed to the high temperatures as reported by Legg and Ogwal (1994). This observation is in agreement with what has been reported that in East Africa, whiteflies are abundant on sweetpotato during the hot dry period from November to May and especially on crops 2-4 months old (Sheffield, 1957; Aritua et al., 1998; Alicai et al., 1999). Whitefly population in rogue decreased gradually and this confirms reports by Karyeija et al., (1998) that phytosanitation offers benefits in pests and disease control.

At 12 to 14 weeks after planting, there was a sharp increase in vector’s population with the highest population observed in plots surrounded by maize. The vector’s sharp increase would be attributed to the favourable weather conditions (lack of irrigation coupled with high temperatures). This observation is in agreement with reports by Legg and Ogwal (1994). *B. tabaci* high population in plots surrounded by maize is consistent with observations by Otim et al. (2001) that significant differences in abundance of the insect vector may be attributed to the surrounding vegetation among other factors. Reports made by Kibaru 2003 suggest that effectiveness of trap/barrier crops could be enhanced by spraying at the appropriate time which was never done in maize barrier in our case.

There was a dramatic reduction in vectors population due to heavy rains and irrigation at 14 to 16 weeks after planting. This concurs with reports made by Golding (1936) that a reduction in adult whitefly population after heavy rain showers and attributed it to mechanical destruction of whiteflies by heavy rain. Similarly, Fishpool et al. (1995) reported a negative correlation between rainfall and whitefly population size in cassava and attributed it to a reduction in oviposition. There was slight increase in vector’s population between 16 and 18 weeks after planting which could be attributed to the development of new flushes of leaves. It can be concluded that alternating dimethoate and karate pesticides was successful in *B. tabaci* control.

**Acknowledgement**

Funding by the Regional Universities Forum for Capacity Building in Agriculture (RUFORUM -Grant 2005 RU CG 006) is gratefully acknowledged. Special thanks goes to the field manager Jomo Kenyatta University of Agriculture and Technology for providing land.

**References**