Sweet Potato Weevil (*Cylas formicarius*) Incidence in the Humid Lowlands of PNG

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Abstract

Sweet potato is the main staple crop in PNG and this paper presents a study from the humid lowlands of the Morobe Province. Three experiments were carried out at two locations (Hobu and Unitech) to evaluate the effect of inorganic fertiliser inputs and fallow vegetation on the incidence of sweet potato weevil, *Cylas formicarius* (Coleoptera: Brentidae), and damage to sweet potato *(Ipomoea batatas*) under natural levels of infestation. Nitrogen and potassium application at rates from 0 to 150 kilograms per hectare and 0 to 50 kilograms per hectare, respectively, and fallow vegetation treatments of *Imperata cylindrica*, *Piper aduncum* or *Gliricidia sepium,* had no significant effect on sweet potato weevil incidence and tuber damage over two consecutive seasons. At Hobu, the mean tuber damage category in the continuous sweet potato treatment was slightly higher than fallow treatments in two consecutive seasons, though not significantly so. In the second season, there was a 20-fold increase in the numbers of weevil stages found in damaged tubers of the continuous sweet potato treatment.

Differences in above-ground weevil incidence were recorded between sites with up to 28.5 weevils per square metre at Unitech and a maximum of 0.5 weevils per square metre at Hobu. Levels of tuber and vine damage also differed between sites. At the Hobu site, despite low above-ground weevil incidence, vine and tuber damage was high over consecutive seasons with more than 51% of vines and 34% of tubers damaged. At Unitech, vine damage was consistently above 83%, yet tuber damage did not exceed 16%. Tuber damage, although sometimes high in terms of the percentage of tubers damaged, was superficial at both sites. This had little effect on marketability or yield as low levels of weevil life stages were recorded in the tubers. Site-related differences, in particular rainfall, soil properties and cultivar characteristics may have contributed to the relatively low levels of tuber damage compared with the high levels of weevil incidence on the vines and foliage.

SINCE its introduction to PNG around 400 years ago, sweet potato (*Ipomoea batatas* (L.) Lam.) has been cultivated in low and high altitude ecogeographical environments, and over a wide range of soil types and farming systems (Bourke 1985). Sweet potato is particularly important as a staple in subsistence agriculture where its tubers (storage roots) and, to a lesser extent, vines and leaves are used for human and animal consumption (Kimber 1972).

Sweet potato weevil (*Cylas formicarius* (Fabricius) (Coleoptera: Brentidae)) is the major pest constraint of sweet potato production and is ranked as the fifth most important invertebrate pest in PNG (Waterhouse 1997). It causes economic damage in areas with a marked dry season or in unseasonally dry years (Bourke 1985). The weevil spends its entire life cycle on the host plant, and both larval and adult stages

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damage the tubers and vines. Damage to tubers can reach up to 90% (Sutherland 1986a) and relatively minor damage can both reduce yield and render infested tubers unmarketable due to the presence of feeding marks and oviposition holes. Weevil-infested tubers emit offensive odours due to the presence of terpenes produced by the insects (Sato et al. 1981) and to a rise in the level of phenolic compounds in the tubers (Padmaja and Rajamma 1982), rendering them unpalatable for human or animal consumption. Tuber shrinkage also occurs due to loss of water through feeding or oviposition cavities made by the weevils. The main damage is due to larvae developing inside the edible tubers, but yield losses also occur due to adults and larvae feeding on the vines (Sutherland 1986a). Despite the considerable importance of sweet potato to the subsistence economy of PNG, there are few published studies that examine the interactions of sweet potato weevil with sweet potato, its primary host. In PNG, sweet potato yields are declining or static and there is a potential for yield improvement through both improved nutrient management and an understanding of the fundamental factors that influence the incidence of sweet potato weevil.

A number of management practices influence the incidence of sweet potato weevil and damage to sweet potato. In this study we consider three key factors: fallow vegetation, inorganic nutrient inputs and cultivar selection. Fallow vegetation can influence soil fertility levels but can also potentially reduce pest incidence by disrupting the pest's life cycle either through a break in crop rotation or by the release of allelopathic chemicals (allelopathy is the ability of one plant to use chemicals to repel other plants in order to gain nutrients and light).

Nitrogen (N) and potassium (K) can influence host plant–insect interactions and pest damage levels by changing the chemical characteristics of a crop. This has the potential to influence the feeding or ovipository (egg laying) behaviour of insect pests. Nitrogen increases the protein and starch content of sweet potato (Bartoloni 1982; Li 1982) and influences the levels of triterpenoids in other plants (Gershenzon 1991). Protein and starch are important nutritional requirements of insects, whilst triterpenoids are known to influence the ovipository behaviour of sweet potato weevils (Nottingham et al. 1988).

The objectives of our study were to quantify the incidence of sweet potato weevils and subsequent damage to the sweet potato crop under natural infestation pressure, and to evaluate the effects of inorganic fertiliser inputs and fallow regimes on these parameters. Incidence of sweet potato weevils is also related to cultivar and soil characteristics and rainfall patterns and the relationship between these factors is described. Data included in this paper form part of a series of long-term experiments examining integrated nutrient management strategies (Hartemink et al. 2000).

Materials and Methods

Experimental sites

Experiments were conducted at two locations in the humid lowlands of Morobe Province, PNG. Three experiments were conducted between November 1997 and November 1998 onfarm at Hobu (6°34', 147°02'E, 405 metres above sea level) and on an experimental farm at the PNG University of Technology (Unitech), Lae (6°41', 146°98'E, 65 metres above sea level).

Soils at Hobu were classified as sandy-clay Typic Eutropepts whereas soils at Unitech were sandy Typic Tropofluvents (Soil Survey Staff 1998). At Hobu, secondary vegetation consisting mainly of seven-year old *Piper aduncum* L. was slashed manually in October 1996 prior to site establishment. At Unitech, the experimental site had been under grassland for six years and was chisel-ploughed in June 1996 prior to planting sweet potato. Three successive seasons of sweet potato cultivation had been carried out at the Unitech site prior to the establishment of the trial described in this study.

Rainfall records at Hobu for the experimental periods are shown in Figure 1. At Hobu in 1997, the total annual rainfall of 1897 millimetres (mm) was below the long-term average due to the El Niño phenomenon that affected the Pacific region during that year. In the following year, annual rainfall almost doubled, reaching 3667 mm. At Unitech, the mean annual rainfall is 3789 mm but has varied from 2594 to 4918 mm over the past 25 years. Annual rainfall in 1997 was 2606 mm.

Experimental design and analysis

All experiments were laid out as randomised complete block designs. Plot sizes at Hobu were six square metres (6.0 m × 6.0 m) for trial I and 4.5 m × 4.5 m for trial II. Cultivar Hobu1, obtained from local gardens, was planted on a 0.75 m × 0.75 m grid. At Unitech, plot sizes were 3.2 m × 4.0 m with planting distances of 0.4 m × 0.8 m and the cultivars Markham (trial III, two seasons) and Hobu1 (trial III, one season) were planted. Vine cuttings of 0.3 m length were used as planting material in all trials. Plots were replanted directly after each harvest. Weed control was manual for all trials and no pesticides were applied. Weevil infestation was natural for all trials.

Trial I

In trial I the effect of fallow vegetation on sweet potato weevil incidence and sweet potato damage was investigated. The trial consisted of four treatments replicated four times. The fallow treatments were *Piper aduncum*, *Gliricidia sepium* and *Imperata cylindrica* and the control treatment was continuous sweet potato. The control had previously been under continuous sweet potato for two seasons whilst the fallow plots had been under fallow for one season previously. The fallow vegetation was slashed prior to planting sweet potato. The trial was carried out over two consecutive cropping seasons of 168 and 174 days, respectively, at the Hobu site. Total rainfall was 1894 mm for the first season and 1576 mm for the second season (Fig. 1).

Trial II

The effects of inorganic fertilisers on sweet potato weevil incidence and damage to sweet potato were examined in trial II. It consisted of eight treatments replicated four times and was carried out over one growing season at Hobu. The trial was laid out as a factorial combination of four levels of N (0, 50, 100 and 150 kilograms per hectare) and two levels of K (0 and 50 kilograms per hectare). Fertilisers were applied in split dressings at 8, 55 and 81 days after planting. The growing season lasted 179 days. Total rainfall for the growing season was 2214 mm (Fig. 1).

Trial III

During the first season of trial III, three levels of inorganic N (0, 50 and 100 kilograms per hectare) were applied and the sweet potato cultivar Markham was used. In the subsequent season, the trial was repeated using the same treatments but with the addition of sweet potato cultivar Hobu1 in order to compare cultivar susceptibility to sweet potato weevil. Each treatment and control was replicated four times in both seasons. Fertilisers were applied in split dressings at 29 and 51 days after planting. The length of the growing season was 171 and 163 days for the first and second seasons, respectively. Total rainfall for the first and second seasons was 1838 mm and 2293 mm respectively (Fig. 1).

Weevil incidence and damage

At both sites, for trials II and III (second season) within-foliage populations of adult sweet potato weevil were monitored bi-weekly throughout the season, up to and including the final harvest. For trials I and III (first season) weevil counts were only made at final harvest. All above-ground weevil counts were determined using one metre square metal quadrats randomly positioned and repeated three times in each plot.

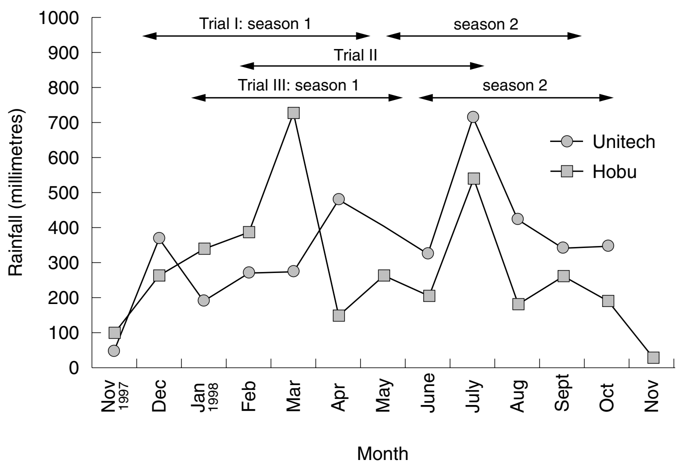

Figure 1. Monthly rainfall patterns at experimental sites during growing seasons.

At harvest, all vines were slashed to within 0.15 m of the tuber crown and removed from the plot. Three plants were dug manually, removed from each plot and the remaining vine sections cut and placed in paper bags. The number of vines (damaged and undamaged) and vine weights were recorded. Vines were dissected to assess damage as indicated by the presence of feeding marks and weevil life-stages. Tubers were counted, weighed and separated into marketable (> 100 grams) and non-marketable (< 100 grams) tubers. Marketable tubers were subdivided by external appearance of the outer periderm as either damaged (presence of feeding and/or ovipositon marks) or undamaged (no marks). Damaged marketable tubers were sliced at the zone of maximum surface damage and categorised using the visual damage rating scale of Sutherland (1986b). Damaged tubers were sliced into 3 mm sections to count weevil life stages.

Data analysis

Data from all trials were analysed using the statistical software package Statistix for Windows and subjected to analysis of variance. The test of least significant difference (LSD) was used to compare treatment means. After preliminary analysis of final harvest data from all trials, no significant differences between treatments were observed and treatment data were therefore pooled to allow comparison between treatments and controls in each trial.

Results

Trial I

Above and below-ground parameters measured for the fallow trial at Hobu over two consecutive cropping seasons are shown in Table 1. Above-ground adult weevil populations at final harvest were low for all treatments and there were no differences ($P > 0.05$) between treatments over both growing seasons. Vine damage was high over both seasons, with more than 50% of vines damaged, but few life stages were observed in the vines. There were no differences ($P > 0.05$) between treatments for all above-ground parameters examined within each season. However, the number of weevil life stages per vine was consistently higher for the continuous sweet potato treatment for both seasons but 2.5-fold higher in the first season.

Over three-quarters of all marketable tubers were damaged in the first season and over one-third of tubers in the second season for all treatments. Damaged tubers were predominantly category 1–2 (i.e. only superficial damage by weevils) over both cropping seasons and treatment differences were not significant ($P > 0.05$).

When examining the between-season trends for weevil damage, there was at least 50% less tuber damage in the second season compared with the first season. However, in the second season there was a 20-fold increase in the number of weevil stages found in damaged tubers of the continuous sweet potato treatment (Table 1), which was reflected in the higher mean damage category value.

Trial II

Table 2 shows the above- and below-ground parameters measured in the inorganic fertiliser trial over one growing season at Hobu. The above-ground adult weevil population was highest in the control and, although it was lower where fertiliser had been applied, the differences were not significant ($P > 0.05$). Vine damage was high for all treatments, with more than three-quarters of vines damaged. However, few life-stages were observed in the vines. There were no significant differences ($P > 0.05$) between treatments for any of the above-ground parameters examined. Damaged tubers for all treatments were predominantly category 1 (i.e. only superficial damage by weevils) with the exception of the control (category 2), but the number of damaged tubers was high (78–100%). This was in marked contrast to the number of weevil stages found in the tubers, which was low for all treatments. There were no significant differences ($P > 0.05$) between treatments for any of the below-ground parameters examined.

Trial III

Table 3 shows the above and below-ground parameters measured in the inorganic N fertiliser trial over two consecutive cropping seasons at the Unitech site using the Markham cultivar. There were no significant differences ($P > 0.05$) between treatments, in any parameter, within each season.

There was a marked reduction in the number of above-ground weevils on the foliage at final harvest in the second season compared to the first season, but this was not reflected in other above-ground parameters. The number of weevils on the foliage prior to harvest increased with increasing N application in both seasons although the increase was not statistically significant ($P > 0.05$). Weevil counts at the Unitech site were relatively higher than those recorded at the Hobu site (Tables 1 and 2).

Table 1. Comparison of above and below-ground sweet potato weevil incidence and damage (± SD) under continuous cropping and fallow treatments (trial I, Hobu site).

Season	Treatment	Weevils on foliage (no. per m^2)	Damaged vines (%)	Weevil life stages per damaged vine	Marketable tuber damage (%)	Weevil life stages per damaged tuber	Mean damage category
First	Continuous sweet potato	0	52 ± 20	1.5 ± 2.4	78 ± 11	0.3 ± 0.5	1.7 ± 0.4
	Sweet potato after one year fallow[a]	0	62 ± 14	0.6 ± 0.9	88 ± 20	0.7 ± 1.2	1.5 ± 0.5
Second	Continuous sweet potato	0.5	55 ± 18	0.5 ± 0.6	35 ± 18	5.3 ± 10.5	2.6 ± 0.7
	Sweet potato after one year fallow[a]	0.1	51 ± 30	0.3 ± 0.7	34 ± 21	0	1.6 ± 0.8

[a]Fallow vegetation is pooled data from fallow treatments with *Piper aduncum*, *Gliricidia sepium* and *Imperata cylindrica* for both seasons.

Table 2. Assessment of above and below-ground sweet potato weevil incidence and damage (± SD) at four combinations of inorganic fertiliser input rates (trial II, Hobu site).

Treatment	Weevils on foliage (no. per m^2)	Damaged vines (%)	Weevil life stages per damaged vine	Marketable tuber damage (%)	Weevil life stages per damaged tuber	Mean damage category
No fertiliser	0.9 ± 1.4	87 ± 16	0.25 ± 0.50	78 ± 11	0.25 ± 0.50	2.1 ± 0.9
N 100 kg /ha	0.5 ± 0.7	83 ± 18	0.16 ± 0.55	88 ± 20	0.16 ± 0.55	1.3 ± 0.9
K 50 kg/ha	0.2 ± 0.3	97 ± 5	0	100 ± 0	0	1.3 ± 0.6
N+K[a]	0.2 ± 0.3	80 ± 18	0.33 ± 0.89	100 ± 0	0	1.3 ± 0.5

[a]N+K = N at 100 and K at 50 kilograms per hectare (kg/ha)

Table 3. Assessment of above and below-ground sweet potato weevil incidence and damage (± SD) to sweet potato cultivar Markham at three different rates of inorganic nitrogen (N) application over two consecutive seasons (trial III, Unitech site).

Treatment	Weevils on foliage (no. per m^2)	Damaged vines (%)	Weevil life stages per damaged vine	Marketable tuber damage (%)	Weevil life stages per damaged tuber	Mean damage category
First season						
No fertiliser	12.8 ± 3.5	100	3.5 ± 3.9	0	0	0
N 50 kg/ha	20.5 ± 12.5	100	3.0 ± 1.8	0	0	0
N 100 kg/ha	28.5 ± 14.8	100	4.8 ± 2.2	16	0.3	1
Second season						
No fertiliser	2.3 ± 2.2	97 ± 7	5.3 ± 5.9	0	0	0
N 50 kg/ha	3.0 ± 3.4	100	3.0 ± 2.6	6	0	0.3
N 100 kg/ha	3.8 ± 2.5	93 ± 14	3.0 ± 2.3	6	0	0

The percentage of damaged vines was high (93–100%) for all treatments over both seasons. Despite considerable vine damage in both seasons, tuber damage was relatively low as reflected by the low number of weevil life stages in the tubers (Table 3). Whilst weevil counts on the foliage were relatively high, only the N treatments showed some degree of marketable tuber damage (category 1).

Table 4 shows the parameters measured in trial III, which compared the effect of N applications on two sweet potato cultivars, Hobu1 and Markham, over one cropping season at the Unitech site. There were no significant differences ($P > 0.05$) between treatments or cultivars. Vine damage was relatively high (83–100%) for all treatments, and this was reflected in the higher number of weevil life stages recorded in dissected vines. The percentage of marketable tubers with weevil damage was relatively low for all treatments and the mean tuber damage category level was low (< 1), with the exception of the Hobu1 cultivar control treatment which had a mean damage category of 2 and higher weevil numbers present in the tubers.

Weevil incidence, rainfall and cultivar

When comparing above-ground weevil counts at final harvest (Tables 1–4) there was no correlation with total seasonal rainfall levels at either experimental site. For trials II and III (second season), no significant differences in weevil counts were observed between treatments in both trials throughout the season. However, the above-ground incidence of weevils fluctuated throughout the season. At Hobu during the period of trial II, above-ground weevil incidence was relatively low for the first nine weeks of the season. The incidence of weevils steadily increased from week 14 up to and including final harvest at week 23 (Fig. 2).

At Unitech, from week 10 to week 18 of trial III, weevil incidence on the foliage was relatively high on both varieties. Approaching final harvest, corresponding with a period of high rainfall, weevil levels generally declined on both varieties (Fig. 3). This was in marked contrast to weevil levels at the Hobu site which were relatively high at final harvest despite high rainfall (Fig. 2). Differences in above-ground weevil populations on the two cultivars were not significant but the Markham cultivar showed generally lower above-ground weevil levels over the season than the Hobu1 cultivar (Fig. 3).

Discussion

Fallow treatment and weevils

Fallow vegetation had no effect on weevil incidence or tuber damage. Continuous crops of sweet potato, however, resulted in a cumulative build-up in weevil populations in the tubers. This was reflected in the higher mean damage categories in the second season. The presence of old vine material, near or within the plots after harvesting in the first season, may have acted as a source of weevil infestation in the following season. This highlights the need for crop rotation, fallow or effective sanitation to break the weevil's life cycle (Talekar 1983) as the insect can only survive on sweet potato or related plants of the family Convolvulaceae (Sutherland 1986c).

Table 4. Comparison of sweet potato weevil incidence and damage (± SD) to two sweet potato cultivars, Markham and Hobu1, at three different rates of inorganic N application (trial III, Unitech site).

Treatment	Weevils on foliage (no. per m^2)	Damaged Vines (%)	Weevil life stages per damaged vine	Marketable tuber damage (%)	Weevil life stages per damaged tuber	Mean damage category
Markham						
No fertiliser	2.3 ± 2.2	97 ± 7	5.3 ± 5.9	0	0	0
N 50 kg/ha	3.0 ± 3.4	100	3.0 ± 2.6	6	0	0.3 ± 0.5
N 100 kg/ha	3.8 ± 2.5	93 ± 14	3.0 ± 2.3	6	0	0
Hobu1						
No fertiliser	2.3 ± 1.7	100	2.3 ± 1.0	11	2.8 ± 4.9	2.0 ± 2.3
N 50 kg/ha	3.0 ± 2.9	94 ± 12	2.5 ± 1.3	4	0	0.3 ± 0.5
N 100 kg/ha	3.3 ± 1.9	83 ± 25	0.8 ± 1.0	5	0.3 ± 0.5	0.5 ± 1.0

Inorganic fertiliser and weevil damage

Levels of some nutrients and ovipository stimulants in the sweet potato, and their effect on sweet potato weevils, could have been influenced by the use of inorganic fertilisers in this study. Further studies should consider qualitative and quantitative measurements of these chemical factors. Increased N application increases the protein and starch content of sweet potato tubers (Bartolini 1982), which could act as feeding stimulants for the sweet potato weevil. Li (1982) has shown that the protein content of sweet potato roots and foliage varies according to the level of N applied. Applications of between 50 and 150 kilograms of N per hectare can increase protein content significantly. Although we did not assess starch and protein levels, the application of inorganic N at similar levels in our study resulted in increased N

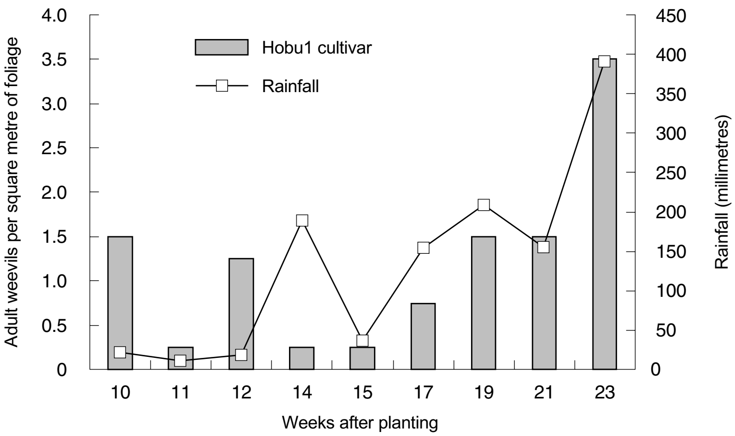

Figure 2. Relationship between adult sweet potato weevil incidence and rainfall distribution throughout the growing season on the Hobu1 sweet potato cultivar, under unfertilised conditions at Hobu (trial II).

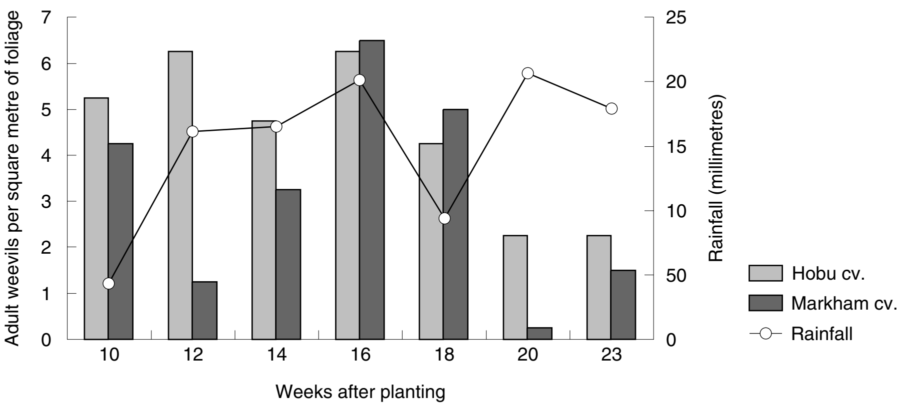

Figure 3. Relationship between adult sweet potato weevil incidence and rainfall patterns on Hobu1 and Markham sweet potato cultivars, under unfertilised conditions throughout the growing season at Unitech (trial III).

levels in the leaves (data not presented). Nottingham et al. (1988) have shown that the leaf surface chemistry appears to have no major influence on resistance to sweet potato weevil, but leaves are required for a nutritionally balanced diet (Hahn and Leuschner 1982). The leaves and vines of both varieties used in this work sustained high weevil incidence and damage, indicating that there was no apparent resistance factor in the foliage and that the foliage may have acted as a nutrient source for the insects.

Sweet potato cultivars susceptible to attack by sweet potato weevil have triterpenoids located in the outer periderm of the tubers (Nottingham et al. 1987; Son et al. 1990), which increase the ovipository behaviour of adult females. Triterpenoid levels can be reduced or remain unchanged following N inputs and can increase in drought conditions (Gershenzon 1991). Although triterpenoid levels were not measured in our study, N inputs showed no significant effect on tuber damage and hence ovipositional behaviour.

Soil factors and weevil damage

Soil differences between the two sites could have influenced weevil accessibility to tubers. Cracking around tubers as they enlarge and when soils dry out under low rainfall conditions can influence tuber accessibility. Weevils generally fail to penetrate wet soils but can penetrate dry soils readily and to depth (Teli and Salunkhe 1994). Tuber damage at Unitech was very low despite high weevil numbers in the canopy, which suggests that the sandy soil type at this site may have hampered access to the tubers.

Low levels of weevil population on the foliage at final harvest are indicative of either a generally low level of infestation per se or migration of weevil populations from the foliage to the tubers earlier in the season. The relatively high levels of tuber damage and low levels of weevils on the foliage at Hobu suggest the latter scenario and that the sandy-clay soil at Hobu may have facilitated accessibility to tubers.

Rainfall and weevil incidence

Rainfall has been shown to influence sweet potato weevil incidence and damage levels in PNG (Sutherland 1986b). In PNG, high levels of weevil incidence generally correspond with lower rainfall levels (Smee 1965; Sutherland 1986b) but in other countries the reverse has been shown (Pardales and Cerna 1987; Jansson et al. 1990). This suggests that the interactions between rainfall distribution and host plant growth and development and soil-related factors may be important in determining correlations between weevil incidence and rainfall. Rainfall may have influenced the severity of tuber damage and weevil accessibility at both experimental sites in our study. The reasons for this were hitherto not fully understood.

During weeks 10 to 15 at Hobu both rainfall levels (< 50 mm) and above-ground weevil levels were relatively low. During this dry period, weevils may have gained access to the tubers and this would account for the higher tuber damage levels at Hobu compared to Unitech. This increase could also be related to the fact that sweet potato tubers actively enlarge during the 6–16 week period (Bouwkamp 1983) and may have provided a greater food source for the weevils thereby leading to an increased population. The swelling of tubers could have also enhanced soil cracking in the tuber zone in the more clayey soils at Hobu. After week 15, rainfall increased and the above-ground weevil incidence also increased, suggesting that the weevils could no longer access the tubers because of high rainfall and a possible reduction in soil cracking.

At Unitech, rainfall levels were relatively high (> 100 mm) during weeks 10 to 15 and this corresponded with relatively high weevil levels on the foliage. During this period, rainfall may have reduced tuber accessibility. By week 20, above-ground weevil levels were lower, suggesting that weevils may have moved into the soil later in the season than at the Hobu site, and this could account for the lower tuber damage at Unitech. Sequential tuber harvesting would help to resolve these questions in future studies.

Cultivar and weevil damage

Preliminary observations suggest that cultivar characteristics may have influenced the incidence of weevils and degree of damage to sweet potato tubers. The Hobu1 cultivar showed consistently higher damage levels at both trial locations whereas the Markham cultivar over two seasons at Unitech showed relatively low tuber damage levels. However, the levels of damage observed on both cultivars were generally below those affecting marketable quality, suggesting that chemical characteristics of the tuber periderm could be influencing feeding or ovipository behaviour. To verify whether the Markham and Hobu1 cultivars have different levels of resistance, further observations need to be carried out under controlled conditions.

Conclusion

Fallow vegetation and inorganic fertiliser inputs, in the form of N and/or K, had little influence on weevil incidence or weevil damage to sweet potato. In our experiments, site factors, particularly rainfall and soil type, and cultivar characteristics are more likely to have influenced weevil incidence levels, their accessibility to sweet potato tubers and subsequent damage to marketable tubers. This study highlights the fact that further studies are required to understand the complex host plant–pest–environment interactions to be able to effectively manage sweet potato weevil in PNG.

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