caribbean
food
crops society

Eighteen
Annual Meeting
August 22 to 28th 1982
Dover Convention Centre
BARBADOS

Vol. XVIII

VARIETAL RESISTANCE AS A CONTROL STRATEGY AGAINST THE WEST INDIAN SWEET POTATO WEEVIL, EUSCEPES POSTFASCIATUS (FAIRMAIRE) ON SWEET POTATOES IN BARBADOS

E.H. Alleyne, Ph.D.[1/]

ABSTRACT

Twenty-one sweet potato varieties are assessed at two locations for resistance to the West Indian sweet potato weevil, Euscepes postfasciatus (Fairmaire). All varieties are susceptible, although B-63-726, the most highly acceptable variety, showed some resistant qualities. Insect populations were generally very high at the Central Agronomic Research Station, one of the trial sites, and extensive tuber damage resulted. C-104, 0/100 and T-62 were the ones most seriously affected. A26/100, A26/86, T-57 and 0/100 yielded poorly at both sites. Excellent yields were obtained from the Fairview trial site. Tubers of most varieties are relatively free of infestation for the greater part of their growing period. Proper timing of harvest of tubers, enables relatively insect-free tubers to be obtained.

INTRODUCTION

Sweet potato (Ipomoea batatas (L.) Lam.) is cultivated throughout Barbados, at both the plantation and peasant farmer levels. Next to yams, they currently occupy the largest annual acreage of non-sugar crops, although there has been a decline in recent years because of increase vegetable production (Alleyne 1980). Despite the widespread cultivation of sweet potatoes, and its increasing importance, both for local consumption and more recently as an export commodity, there has been very little control of the West Indian sweet potato weevil, Euscepes postfasciatus (Fairmaire), the most serious pest attacking this crop.

Varieties have improved considerably within the last decade or so, the emphasis being on gross yields of tubers, but the insect continues to inflict very serious damage to tubers, and total crop loss is not uncommon.

The importance of controlling this insect has long been recognized. Tucker, 1938, using chemical insecticides, reported moderate control. Organo-chlorinated insecticides, particularly chlordane and D.D.T. are often used, either as dips on propagative stem cuttings (slips) or as foliage and soil treatments of sweet potato plants in the field, but consistant acceptable control is yet to be achieved.

1/ Entomologist, Plant Protection Division, Ministry of Agriculture, Food & Consumer Affairs, Barbados.

More recent studies (Alleyne 1979 unpublished) conducted both in the field and in the laboratory, have shown that the insect has become quite resistant to most of the insecticides available locally. There is therefore need for a more effective control strategy, which does not depend heavily on insecticides. In this paper such a strategy is examined, as the relative effect of E. postfasciatus on different sweet potato varieties is assessed in an effort to select those which possess natural resistant qualities. Additionally the consumer preference of the varieties is examined since this, perhaps more than any other factor, will finally determine varietal acceptance.

MATERIALS AND METHODS

All varieties were planted from slips in two rows each measuring 800 m long. Rows were 1 m wide and slips were about 10 cm apart within rows. In the first phase, two trials were set up at Central Agronomic Research Station (C.A.R.S.), Graeme Hall. In the first of these two trials, tuber samples were collected after a growing period of 132 days, while the second was sampled after 181 days, both periods being considerably longer than required for the normal maturation of the tuber. Tubers (20 samples per variety) were graded according to infestation (Table 1) and slips (50 samples per variety per stem section) were assessed (Table 2).

Table 1.--Grading system of sweet potato tubers for E. postfasciatus damage

1 - Total damage - tuber not suitable for eating
2 - Badly damaged - small portion of tuber suitable for eating
3 - Fair - about 1/2 - 3/4 tuber suitable for eating
4 - Slight damage
5 - No damage

Two further trials were set up subsequently, one at C.A.R.S. and the other at Fairview Plantation, St. George. Fairview plantation falls within the intermediate rainfall zone. C.A.R.S. is in the low rainfall zone. Spacing of plants was as outlined in the first phase of trials. All slips were taken from the apical region of stems from areas which were examined and found to be relatively free of infestation. Tip cuttings (20 samples per variety) and tubers were collected at intervals starging at about 10 1/2 weeks after planting. Tubers of each variety were graded for degree of infestation as outlined in Table 1.

Table 2.--Relative distribution of E. postfasciatus in stem cuttings of sweet potato varieties and the susceptibility rating of tubers (C.A.R.S. - November 1981)

Variety	% stem cuttings infested			Susceptibility rating of tubers
	Tips	Middles	Bottoms	
A26/7	4	12	26	4
A26/86	2	14	24	4
A26/100	0	0	10	4
B63-05	0	6	6	4
B63-343	8	6	14	3
B63-399	0	20	12	3
B63-503	2	14	8	4
B63-532	0	0	2	3
B63-572	0	6	10	3
B63-603	2	2	6	3
B63-726	10	12	12	4
Cliff	0	2	6	4
C-104	0	2	14	3
Deep South	2	6	18	3
HSW	2	6	10	2
K-4	0	4	10	4
T-57	6	14	42	1
T-62	0	10	16	3
T-67	0	4	22	4
0/100	4	6	24	2
02/59/94	0	2	4	4

Tests were also conducted to determine the consumer preference of the twenty-one varieties being assessed. Tubers of each variety were peeled, cooked, and then tasted by 15 persons selected at random from all categories of Agricultural staff. Because of the large number of varieties involved, and the difficulty of making accurate qualitative assessments when many varieties are involved, the varieties were divided for convenience into 4 groups, three of 5 varieties each and one of six varieties. The two most acceptable varieties from each group were selected in the first eliminations. The eight varieties selected were then divided into 2 groups of 4 each, and the process repeated. Again the best two were selected from each group. A final comparison was then made of the four most acceptable varieties (Table 5).

RESULTS AND DISCUSSION

Table 1 shows the grading system used in the classification of the sweet potato tubers. Grades 1 and 5 represent most susceptible and least susceptible respectively, susceptibility decreases more gradually from grades 2 to 4. These grades were determined only after the damaged portions of the selected tubers were removed. This is the normal practice adopted by housewives when preparing sweet potatoes for cooking.

C.A.R.S. Trials

The first C.A.R.S. trial was used to determine the relative susceptibility of the twenty-one sweet potato varieties, to the West Indian sweet potato weevil, as well as the percentage infestation of the stem cuttings (Table 2). Because tubers were allowed to remain in the soil long beyond the normal harvest period, infestation was high. Such high levels of insect populations enable a more accurate assessment of susceptibility to be made. Slips used as planting material will be similarly affected. It will be noted from results in Table 2 that the percentage infestation of stem cuttings increased from tip to base portions. This is expected because the behavior of the adult suggests that it prefers to remain close to the soil, and the apical cuttings are the most distant from this point. What is, however, quite surprising is that some slip cuttings showed unusually heavy infestations. This was most pronounced in B63-726. Such levels of infestation in propagative cuttings will certainly allow the weevil to establish itself quite early, particularly in susceptible varieties. It is thus vital that areas from which cuttings are to be collected, be sampled to ensure that tip infestation is absent or negligible, since in the absence of flight this must be one of the major means of dispersing the pest.

Although most of the 21 varieties being assessed were very susceptible, some of them seem to possess resistant qualities. However, in trials of this nature, distribution of insects is never even. This, therefore, makes it necessary for further trials, as it is unlikely that a consistent resistant rating could be attributed to low infestation in all instances, if population levels are generally high. None of the varieties were entirely resistant,

but Cliff, K-4, T-67, A26/100, 02/59/94 and A26/86 were minimally affected by the insect. Varieties T-57, HSW and 0/100 were badly damaged and are thus highly susceptible.

In the second C.A.R.S. trial, another and perhaps closer look was made of all varieties with emphasis on yields and susceptibility since these are undoubtedly two of the most important determinants of sweet potato varietal acceptance.

Both the total yields of tubers as well as the percentage tuber damage was determined at different intervals of growth. Harvesting at regular intervals allows both tuber yields and insect damage to be assessed at ecah stage, so that a point can be reached where the maximum net yields can be achieved for each variety. Suventy-eight days after planting, tubers of many varieties were too small to be harvested, but others were producing well and the West Indian sweet potato weevil was already causing some damage. Varieties B63-726, B63-503 and B63-572 were the best at this point (Table 3). Sixteen percent of the weight of tubers of K-4 was lost to the weevil at this stage.

By the 97th day when the second samples were collected, all varieties except A26/100 had marketable tubers. T-57 did not grow well and consequently no samples were collected for the entire trial. Most varieties had shown a substantial increase in tuber weight at the second sampling compared to the first one. There was also a noticeable increase in weevil damage with Deep South, B63-603 and C-104 being most affected and B63-572 being least damaged. The third set of samples was collected 111 days after planting. There was a slight increase in weight of tubers, but a more than substantial increase in damaged tubers resulted.

In C-104 there was a loss of 80% in tuber weight. B63-603, HSW and A26/100 also suffered heavily from weevil attack. Tubers were collected from A26/100 for the first time at this point. Some of the varieties although not showing substantial tuber yield increases, remained relatively free from attack with B63-726 being the most noticeable.

The fourth set of samples was collected after 132 days and tubers did not increase appreciably in any of the varieties, but the damage was extremely severe. In C-104, 0/100 and T-62 tubers were totally damaged, and there was more than 90% loss in 02/59/94, A26/7 and HSW. Only B63-726 and Deep South had losses of less than 20%.

RAIRVIEW TRIALS

Th trial set up at Fairview Plantation, St. George, provided a contrast of conditions since it falls into a different rainfall zone. Here unlike at C.A.R.S., sweet potatoes occupy a very small portion of the total cultivated acreage and there is a good rotation with sugar canes. Consequently, population levels of the weevil were quite low.

Table 3.--Yield of sweet potato varieties at different stages of maturity
(C.A.R.S. January - June 1982)

Variety	1st sample (78 days)		2nd sample (97 days)		3rd sample (111 days)		4th sample (132 days)	
	Yield	% damage	Yield	% damage	Yield	% damage	Yield	% damage
	(kg/ha)		(kg/ha)		(kg/ha)		(kg/ha)	
A26/7	*	*	9196.0	39	7744.0	4	4743.0	92
A26/86	*	*	1452.0	2	5227.0	0	4404.0	33
A26/100	*	*	*	*	2178.0	60	3823.0	51
B63-05	11132.0	0	12100.0	11	12584.0	32	11036.0	52
B63-343	2613.0	3	6292.0	12	17908.0	0	14036.0	71
B63-399	7744.0	0	3630.0	48	16456.0	12	98736.0	48
B63-503	13552.0	5	11616.0	26	23322.0	9	15324.0	63
B63-532	8712.0	13	11132.0	25	10648.0	40	11132.0	82
B63-572	13552.0	1	15972.0	0	17908.0	0	16776.0	61
B63-603	3097.6	11	4840.0	69	9196.0	68	8712.0	84
B63-726	13552.0	3	13552.0	8	12584.0	0	13712.0	15
Cliff	5808.0	0	10164.0	8	15488.0	6	14036.0	49
C-104	*	*	4743.2	49	9196.0	80	8440	100
Deep South	4259.0	10	7260.0	50	9196.0	32	5130.0	100
HSW	*	*	7260.0	30	7260.0	53	3821.0	94
K-4	9196.0	16	10648.0	22	19844.0	32	19196.0	80
T-57	-	-	-	-	-	-	-	-
T-62	*	*	5324.0	35	4791.6	14	5324.0	100
T-67	7260.0	5	18876.0	23	18392.0	10	15972.0	88
0/100	*	*	4356.0	43	8616.0	35	6776.0	100
02/59/94	*	*	7744.0	16	15004.0	42	10712.0	95

*No samples taken because tubers were too small. T-57 not sampled.

The first set of samples collected 76 days after planting, produced marketable tubers from all varieties with good tuber yields being obtained for B63-503, B63-532 and C-104. Damage was recorded from 4 varieties but in all instances the percentage was low (Table 4).

By the time the second set of samples was collected, yields of some varieties were averaging 10 tons per acre or more. B63-503 was the highest yielding at this point. Only one variety had tuber losses of more than 10%, this being the low yielding 0/100. The pattern of tuber yield increase continued with both third sampling, after 109 days, fourth after 124 days and fifth after 136 days. Only at the fifth sample stage was there an appreciable increase in damaged tubers. K-4 with 83%, Deep South with 40%, B63-399 with 29% and T-62 with 26% were the varieties most severely damaged. The yields at this stage were extremely good with almost half of the varieties averaging above 10 tons/acre. Variety 02/59/94 was close to 20 tons/acre.

There were also some varieties A26/86, A26/100 and T-57 which yielded poorly even under such favourable growing conditions as existed at Fairview.

Consumer appeal

The relative preference of the varieties being examined in this program was assessed (Table 5). Varieties classified as highly acceptable (in descending order) are those most favoured, and were selected when all varieties were compared. The varieties in the other two categories i.e. acceptable and least acceptable, were not all compared against each other, but were compiled from results of the group assessments outlined above (see Materials and Methods). It should also be noted that such a classification is entirely relative, since only when a choice of varieties is offered does such selectivity occur. As a matter of fact, A26/7 is presently one of the most popular local varieties cultivated and consumers accept it willingly.

CONCLUSION

Although consumer appeal may influence the acceptability of sweet potato varieties, both tuber yields and West Indian sweet potato damage are very important considerations. As a result of trials conducted both at C.A.R.S. and Fairview plantation, some varieties eliminate themselves from further trials. The yields obtained from A26/86, A26/100, T-57 and 0/100 at both sites were unacceptably low and this makes further assessment unnecessary. In addition A26/100 also matures rather late. K-4 is a moderately yielding variety, but monkeys seem to prefer cuttings of this variety to all others. As a result many cuttings were destroyed before they had an opportunity to establish themselves. The reason for this preference is not presently understood but inasmuch as it occurred at both C.A.R.S. and Fairview, it cannot be regarded as mere coincidence. At high population levels most of the twenty-one varieties were severely affected.

Table 4.--Yield of sweet potato varieties at different stages of maturity
(Fairview, St. George, January - June 1982)

Variety	1st sample (76 days)		2nd sample (96 days)		3rd sample (109 days)		4th sample (124 days)		5th sample (136 days)	
	Yield	% damage	Yield	% damage	Yield	% damage	Yield	% damage	Yield	% damage
	(kg/ha)		(kg/ha)		(kg/ha)		(kg/ha)		(kg/ha)	
A26/7	8228.0	0	22264.0	0	22748.0	0	34848.0	1	25652.0	0
A26/86	5324.0	5	3678.4	0	7018.0	0	9196.0	1	5275.6	0
A26/100	822.8	0	4791.0	2	3872.0	0	9196.0	1	6776.0	0
B63-05	1210.0	0	10648.0	30	11616.0	0	18876.0	0	9196.0	0
B63-343	8228.0	1	8712.0	0	11616.0	0	12584.0	1	10648.0	0
B63-399	3968.8	0	13552.0	12	19360.0	1	17424.0	0	10648.0	29
B63-503	17908.0	0	28072.0	0	19844.0	0	28556.0	0	39688.0	0
B63-532	14036.0	0	24248.4	1	28072.0	0	24748.0	0	27588.0	0
B63-572	9196.0	4	22264.0	0	18392.0	0	25652.0	1	27588.0	11
B63-603	6776.0	0	11616.0	17	1132.0	0	14036.0	1	11132.0	5
B63-726	9196.0	0	17908.0	6	22748.0	0	22264.0	0	25652.0	0
Cliff	10018.8	0	13552.0	0	23716.0	0	23716.0	0	28556.0	0
C-104	14036.0	0	20812.0	0	36784.0	0	23716.0	0	37268.0	6
Deep South	7744.0	2	20812.0	1	17424.0	0	28556.0	2	24684.0	40
HSW	1790.8	0	13068.0	5	19844.0	0	18876.0	0	26620.0	2
K-4	12584.0	7	21780.0	3	20328.0	0	23716.0	0	11132.0	83
T-57	5324.0	0	8228.0	1	9680.0	0	13552.0	0	7260.0	3
T-62	1645.6	0	12584.0	7	17424.0	0	32428.0	0	35332.0	26
T-67	9196.0	4	15488.0	2	20328.0	0	21296.0	2	18876.0	0
0/100	2613.6	0	8712.0	18	11132.0	9	20812.0	4	19844.0	0
02/59/94	8712.0	0	9196.0	9	22264.0	0	33396.0	1	50336.0	7

Under the much lower population conditions at Fairview damage was minimal. Susceptibility of varieties to E. postfasciatus is therefore more accurately determined on the basis of C.A.R.S. trials. Results indicate that B63-726 exhibits resistant qualities in all trials although it is not among the highest yielding. However, many varieties remain relatively free of attack for a considerable period of their growth and this factor will have to be fully exploited, in particular with the most acceptable ones (Table 5).

If tubers are harvested before the 110 day (Table 3), moderately susceptible varieties will escape much of the weevil damage and still produce acceptable yields. However, if clean planting materials is used along with a proper system of rotation, weevil populations will be kept to very low levels and it will be possible to grow even very susceptible varieties like HSW, which are well liked by Barbadian consumers.

Table 5.--Consumer preference of sweet potato varieties examined

Most acceptable	Acceptable	Least acceptable
B63-726	B63-532	Deep South
Cliff	B63-05	B63-503
HSW	B63-343	A26/7
T-67	B63-603	02/59/94
	B63-399	T-62
	B63-572	T-57
	0/100	A26/100
	K-4	
	A26/86	
	C-104	

REFERENCES

Alleyne, E.H. 1980. Pest and Pesticide Management (Agriculture) in Barbados. pp. 38-49 in Pest and Pesticide Management in the Caribbean. Vol. III - Country papers ed. E.G.B. Gooding.

Tucker, R.W.E. 1937. The Control of Scarabee (Euscepes batatae, Waterhouse) in Barbados. Agricultural Journal (Barbados) Vol. 6 No. 4 pp. 133-135.