Two Sweetpotato (*Ipomea batatas* var. *batatas*) field trials on Maui Demonstrate the Potential of Utilizing Tissue-cultured Planting Materials

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ABSTRACT

Tissue-cultured, virus-tested plantlets of three sweetpotato cultivars (Okinawan, LA 08-21p, and Murasaki-29) were obtained from Louisiana State University Agricultural Center. There were two objectives to the field trials conducted at the Kula Agricultural Park on the Island of Maui ((lat. 20.7928 ºN, long. 156.3540 ºW, elevation 427 m): 1) to compare 'Okinawan' obtained from a commercial field with tissue-cultured 'Okinawan'; and 2) to compare three tissue-cultured sweetpotato cultivars. A plot consisted of three hills that were 1.5 x 9.1 m. Cuttings of commercial 'Okinawan' were planted at a spacing of 0.3 m in all three hills. Three tissue-cultured cultivars were planted at a spacing of 0.3 m in one hill per cultivar. Treatments (tissue-cultured *vs.* commercial) were blocked four times in a randomized complete block design. Cover crops were planted between the experimental plots to prevent or retard movement of insects that could carry viruses between experimental plots. Two trials were planted on October 2015 and August 2016, and harvested 4 to 5 months later. Storage roots were graded according to State of Hawaii standards, and categorized as Grade AA, A, B, and off-grade. Marketable yields combined storage roots in Grades AA, A, and B. In addition, injuries of storage roots in each category were estimated due to infestations of sweetpotato weevil [*Cylas formicarius elegantulus* (Coleoptera: Brentidae)] and rough sweetpotato weevil (*Blosyrus asellus* (Coleoptera: Curculionidae). In both trials, fresh and dry weights of marketable storage roots of 'Okinawan' from virus-tested, tissue-cultured planting materials were significantly greater than those from a commercial source (nearly twice the yield). It is uncertain whether this effect was due to a superior genotype of 'Okinawan' placed into tissue-culture or whether it was due to viruses reducing yields in commercial 'Okinawan'. In both trials, fresh weight yields differed significantly among three tissue-cultured cultivars; however, significant interactions were found, indicating that yields of cultivars differed between years. In the first field trial, 'LA 08-21p' had 1.6 to 1.7 times greater fresh weight of marketable storage roots compared to the other two cultivars. In the second field trial, 'Okinawan' had 1.7 times greater marketable storage roots compared to 'Murasaki', but did not differ from 'LA 08-21p'. In both trials, LA 08-21p had significantly greater injury due to sweetpotato weevil compared to the other two cultivars, perhaps due to its growth habit of tight clusters of storage roots located near the soil surface. Interestingly, in the second trial, 'Okinawan' had significantly greater injury due to rough sweetpotato weevil, indicating that it is more susceptible to this pest than other cultivars. Results from these two field trials indicate that use of virus-tested, tissue-cultured planting materials could significantly increase yields of 'Okinawan'.

MATERIALS AND METHODS

Figure 1. Virus-tested, tissue-cultured sweetpotato plantlets.

Both Trials.

1. Virus-tested, sweetpotato plantlets of 'Okinawan', 'LA 08-21p', and 'Murasaki' were obtained from Louisiana State University Agriculture Center (Figure 1)
2. In field trial, one plot contained one 9.1 m row each of three sweetpotato cultivars (Okinawan, 0821-P, and Murasaki) obtained originally from virus-tested, tissue-cultured planting materials (Figure 2)
3. Other plot contained three 9.1 m rows of 'Okinawan' obtained from commercial source of cuttings
4. Experimental design followed a randomized complete block design with four blocks
5. Sorghum x sudangrass and marigolds were planted in borders surrounding plots of sweetpotatoes to prevent easy movement of insects between plots
6. Storage roots of sweetpotatoes were graded according to the Hawaii Department of Agriculture standards (AA, A, B, and off-grades)
7. Marketable category combined AA, A, and B grades
8. Following grading, they were placed into sub-categories based on no injury, or injuries due to sweetpotato weevil [*Cylas formicarius elegantulus* (Coleoptera: Brentidae)], rough sweetpotato weevil [*Blosyrus asellus,* (Coleoptera: Curculionidae)], or other
9. Fresh weights were determined

Trial 1.

1. Treatments were planted on 22 October 2015
2. Treatments were harvested five months later during 23 to 28 March 2016

Trial 2.

1. Treatments were planted on 29-30 August 2016
2. Treatments were harvested after four months during 1-3 January 2017

RESULTS

Figure 2. Plots at Kula Agricultural Park showing three rows of sweetpotato treatments surrounded by sorghum-sudangrass in border rows.

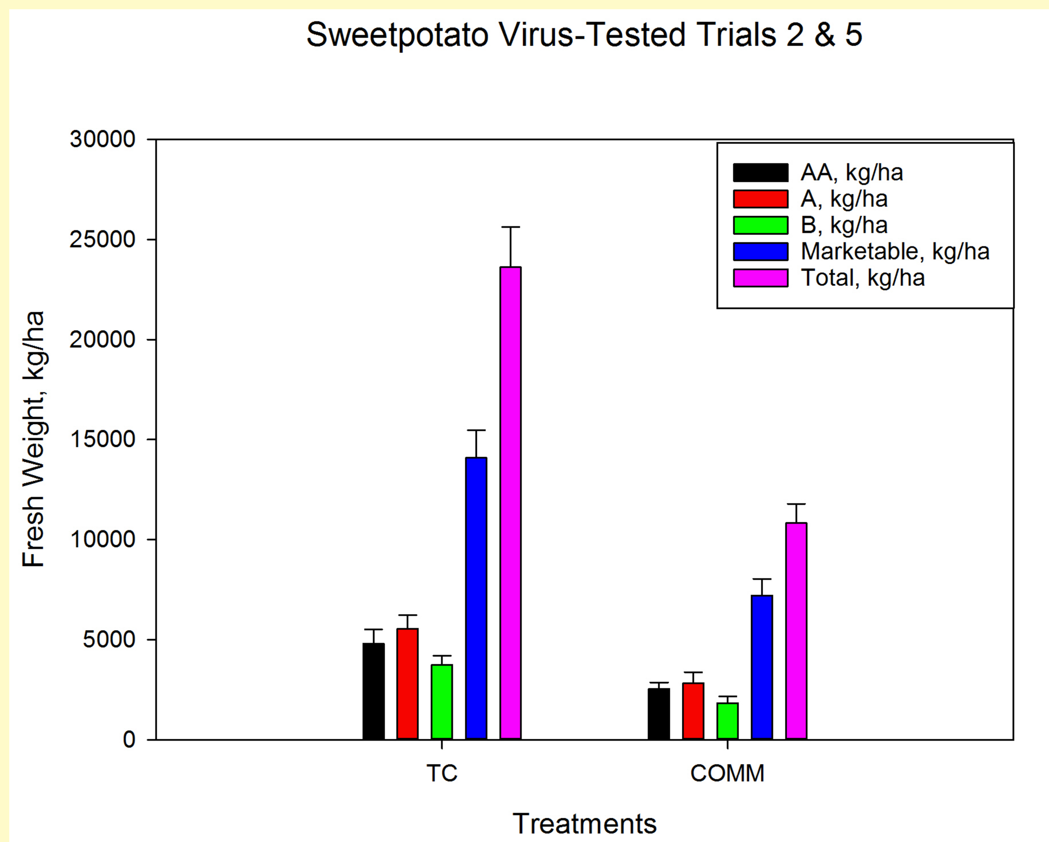

Figure 3. Fresh weights of 'Okinawan' storage roots grown from virus-tested, tissue-cultured (TC) planting materials compared to those grown from a commercial source (COMM). Storage roots were graded into AA, A, B (summed into marketable), and total (marketable plus off-grade).

Cultivar	% Weevil in Marketable	SE
Okinawan	3.2b	1.3
LA 08-21p	24.3a	5.3
Murasaki	2.1	1.0

Table 1. Incidence of sweetpotato weevil damage among three cultivars averaged across two years.

In both trials, fresh and dry weights of marketable storage roots of 'Okinawan' from virus-tested, tissue-cultured planting materials were significantly greater than those from a commercial source (Figure 3). It is uncertain whether this effect was due to a superior genotype of 'Okinawan' placed into tissue-culture or whether it was due to viruses reducing yields in commercial 'Okinawan'.

In both trials, fresh weight yields differed significantly among three tissue-cultured cultivars; however, significant interactions were found, indicating that yields of cultivars differed between years (Figure 4). In the first field trial, 'LA 08-21p' had 1.6 to 1.7 times greater fresh weight of marketable storage roots compared to the other two cultivars. In the second field trial, 'Okinawan' had 1.7 times greater marketable storage roots compared to 'Murasaki', but did not differ from 'LA 08-21p'.

In both trials, 'LA 08-21p' had significantly greater injury due to sweetpotato weevil compared to the other two cultivars (Table 1), perhaps due to its growth habit of tight clusters of storage roots located near the soil surface (Figure 5). In 2015, there was little incidence of damage due to rough sweetpotato weevil among all three cultivars. In 2016, 'Okinawan' had significantly greater damage due to rough sweetpotato weevil than other two cultivars, perhaps indicating greater susceptibility to this pest.

RESULTS

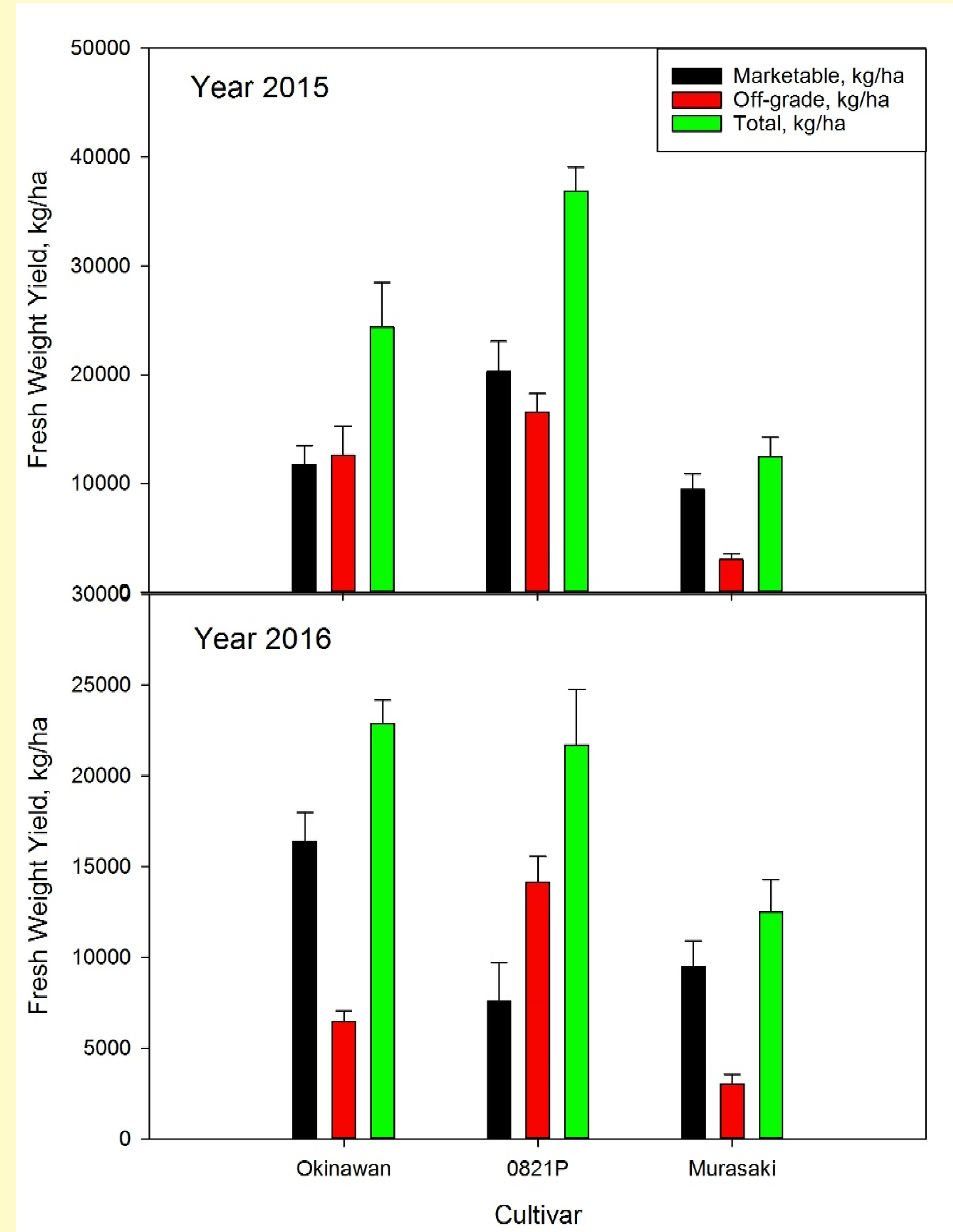

Figure 4. Fresh weight yields of 'Okinawan', 'LA 08-21p', and 'Murasaki-29' grown from virus-tested, tissue-cultured planting materials. Significant differences were found among cultivars; however, significant interactions were found between Year and Cultivar, indicating that yields of cultivars differed between years.

Cultivar	% Rough weevil in Marketable, 2015	SE	% Rough weevil in Marketable, 2016	SE
Okinawan	3.6	2.1	37.2	10.2
LA 08-21p	3.7	2.5	5.1	0.5
Murasaki-29	1.9	1.6	6.0	5.9

Table 2. Incidence of Rough sweetpotato weevil in marketable storage roots of three sweetpotato cultivars grown over two years.

Figure 5. Cultivar LA 08-21p with its tight cluster of storage roots located near the soil surface. It had significantly greater injury due to sweetpotato weevil.

ACKNOWLEDGEMENTS

This project was funded by the County of Hawaii Department of Research and Development and by USDA National Institute of Food and Agriculture Hatch project #08029-H, managed by the University of Hawaii Manoa-College of Tropical Agriculture and Human Resources. The authors would like to thank Mr. Layne Matsushita at the Waiakea Research Station for acclimating and growing the virus-tested plants in the greenhouse. We would like to acknowledge the hard work of the Farm Manager Pam Shingaki and Agricultural Technicians (Edwin Perez, Glenn Otani, Earl Fujitani, Mark Kubo, Alfredo Hernandez, and Lanny Billings) at the Maui Agricultural Research Center.