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EFFECTS OF METALAXYL AND BENOMYL ON POST-HARVEST DECAY OF CORMS OF DASHEEN COLOCASIA ESCULENTA (L.) SCHOTT

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SUMMARY

Tests were carried out to prolong the shelf life of dasheen corms. The dip in a mixture of 250 ppm metalaxyl and 500 ppm benomyl preserved the dasheen corms in excellent condition for up to 4 weeks at ambient conditions. *Pythium* spp and *Botryodiplodia theobromae* were isolated from rotted corms. The treatment is described and recommended for use in the export of dasheen corms both within and outside the Caribbean, subject to acceptable residue levels.

RESUME

Des tests ont été conduits pour une conservation accrue des tubercules de C. esculentum (taro) après récolte. Un trempage dans une solution comportant 250 ppm de métalaxyl et 500 ppm de bénomyl garde le tubercule de taro en excellente condition jusqu'à 4 semaines en milieu ambiant. Pythium spp et Botryodiplodia theobromae ont été isolés des pourritures. Le traitement décrit se recommande pour l'exploitation dans la Caraïbe et au delà, sous la réserve que les résidus demeurent en deçà du seuil du seuil d'acceptabilité.

INTRODUCTION

Dasheen (*Colocasia esculenta* (L.) Schott) is a staple food crop of the wetter, humid regions of the Caribbean, cultivated primarly for its corms. Dominica is the largest producer of dasheen in the region producing 10,700 tonnes of dasheen annually from 850 ha (ADAMS and P'DIAL, 1983). On average 300 tonnes of dasheen corms worth $ 268,000 -

322,560 EC (ca. US$ 100,000) are exported annually from Dominica to regional markets by unrefrigerated ships or schooners, and an additional 10 tonnes are shipped to the U.K. (Thomas, 1984) on refrigerated banana boats.

The potential for the export of dasheen corms is not fully realized due to a fungal rot which is a serious post-harvest problem in Dominica (CLARENDON, 1981), Grenada (JAMES, 1981), St. Lucia (POLIUS, 1981) and St. Vincent (VANLOO, 1981). The resulting short storage life, 3-7 days, is recognized as one of the major factors affecting the development of a stable export market (FERGUSSON, 1981). The rotting may be reduced by refrigeration, however this is expensive and may lead to chilling injury (FULLERTON and PUREA, 1982).

An inexpensive and appropriate method of prolonging the shelf-life of dasheen corms stored at ambient temperatures is required in order to allow an increase in the volume exported to regional markets, and decrease the cost and likelihood of chilling injury during export to the U.K. In order to achieve this objective, an investigation was conducted into the effects of the fungicides metalaxyl and benomyl in preventing or delaying the fungal corm rot of dasheen stored under ambient conditions.

MATERIALS AND METHODS

Mature and marketable dasheen corms weighing an average of 0.75 kg were bought from farmers, cleaned of rotted roots and washed free of dirt and debris in flowing tap water, containing 1 ppm chlorine. Well-rounded corms, free of bruises or unnatural wounds were then selected for treatment and tails and heads of corms excised to the main curvature. The corms were then dipped for 5 to 10 seconds in either of two fungicidal mixtures : 250 ppm a.i. metalaxyl plus 500 ppm a.i. benomyl ; or 500 a.i. metalaxyl plus 500 ppm a.i. benomyl (obtained from Ridomil MZ 58 a.i. 10 per cent metalaxyl and benlate W.P.50, respectively). An equal number of corms were washed as above in running tap water, tails and heads excised, and kept as a control. Treatments comprised 30 corms and were replicated thrice.

Treatments were done at 4, 24 and 48 hours after harvest and all corms placed immediately in well ventilated plastic boxes (40 cm x 30 cm x 60 cm) and stored at ambient conditions (27 - 29°C and 78 - 88 per cent relative air humidity). Observations on the rotting of 15 corms, randomly selected from the boxes were made 4 weeks after treatment, and the remaining 15 were examined after 6 weeks. Each corm was cut into quarters along the longitidinal axis and the exposed surface examined for signs of rotting. A rating of 0-4 based on the total rot per individual corm was assigned as follows :

Percent rot of individual corm	Rating
0	0
1 - 10	10
11 - 25	22
26 - 60	3
61 - 100	4

The sum total of the corm rot rating in each treatment were then expressed as the rotting disease index (RDI) using the Mc Kinney's modified formula :

$$RDI = \frac{\text{sum of observed ratings per treatment}}{\text{total number of corms observed per treatment}} \times \frac{100}{\text{maximum disease category}}$$

Corms with an RDI of less than 30 were considered very acceptable for market.

Selected isolations for fungi from corms were done using standard methods.

RESULTS

The two fungicidal treatments (250 ppm metalaxyl + 500 ppm benomyl and 500 ppm metalaxyl + 500 ppm benomyl) were equally effective in reducing the incidence of corm rot in dasheen stored under ambient conditions for up to 6 weeks after harvest. There was no significant difference between the mean disease indices of corms treated with the two fungicidal dips either after 4 or 6 weeks storage (Tables 1 and 2).

After 4 weeks in storage corms treated with tap water had a significantly higher ($p = 0.01$) mean rotting disease index (RDI) of 62.9, than corms treated with 250 ppm metalaxyl + 500 ppm benomyl ; or 500 ppm metalaxyl + 500 ppm benomyl, RDI 28.77 and 27.87 respectively (Table 1). treatment 4 hours after harvest resulted in a significantly lower ($p = 0.01$) RDI of 26.88, than treatment after 24 hours, RDI 42.31. Corms treated after 48 hours had the highest RDI of 50.36 (Table 1). There was a significant interaction between treatment (Table 1). The lowest RDI, 15.90, was observed in treatments of 250 ppm metalaxyl + 500 ppm benomyl 4 hours after harvest.

After 6 weeks in storage, corms treated with either 250 ppm metalaxyl + 500 ppm benomyl or 500 ppm metalaxyl + 500 ppm benomyl again has significantly lower RDI, 37.81 and 37.92 respectively, than corms treated with tap water, RDI

Table 1. Effect of two fungicidal dips on dasheen corm rot after 4 weeks storage under ambient conditions

Time of Treatment after Harvest	Rotting Disease Indices			Mean
	Control	250 ppm metalaxyl + 500 ppm benomyl	500 ppm metalaxyl + 500 ppm benomyl	
4 hours	46.17	15.90[d]	18.60[d]	26.88
24 hours	73.26	24.08[d]	29.57[d]	42.31[b]
48 hours	69.28	46.34	35.46	50.36[c]
Mean	62.90	28.77[a]	27.87[a]	

[a] Highly significantly different from control $LSD_{0.01} = 6.35$

[b] Highly significantly different from 4 hr. treatment $LSD_{0.01} = 6.35$

[c] Highly significantly different from 4 hr and 24 hr treatment $LSD_{0.01} = 6.35$

[d] Highly significantly different from control $LSD_{0.01} = 11.01$

Table 2. Effect of two fungicidal dips on dasheen corm rot after 6 weeks storage under ambient conditions

Time of Treatment after harvest	Rotting Disease Indices			Mean
	Control	250 ppm metalaxyl + 500 ppm benomyl	500 ppm metalaxyl + 500 ppm benomyl	
4 h.	61.73	36.02	34.18	43.98
24 h.	75.69	33.23	41.16	50.02
48 h.	80.25	44.17	38.41	54.26
Mean	72.55	37.81[a]	37.92[a]	

[a] Highly significantly different from control $LSD_{0.01} = 12.19$

72.53 (Table 2). There was no significant difference between the mean RDI of corms treated either 4, 24 or 48 hours after harvest.

Rotting of the dasheen corm generally started from the tail end and/or the natural wounds left after the removal of lateral suckers. The rotting varied from a spongy white to tan rot with irregular distinct margins from the tails and previous points of attachment of lateral suckers. Isolations of fungi from the margins of the rotted areas yielded mainly *Pythium* spp and *Botryodiplodia theobromae*.

DISCUSSION

The mixture of the two fungicides, metalaxyl and benomyl, was effective in reducing rotting of corms of the dasheen *Colocasia esculenta* (L.) Schott, when compared with tap water, and the effect of the dip was evident up to 6 weeks after treatment. A similar result was obtained by FULLERTON and PUREA (1982), who achieved a shelf-life of 25 - 70 days in dasheen corms treated with metalaxyl and benomyl and stored at 20 - 22°C. Both concentrations of metalaxyl (250 ppm and 500 ppm) were equally effective in controlling the corm rot when combined with benomyl. The use of the lower concentration would considerably reduce the cost of treatment.

The two fungicides are used elsewhere on the dasheen corms and other products and the residue levels have been found acceptable at similar concentrations. However, final acceptance of these treatments is subject to the results of on-going residue analyses.

Although the fungicidal dips were effective for up to 6 weeks, it would seem that the actual shelf life of the corms, as defined by an RDI 30 (less than 10 per cent rotting), was limited to 4 weeks. This should be quite adequate for the demands of intra and extra-regional trade since intra-regional transport takes less than 7 days, while transport to the U.K. market takes a minimum of 14 days. Consumer acceptability of the corms was without doubt very high after 4 weeks storage. Even after 6 weeks storage the consumer acceptability was good.

A fungicidal dip four hours after harvest was most effective at reducing the incidence of corm rot ; indicating the necessity for treating the corms as soon after harvest as possible. Any delay in applying the treatment would seem to increase the likelihood of a high incidence of corm rot during storage. After 6 weeks in storage the advantage of treating soon after harvest was lost. The effectiveness of the benomyl + metalaxyl treatment reflects their known activity against *Botryodiplodia* and *Pythium* spp respectively, both of which were consistently isolated from rotted dasheen corms in the early stages. It should be mentioned that a large number of organisms associated with rotting of the corms, appeared on the heels of the two pathogens cited above, but *Botryodiplodia* and *Phythium* were the main incitants.

CONCLUSION

Dasheen corms, treated 4 hours after harvest with either the fungicide mixture of 250 ppm motalaxyl + 500 ppm benomyl or 500 ppm metalaxyl + 500 ppm benomyl, remained acceptable for market for up to 4 weeks after treatment when stored under ambient conditions. Treatment 24 or 48 hours after harvest was less effective in controlling the rot.

It is recommended that dasheen for export, within and outside the region, may be dipped in the mixture of metalaxyl and benomyl.

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