THE COST OF INTEGRATED PEST MANAGEMENT FOR CYMBIDIUM ORCHIDS

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SUMMARY

The cost of integrated pest management (IPM) is compared with the cost of a "standard" programme which is based on a survey of 21 growers of cymbidium orchids. The "standard" programme cost \$679 per year per 1000 square metres including \$262 for mite control. IPM cost \$1094 per year including \$660 for the distribution of 4000 female *Phytoseiulus* per 1000 square metres five times a year. Growers who have used *Phytoseiulus* prefer the predator to miticides. The difference in cost (\$398) of mite control may be regarded as the value placed by growers on the benefits that accrue from IPM.

INTRODUCTION

Entomology Division, DSIR has been developing Integrated Pest Management (IPM) systems for greenhouse crops since 1980 (Martin 1987). An IPM system is now available for export quality cymbidium orchids. The economics of this IPM programme and its advantages are compared with existing pest and disease control practices. These were determined in a survey of 21 cymbidium orchid growers (Martin and Workman in press), data from which form the basis for this economic analysis.

One way to express the cost of IPM for cymbidium orchids is to calculate the absolute cost of pest and disease control under this system. While this is possible, it is very difficult because it needs to include factors such as greenhouse design and the benefits of heating both for bloom production and for disease control. The approach adopted in this paper is to compare the cost of a "standard" pest and disease control programme with an IPM programme, limiting the comparison to those parts of the "standard" programme changed by adopting IPM. In order to do this the optimal growing conditions for cymbidium orchids, a "standard" pest and disease programme and the modifications to it required by IPM, are described.

CYMBIDIUM ORCHID PEST AND DISEASE CONTROL

"Standard" Pest Control

Pest control practices vary greatly between growers. The following summary is based on what appeared to be the most effective practices found during a survey of 21 growers (Martin and Workman in press).

The greenhouse should have ridge and side vents that can be opened and closed to allow cooling, heating and air circulation to dry the leaves and flowers and thus reduce the incidence of fungal disease. Fans or forced air can help. Watering is either by trickle irrigation into the pots or from overhead sprinklers. In the latter case the leaves are allowed to dry by nightfall. Under these conditions no fungicides are required, although it was found that most growers used them.

Pollen cap browning: This is mainly associated with certain susceptible "cultivars", and may be caused by environmental conditions or by a mould mite, *Tyrophagus nieswanderi* (Acaridae). Mould mite infestations can be reduced by not using organic fertilisers and by regularly removing all plant debris. A pesticide toxic to mould mite can be applied during flowering.

Two-spotted mite (TSM): TSM is controlled by high volume spray of a miticide directed to the underside of the leaves twice during non-flowering (once just after flowering and again before flowering). If mites are seen prior to spraying then an additional spray application is required 7-10 days later.

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Scale insects: These are controlled by a high volume spray of a pesticide during the non-flowering period.

Slugs and snails: Baits are effective against most introduced molluscs but only partially effective against the bush snail, *Zonitoides arboreus* (Zonitidae). The current suggestions for bush snail control are a high volume spray of a liquid molluscicide while the spike is still in the sheath or baits applied in the evening.

Insects during flowering: Pesticide sprays are needed to prevent damage and infestation of flowers by caterpillars, aphids and thrips. The flowering season is from May to early November, about 6 months. Grower practice varies from one pesticide application per month to one a week, that is 6-15 applications. The frequency of application can be less during the winter when the vents are closed but should be increased to once a week in the spring when the vents are opened more frequently. On this basis 13 sprays are recommended.

Bumble bees which pollinate flowers and cause premature senescence can be prevented from entering the greenhouse by putting netting over all openings.

Integrated Pest Management

The differences from the "standard" pest control programme are:

Two-spotted mite: The predatory mite, *Phytoseiulus persimilis*, is distributed through the crop 5 times a year, at the end of flowering, midsummer, before flowering, early flowering and mid-flowering, at the rate of 40,000 females per hectare per release.

Insects during flowering: The same number of spray applications are recommended but the insecticides are restricted to the predator safe products carbaryl, diazinon, and pirimicarb. Diazinon also kills the mould mite.

Bush snail: Baits are compatible with the predator but methiocarb spray is toxic. However a spray applied 2 weeks before the next predator release and only to the base of the plants will minimise its detrimental effects on the predator.

Diseases: Where heating and ventilation are inadequate fungicides safe to the predator are required.

TABLE 1: Annual cost of insect and mite control in the "standard" programme for 1000 m² of cymbidium orchids.

Pest control	Costs per Application (\$)				Costs per Year
	Cost of pesticide	Wage cost ¹	Fixed costs ²	Total costs	
miticide ³	46.50	33.40	7.51	87.41	262.23
insecticide ⁴ non flowering	16.00	33.40	7.51	56.91	56.91
insecticide flowering ⁵	3.50	16.70	7.51	27.71	360.23
Total annual cost					679.37

1. \$ 10/hour, 16.7 cents/minute.

2. 45 min to fill and clean up spray equipment; \$7.51.

3. 500 litres delivered in 200 min at 9.3 cents/litre, 3 times per year.

4. 500 litres delivered in 200 min at 3.2 cents/litre, once a year.

5. 250 litres delivered in 100 min at 1.4 cents/litre, 13 times a year.

ECONOMIC ANALYSIS

The analysis examines the cost of those parts of the pest control programme altered by adopting IPM. The costs of the "standard" programme (Table 1) are based on the prices of pesticides which growers commonly use and which are considered to be the most effective. The costs are all for 1000 square metres.

The cost of insect control in both programmes is similar (Tables 1 and 2), about \$420, but is more than most growers are spending per year (Table 3). Some of this difference in cost is due to the use of foggers which considerably reduce the time spent

spraying and therefore the wage cost. Also most growers applied between 6 and 11 sprays a year compared with the recommended 14.

The main difference between the two programmes is the cost of mite control which in the "standard" programme (\$262) is close to the median amount spent by growers (Table 3). The difference between the cost of mite control in the two programmes (\$398) would be reduced to \$189 when four miticides were applied each year in the "standard" programme and if only four releases of the predator were made. This is the current practice of two growers but we have found that five releases are sometimes necessary during the first few years.

TABLE 2: Annual cost of insect and mite control in the IPM programme for 1000 m² of cymbidium orchids.

Pest control	Costs per Application (\$)				Costs per Year
	Cost of materials	Wage cost ¹	Fixed costs ²	Total costs	
predator ³	132.00	10.00	-	132.00	660.00
insecticide ⁴ non flowering	9.00	33.40	7.51	49.91	49.91
insecticide ⁵ flowering ⁵	5.30	16.70	7.51	29.51	383.63
Total annual cost					1093.54

1. \$10/hour, 16.7 cents/minute.
2. 45 min to fill and clean up spray equipment; \$7.51
3. 4,000 *Phytoseiulus* on 400 leaves spread in 60 min, 5 times per year.
4. 500 litres delivered in 200 min at 1.80 cents/litre, once a year.
5. 250 litres delivered in 100 min at 2.21 cents/litre, 13 times a year.

TABLE 3: Summary of the annual costs of mite, pest and disease control per 1000 m² for 21 cymbidium orchid growers.

\$ per 1000 square metres	Numbers of Growers		
	Disease control ¹	Insect, mollusc and nematode control ²	Mite control ³
0	2	0	0
1-99	6	0	3
100-199	5	8	5
200-299	3	4	5
300-399	3	8	3
400-499	2	0	1
500-599	0	1	3
600-699	0	0	1

1. based on fungicide cost of 6.83 cents/litre.
2. based on insecticide of 3.2 cents/litre for wet spray and the equivalent of 3.4 cents/litre for foggers.
3. based on miticide cost of 11 cents/litre for wet spray and the equivalent of 12.8 cents/litre for foggers. The relatively high cost of miticide is based on the use of miticides during flowering and the high cost of flower safe miticides.

The benefits from using *Phytoseiulus* instead of miticides include not having to spend 10 hours a year spraying during the heat of the summer, reduced exposure to pesticides both during application and when handling the plants, less pesticide applied

to plants and so less chance of plant and flower phytotoxicity, a pest control system that is not dependent on particular weather conditions (dull but also drying conditions are required) and knowing that TSM is not going to become resistant to the predator. The best measure of whether these benefits exceed the extra cost of IPM (\$189-398 a year) is whether growers use IPM. Most of the growers who have tried *Phytoseiulus* state that they will not now return to miticide spraying.

REFERENCES

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