
Growth Distortion in Bedding Plants

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Growth Distortion in Bedding Plants: A Survey to
Determine the Incidence and Potential Losses
Caused by the Disorder

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Growth Distortion in Bedding Plants: A Survey to Determine the Incidence and Potential Losses Caused by the Disorder

1. Introduction

This survey was commissioned and funded by the Horticultural Development Council (HDC) and carried out by the ADAS Ergonomics Unit.

Distortion of growth resulting in malformed leaves, loss of growing point and plant death became a prominent problem on several nurseries in the early 1970s. Petunias and Antirrhinums were the main species affected, but the condition has since been recorded elsewhere on Salvia, Verbena, Alyssum, Zonal Pelargonium, Impatiens, Phlox, Pansy, Marigold and Dianthus. Incidence and severity have varied erratically since the condition was first recognised but individual growers have suffered significant losses.

There is currently no reliable data on the incidence or severity of this distortion. There is no confirmed explanation for the symptoms and investigations into possible causes have yielded inconsistent results.

2. Aim

The main objective of the survey was to obtain information on the size of the problem and its cost to industry. Decisions on funding for future work can be based on this information.

3. Method

The questionnaire shown in Appendix 2 was designed by the Ergonomics Unit in association with Bedding Plant experts in ADAS. A sample of 500 growers was selected and stratified according to size of enterprise. The questionnaire was sent out to these 500 growers together with a prepaid return envelope and a covering letter from the project leader, Geoff Griffin, Plant Pathologist at Wolverhampton. The covering letter is in Appendix 2.

4. Summary of Results

116 questionnaires were returned by the deadline. This represents a very good response rate of 23%.

Detailed results are provided in Figures 1-13 in Appendix 1.

4.1 Size of Respondents' Enterprises (Qu. 1, 2 & 3)

Details of the size of enterprise for those growers who responded are shown in Figures 1-3. Figure 2 also shows the distribution of enterprise size within the sample.

4.2 Source of Planting Material

Details of the source of planting material are shown in figures 4a, 4b and 4c.

4.3 Extent to which Distortion is a Problem (Qu. 4)

22% of respondents considered Distortion to be a problem.

4% of respondents considered Distortion to be a *serious* problem.

Distortion was reported to be a problem by fewer respondents than any other potential reason for rejecting plants (listed in the questionnaire).

Details of these results are in Figure 5.

The relationship between size of enterprise and the extent of the problem of Distortion is shown in figure 6.

4.4 Rate of Occurrence of Distortion (Qu. 4)

A total of 45 respondents reported that Distortion occurs. The following results, for questions 5-9, were analysed for this subset of respondents only.

4.5 Total Number of Trays Rejected This Season (Qu. 5c)

In total, 876995 "boxes and packs" and 2420239 "pots" of Bedding Plants were grown. Of these, 5130 trays were rejected by respondents.

4.6 Occurrence of Specific Symptoms for Each Species (Qu. 5b)

Details of the occurrence of specific symptoms is shown in figure 7. It shows the number of respondents who reported each symptom, for all the species listed.

The total occurrence of each symptom number is shown in figure 8.

The number of respondents reporting Growth Distortion who grew each species this season is shown in figure 9.

4.7 Problem of Distortion Compared to Previous Years (Qu. 5d)

Figure 10 summarises how the problem of growth distortion this year compares to previous years, for each species.

4.8 When Distortion is Noticed (Qu. 7)

32 of the 45 growers reported noticing the problem *after* pricking out.

Overall response is shown in figure 11.

4.9 Proportion of Affected Plants which Die and which Revert to Normal Growth (Qu. 8 & 9)

The mean proportion of affected plants which die is 20%.

The mean proportion of affected plants which revert to normal growth is 34%.

The overall distributions are shown in figures 12 and 13

5. Discussion

5.1 Size of Respondents' Enterprises (Qu. 1, 2 & 3)

Figure 2 shows that the sample of respondents is fairly representative of all growers according to size of enterprise.

5.2 Source of Planting Material

Figure 4a shows that of the growers who did not raise from seed, only 1 reported distortion. This suggests that raising from seed may be related to occurrence of distortion. This should be looked at further.

5.3 Extent to which Distortion is a Problem (Qu. 4)

There may be some bias in these results, which indicate how much of a problem growers *perceive* Distortion to be.

Growers are more likely to respond to the questionnaire if Distortion has been a problem. The mysterious nature of the problem and lack of knowledge of how to treat it may incline growers to rate the problem more seriously. Both factors will tend to increase the reported problem.

Figure 6 shows no relationship between size of enterprise and the extent of the problem of Distortion.

5.4 Rate of Occurrence of Distortion (Qu. 4)

Non-response for this question was high (22%). The 45 respondents who reported that Distortion occurs still represent a large enough sample for the detailed analysis of questions 5-9.

5.5 Total Number of Trays Rejected This Season (Qu. 5c)

The inconsistent use of units makes it difficult to give an absolute figure for the rate of rejection. Excluding pots, the rejection rate is still only 0.58%.

5.6 Occurrence of Specific Symptoms for Each Species (Qu. 5b)

There are clearly differences in the number of symptoms reported for specific species. 23 respondents reported symptoms for Petunia, considerably more than for any other species.

A chi-square test confirmed that the variation in occurrence of symptoms was not due only to the variation in the number who grow each species. Some species are more prone to distortion than others.

5.7 Problem of Distortion Compared to Previous Years (Qu. 5d)

Figure 10 shows little change in the extent of the problem this year, compared to previous years. The response rate for this question is so low that the figures should be treated with caution. For the same reason, no further analysis was made of these results.

5.8 When Distortion is Noticed (Qu. 7)

The fact that 32 growers (84% of those who responded) reported noticing Distortion *after* pricking out, confirms the existing information.

5.9 Proportion of Affected Plants which Die and which Revert to Normal Growth (Qu. 8 & 9)

Response rate for these questions was low. Data shown in Figures 12 and 13 indicate the general pattern of response.

Appendix 1

- Figure 1 - Area of Glasshouses/Plastic Structures
- Figure 2 - Number of Boxes/Packs Grown
- Figure 3 - Number of Pots Grown
- Figure 4- Source of Planting Material
- Figure 5 - Extent of Problem of Distortion & other Potential Reasons for Rejecting Bedding Plants
- Figure 6 - Extent of Problem of Distortion in Relation to Size of Enterprise
- Figure 7 - Occurrence of Symptoms for Each Species
- Figure 8 - Total Occurrence of Each Symptom Number
- Figure 9 - Number of Respondents who Grew Each Species
- Figure 10 - Problem of Distortion this Year Compared to Previous Years
- Figure 11 - When Distortion is Noticed
- Figure 12 - Proportion of Affected Plants which Die
- Figure 13 - Proportion of Affected Plants which Revert to Normal Growth

Figure 1: Area of Glasshouses / Plastic Structures

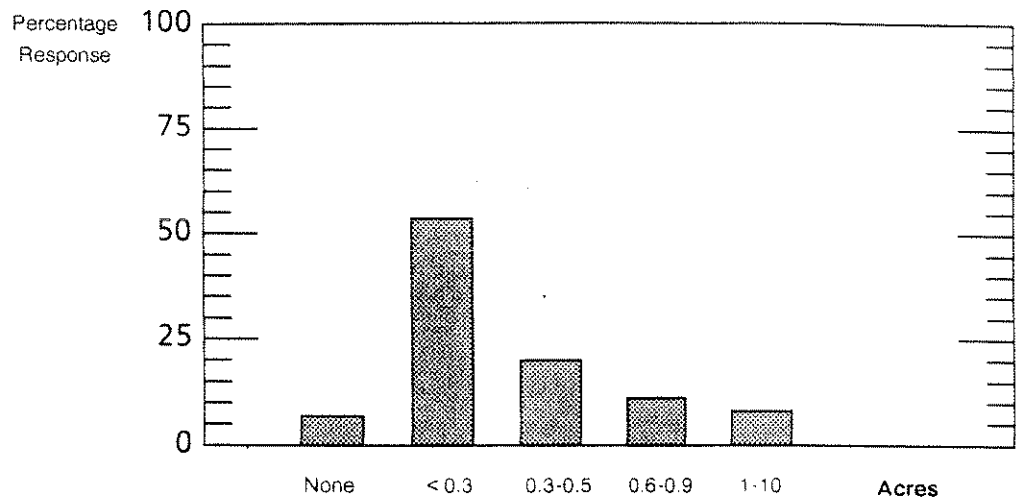


Figure 2: Number of Boxes/Packs Grown

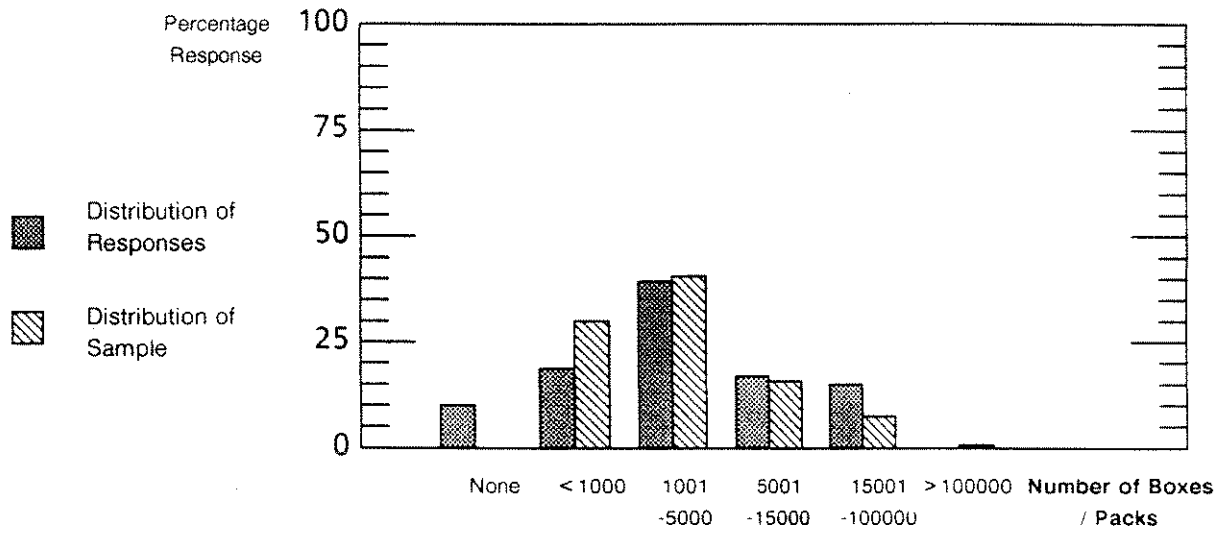


Figure 3: Number of Pots Grown

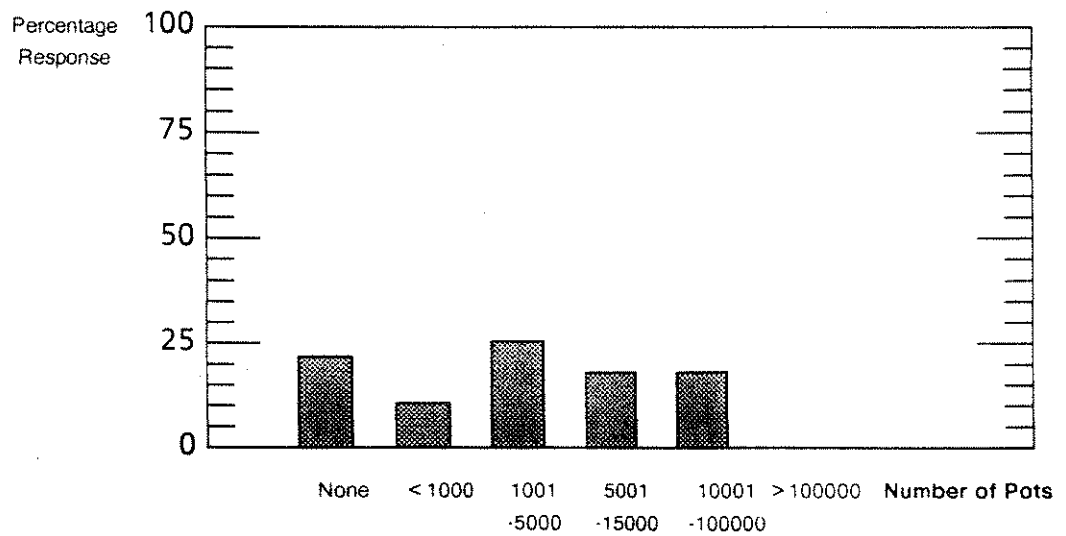
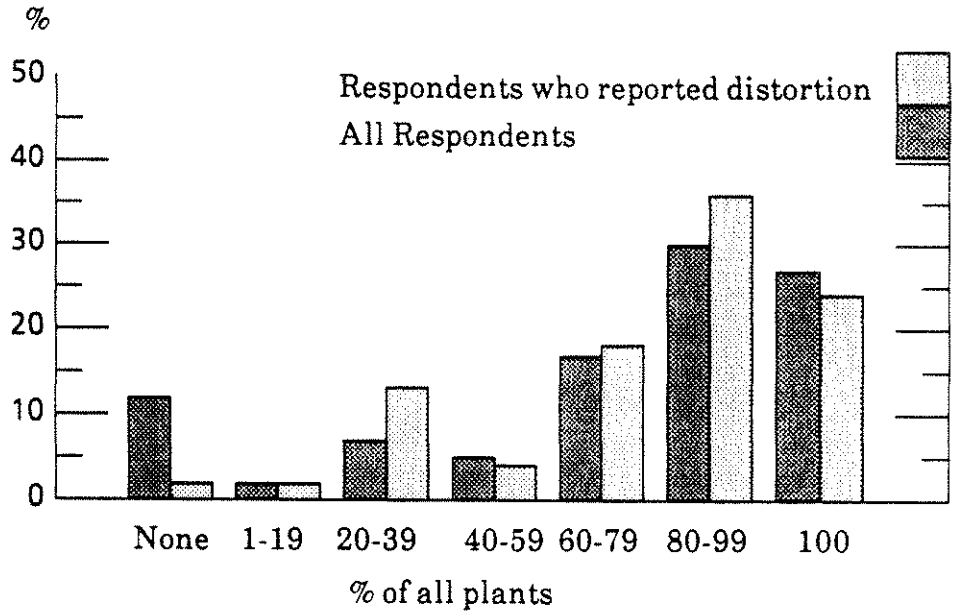
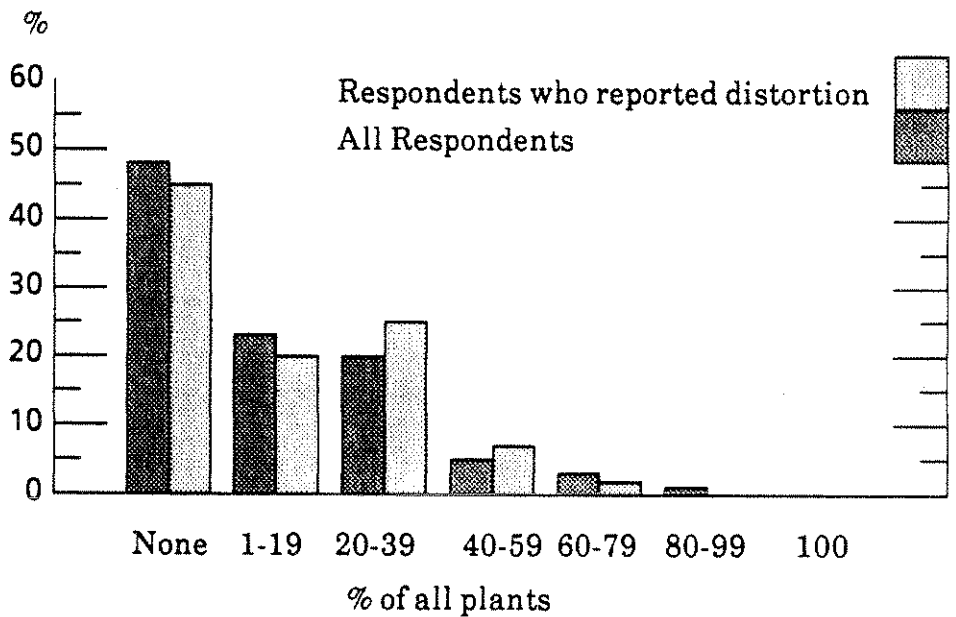


Figure 4: Source of Planting Material

4a.
Percentage of
plants raised
from seed



4b.
Percentage of
plants bought
as seedlings



4c.
Percentage of
plants bought
as plugs

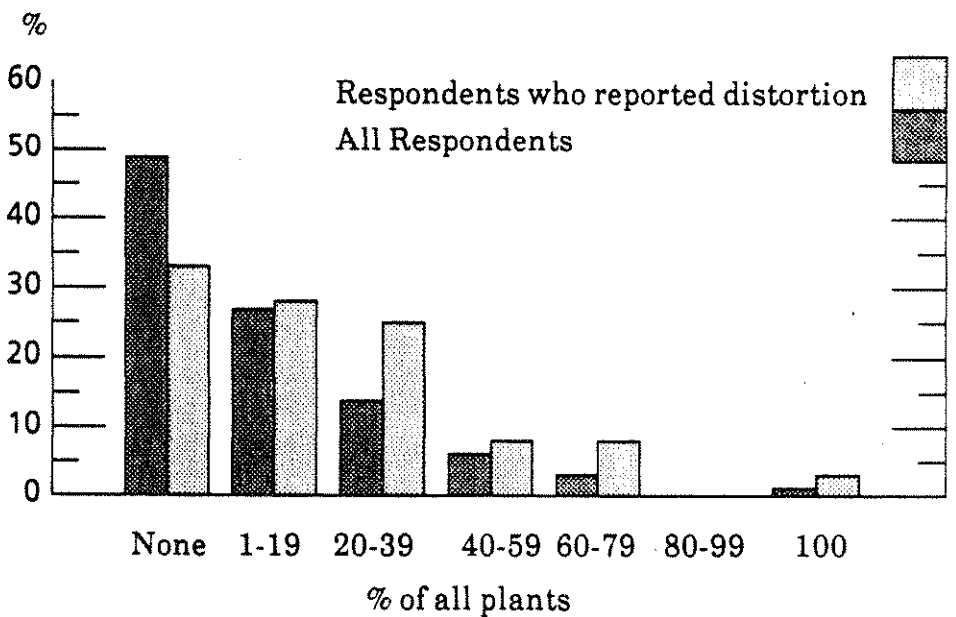
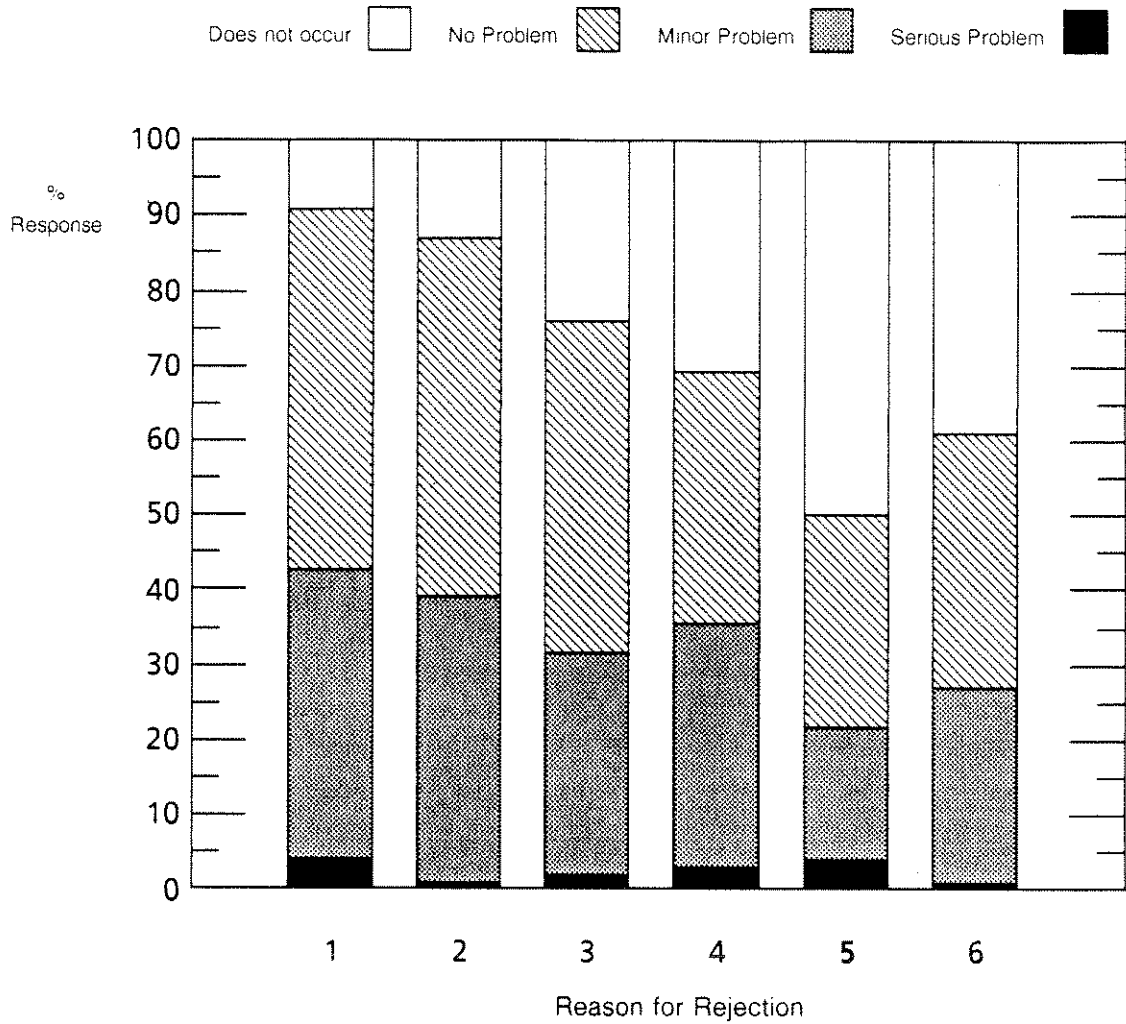


Figure 5: Extent of Problem of Distortion and Other Potential Reasons for Rejecting Bedding Plants



Q 4 Below is a list of possible reasons for rejecting plants...

- 1 = Disease damping off / Stem rot
- 2 = Incomplete box / missing plants
- 3 = Uneven plant growth in box
- 4 = Gone over the top / over mature
- 5 = **Growth Distortion**
- 6 = Physical damage / frost / chemical scorch

Figure 6a & 6b: Extent of Problem Of Distortion in Relation to Size of Enterprise

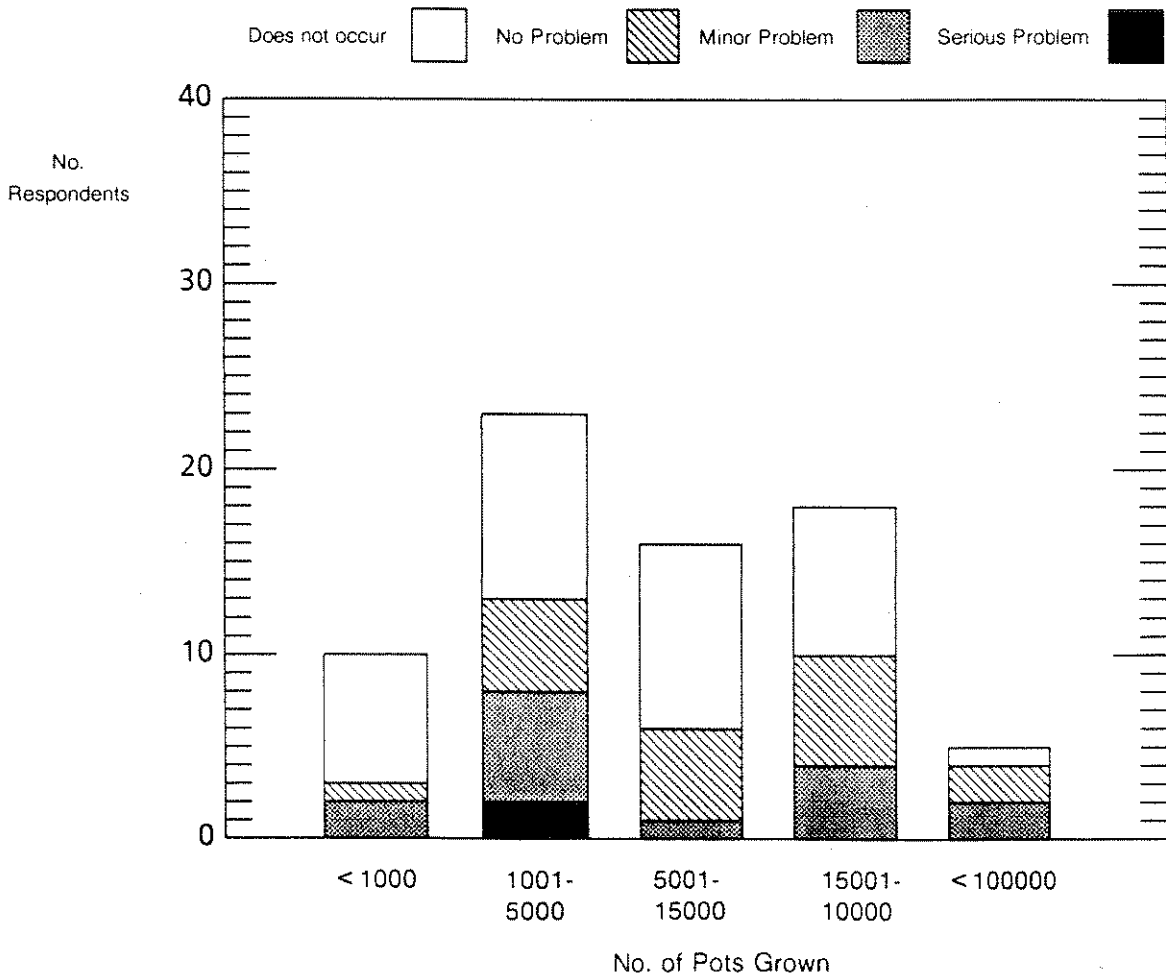
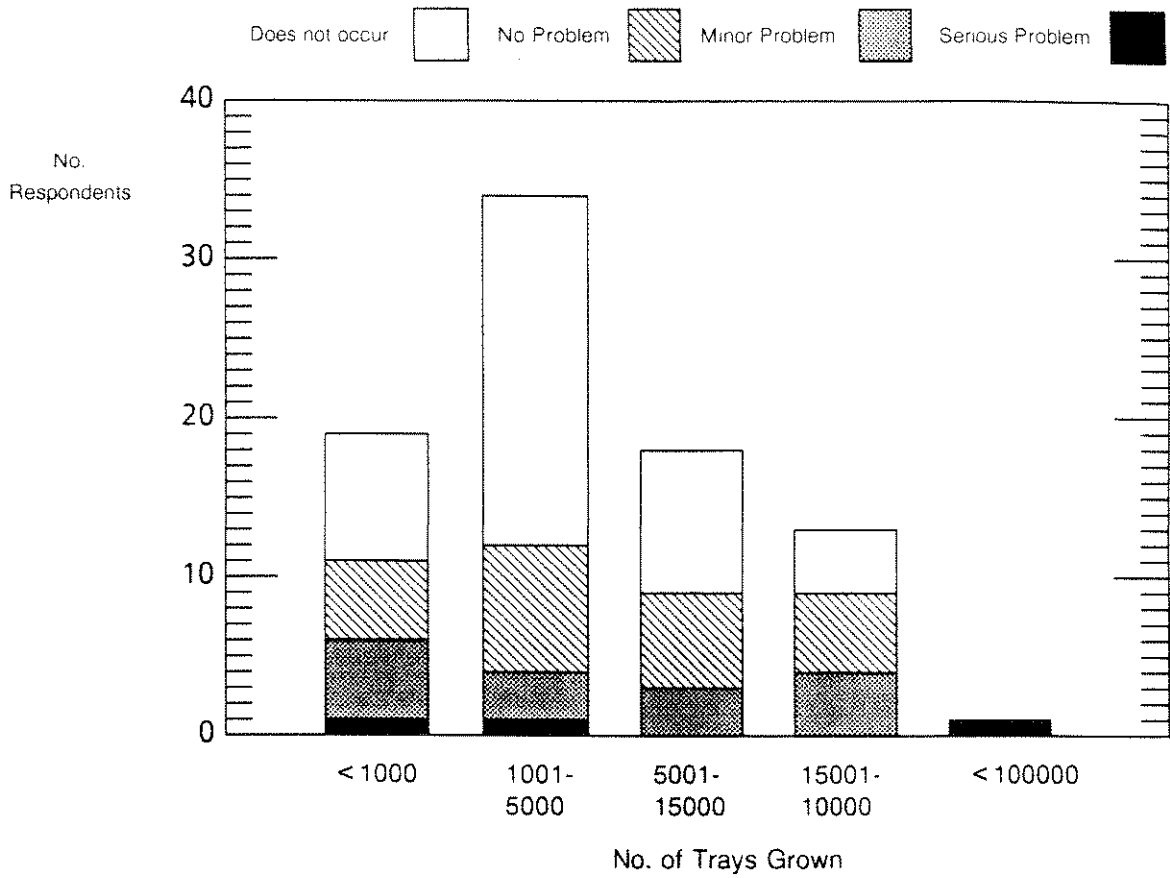
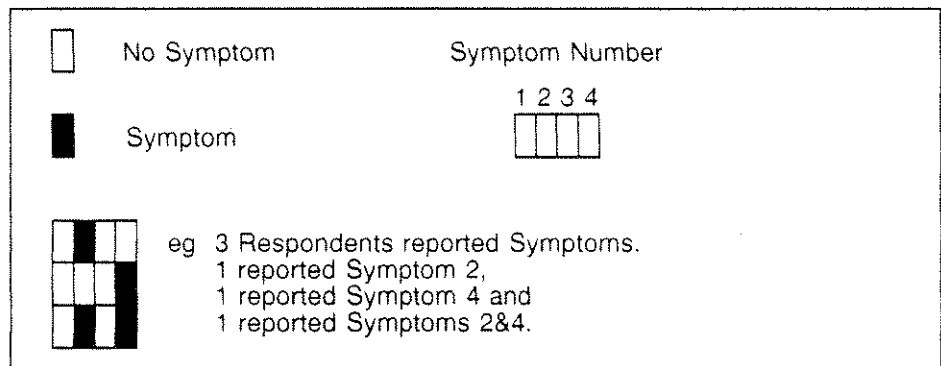
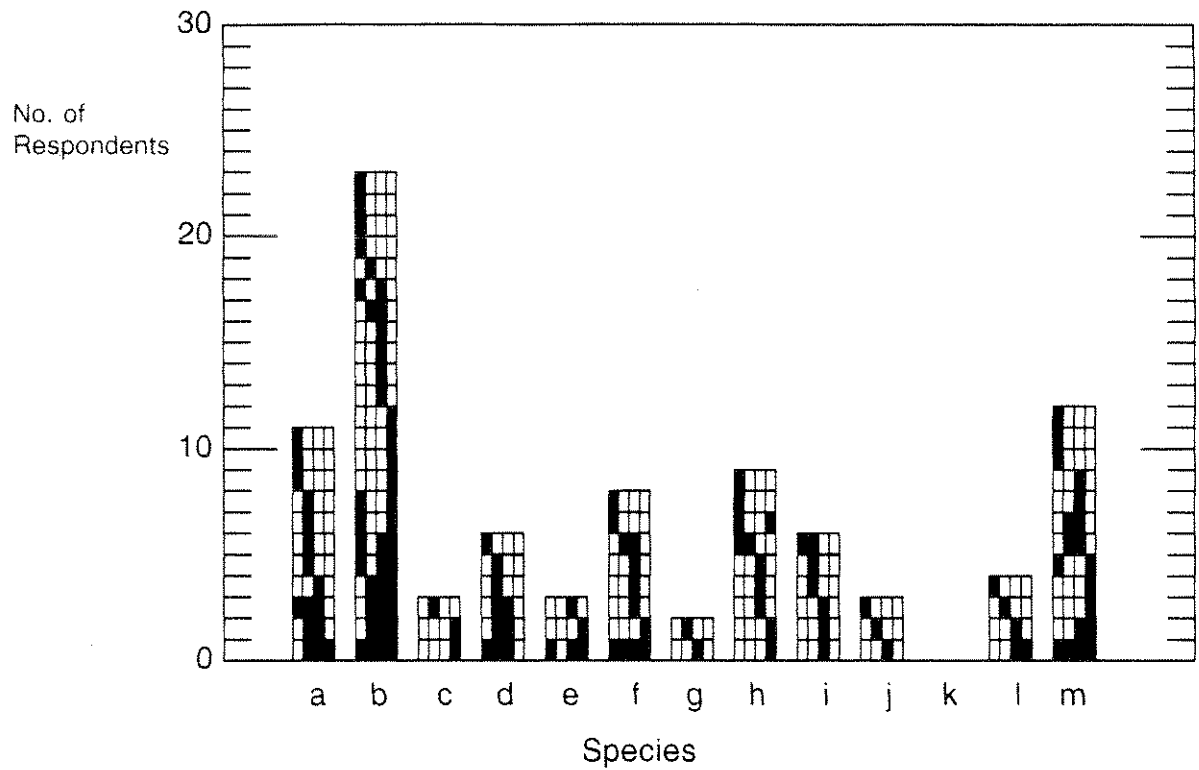


Figure 7: Occurrence of Symptoms for Each Species



- a Antirrhinum
- b Petunia
- c Salvia
- d Verbena
- e Alysum
- f Geranium
- g Mesembryanthemum
- h Pansy
- i Marigold
- j Dianthus
- k Tagetes
- l Phlox
- m Impatiens

Figure 8: Total Occurrence of Each Symptom Number

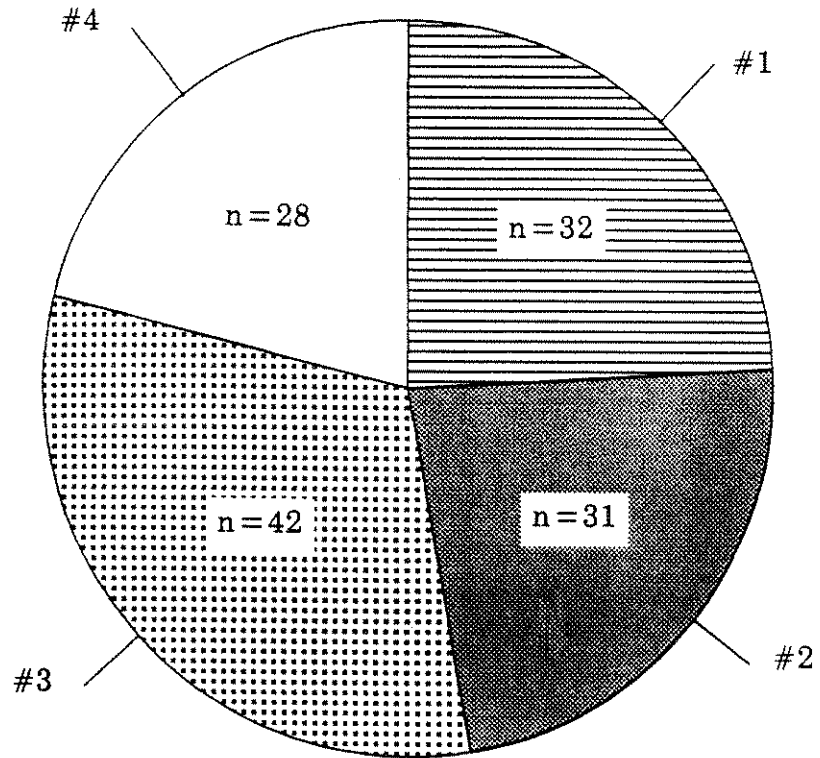
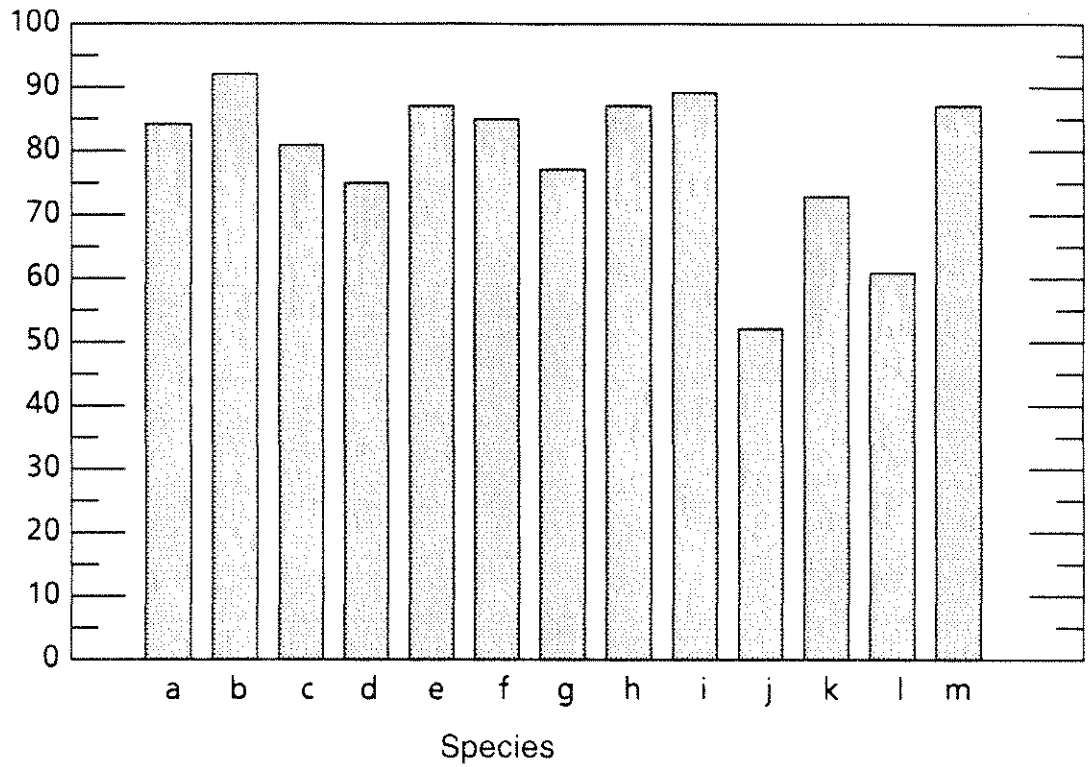


Figure 9: Number of Respondents who Grew each Species

No. of Respondents



- a Antirrhinum
- b Petunia
- c Salvia
- d Verbena
- e Alyssum
- f Geranium
- g Mesembryanthemum
- h Pansy
- i Marigold
- j Dianthus
- k Tagetes
- l Phlox
- m Impatiens

Figure 10: The Problem of Distortion this Year Compared to Previous Years - Average scores for each species

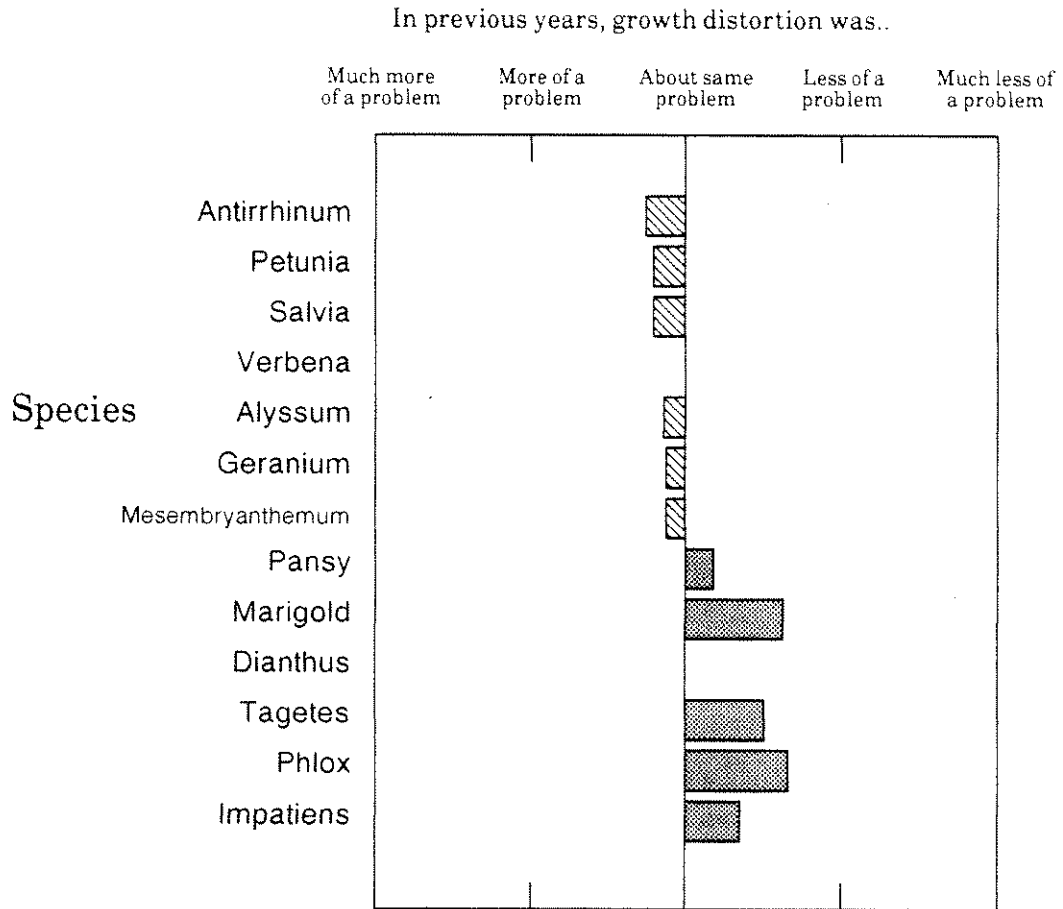
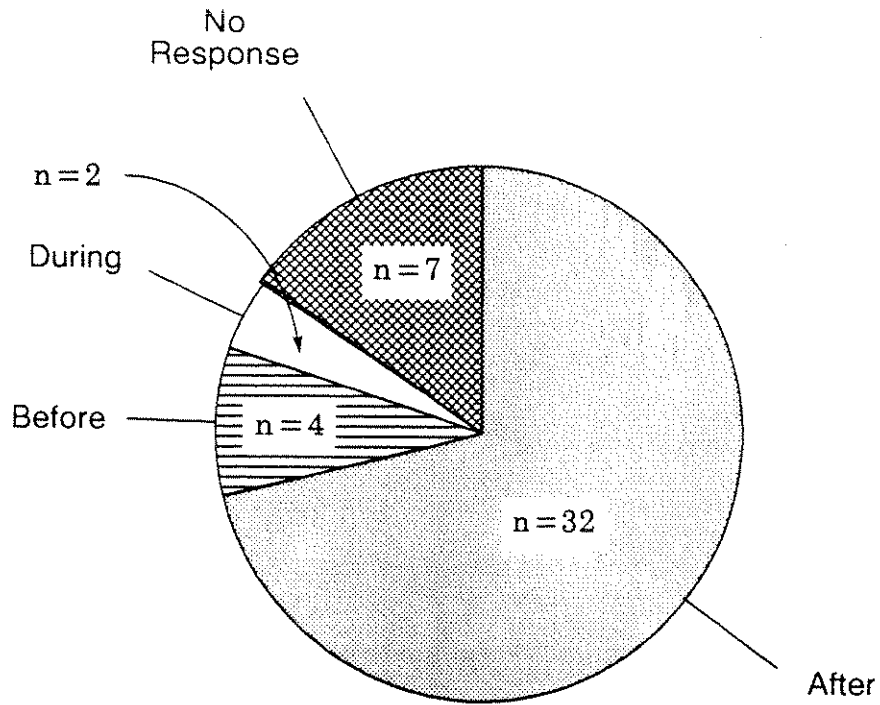


Figure 11: When Distortion is Noticed



Key: *Before, During or After Pricking out*

Figure 12: Proportion of Affected Plants which Die

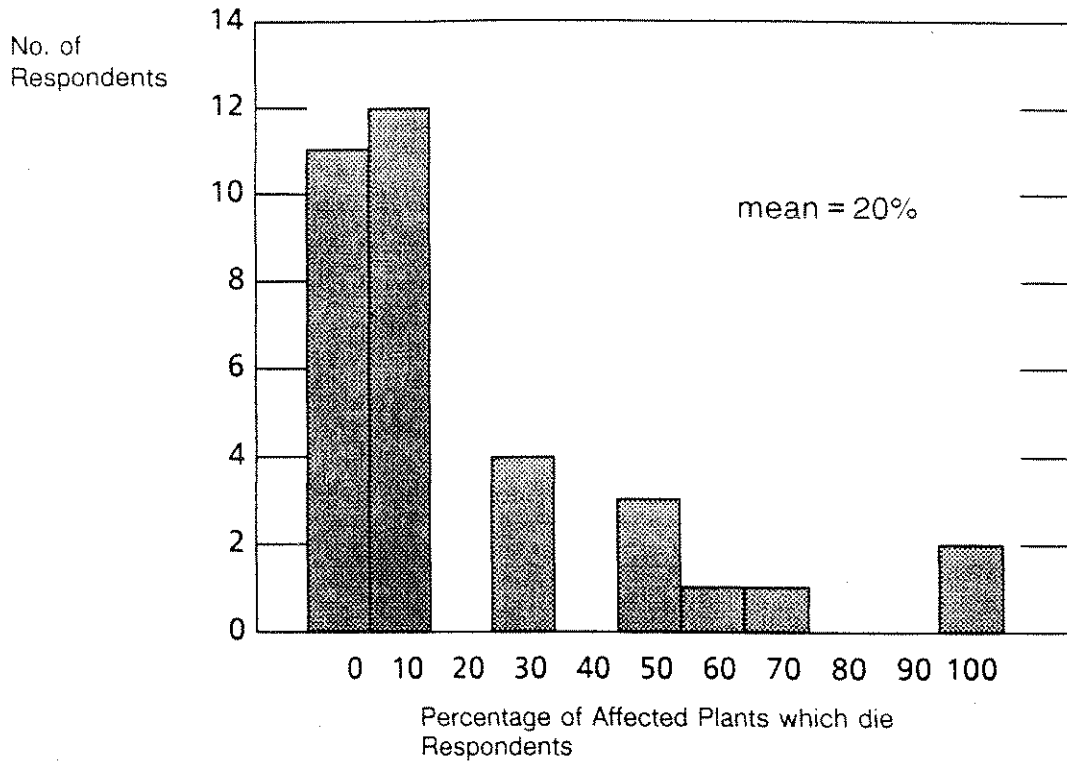
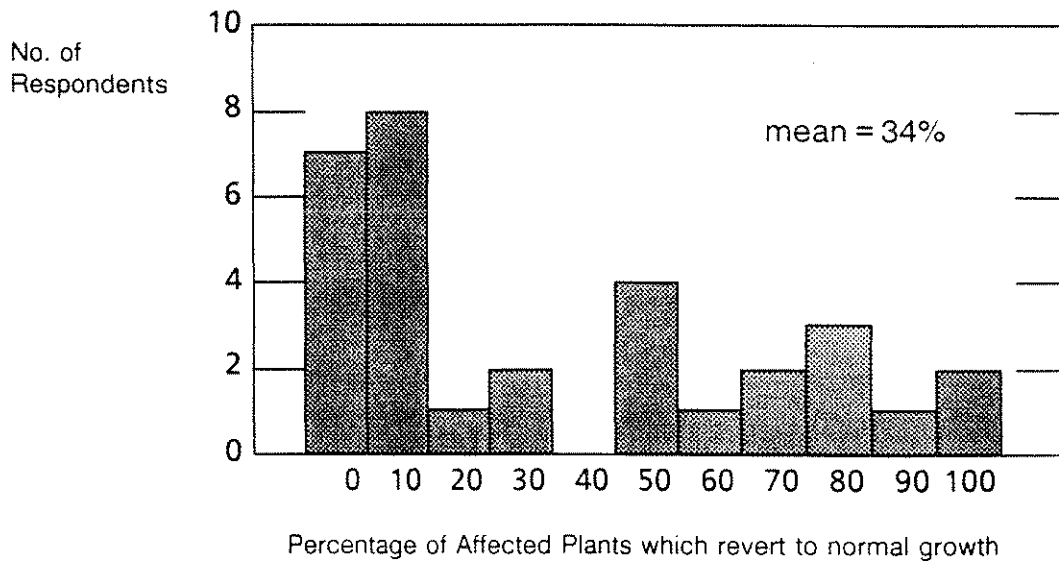


Figure 13: Proportion of Affected Plants which Revert to Normal Growth



Appendix 2

- a) Copy of Postal Questionnaire
- b) Copy of Covering Letter



Distortion in Bedding Plants

Column Number
1

Respondent Number

1 What is the total area of glasshouses and plastic structures you use to produce bedding plants?

<0.3 acres	0.3-0.5 acres	0.6-0.9 acres	1-10 acres	>10 acres
<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
1	2	3	4	5

2

2 How many of the following have you grown during the last 12 months?

Boxes and packs	<input type="text"/>
Pots of bedding	<input type="text"/>

3

4

3 Approximately what % of bedding plants pricked out do you:

Raise from seed yourself	<input type="text"/>	5
Buy in as seedlings	<input type="text"/>	6
Buy in as plugs	<input type="text"/>	7
Total	100 %	

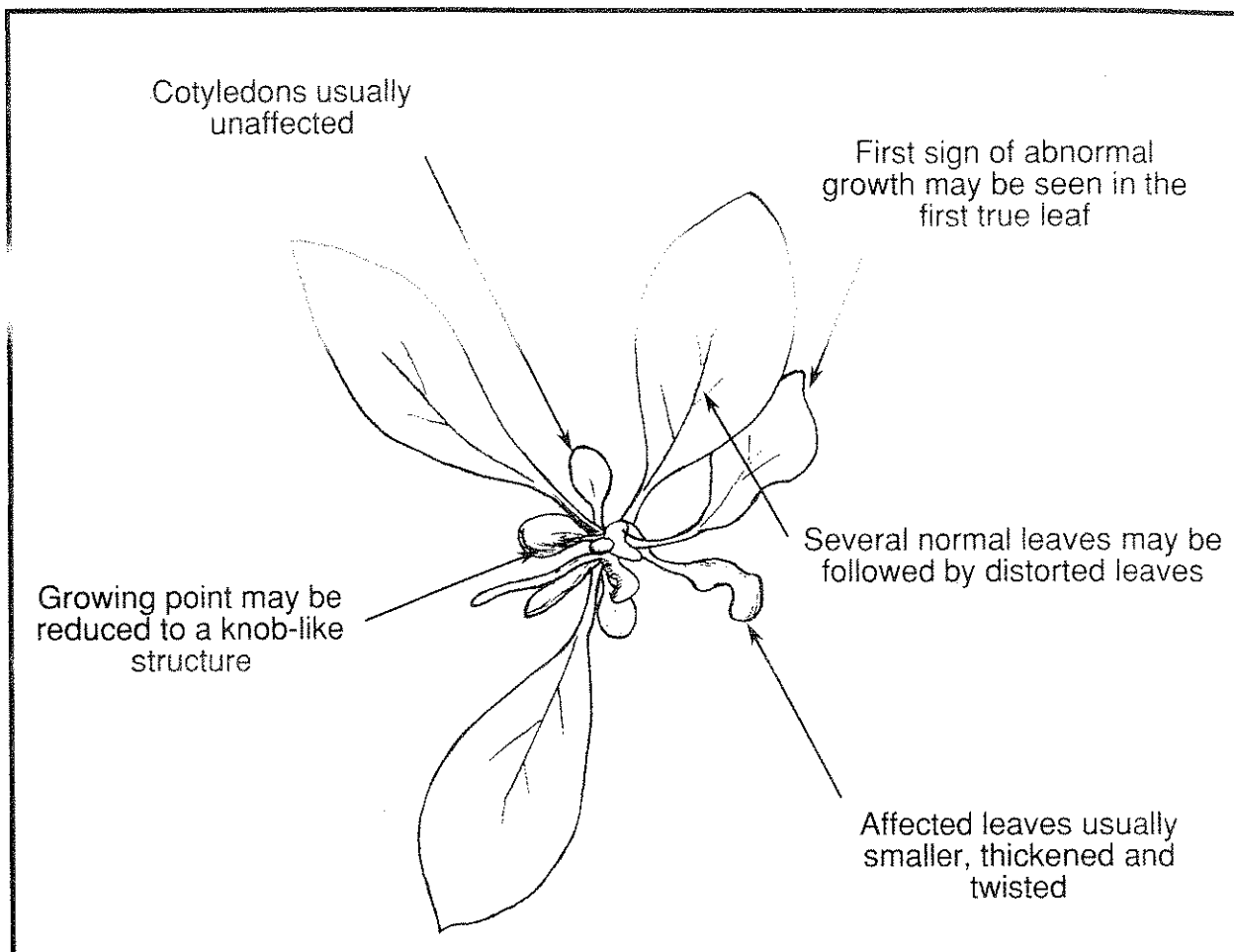
4 Below is a list of possible reasons for rejecting bedding plants after the pricking out stage. Please indicate how much of a problem this has been over the last five years using the following scale:

- A Serious problem** - it has affected the financial viability of growing certain species.
- A Minor Problem** - losses have been absorbed in the cost structure of the product.
- No problem** - losses have occurred but are minimal.
- Does not occur**

Reason for Rejection	Serious problem	Minor problem	No problem	Does not occur	
Disease / damping off / stem rot	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	8
Incomplete box / missing plants	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	9
Uneven plant growth in box	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	10
Gone over the top / over mature	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	11
Growth distortion as described on next page	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	12
Physical damage / frost / chemical scorch	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	13

Possible Symptoms Associated with Growth Distortion in Bedding Plants

The diagram below illustrates some of the symptoms of growth distortion that have been reported by growers. Use this diagram and the table below as an aid to answering question 5.



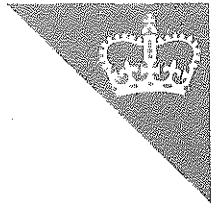
Symptom Description

Symptom Number
(see Question 5)

Abnormal growth in first true leaf	1
Several normal leaves followed by distorted leaves	2
Small, thickened and twisted leaves	3
Growing point reduced to knob-like structure	4

5 This diagram shows symptoms of plant distortion that may occur in bedding plants. On the table opposite please indicate, by **ticking** the appropriate boxes, your answers to the following questions.

- A Which species you have grown **this season**?
- B Which, if any, of these symptoms you have seen **this season**? *tick more than one box if appropriate*
- C Please state how many trays have been rejected **this season** because of growth distortion?
enter number
- D Indicate how these compare to previous years losses from growth distortion.



Your Ref.

Our Ref. **NAWS 445**

Date **5th July 1990**

Distortion in Bedding Plants

Dear Grower

Enclosed is an HDC funded survey of Bedding Plant Growers which is being carried out by ADAS. I am asking for 30 seconds of your time to read this letter, then perhaps 3 further minutes to complete the attached questionnaire.

Why? Since the early 1970's an unsolved problem of bedding plants has cropped up at erratic intervals. It has been variously named:

Corynebacterium, Distortion, Rhodococcus

We have no reliable and consistent information on the cause or extent of the problem.

Why now? Before committing your funds to work on determining the cause of Distortion, HDC needs to know the scale of the problem and a survey is the most reliable means of measuring this.

Why me? You have been selected at random from a list of bedding plant growers. This random selection prevents bias in recording the incidence and severity of the problem.

If you have read this far I hope you are convinced of the usefulness of this survey. Please complete the attached questionnaire and return it ADAS in the post-paid envelope provided. Please return the questionnaire to us as soon as possible.

Results of the survey will be published in HDC News later in the year.

Thank you for your cooperation.

Yours sincerely,

Geoff Griffin
Plant Pathologist

