MYTH & MONEY IN MICROPROPAGATION

PETER C. HARPER[1]

Microplants Ltd.
Longnor, Nr. Buxton, Derbyshire,
SK17 ONZ, U.K.

Cost disadvantage is the main reason for the relatively slow expansion of the micropropagation industry in relation to the industry which it serves—commercial ornamental horticulture.

The starter plant producer suffers from disadvantages shared by all component industries. They are at the base of a long production chain (Table 1). Very little of the cash which funds the chain gets back to base. In the example chosen the retail margin is four times the starter plant selling price.

This is less significant than the vulnerability of the producer to competition from more conventional propagules which have a price advantage over most of the market and buyers are familiar with the technique of handling them. Most of all the supplier has no real control over the market nor any means to influence it.

Until recently the micropropagation techniques were found to be so intriguing that the industry seemed to be driven by technology with the market a secondary force. At that time it seemed that everything produced could be easily sold and customers were relatively tolerant of mistakes, failures and disappointments that were common. Looking back one can question the survival of micropropagation. It had a good 'press' as one of the few sectors of plant biotechnology to show any tangible results. Its advantages seemed to be manifest. There were some successful operators running laboratories with good systems, but the commercial laboratories built up a bad reputation.

Table 1. Added Value Chain for Pot Plants.

Retail selling price	£2.50
Value added tax	.33
Net retail price	2.17
Retail margin (40%)	1.00
Distributor selling price	1.17
Wholesaler including transport + 30% markup	.26
Importer selling price	.90
Importer margin including transport	.45
On-grower selling price	.45
On-grower margin	..20
Microplants/seedling price	.25
Producers margin	.13
Microplants/seedling production costs	.12

[1] Technical Director

The 20 years from the 1960's to the 1980's were unusual for ornamental horticulture in being years of phenomenal expansion in cut flowers, pot plants, and hardy nursery stock. All sectors have benefitted from an exponential increase in demand. For instance, the indoor foliage plant market in the United States was worth $16 million in 1969 and is now worth well over $300 million. Figure 1 gives the per capita per country value of Dutch exports to several European countries from 1970 to 1985. Since Holland provides around 50 per cent of these the graph is a reasonable index of the state of the trade. This expansion has created a demand for starter plants, increasing for 8 to 10 years at around 20 per cent per year. In this situation it is said that a new entrant to a market can take up to 15 per cent of the new business without upsetting the price structure or alarming the existing suppliers.

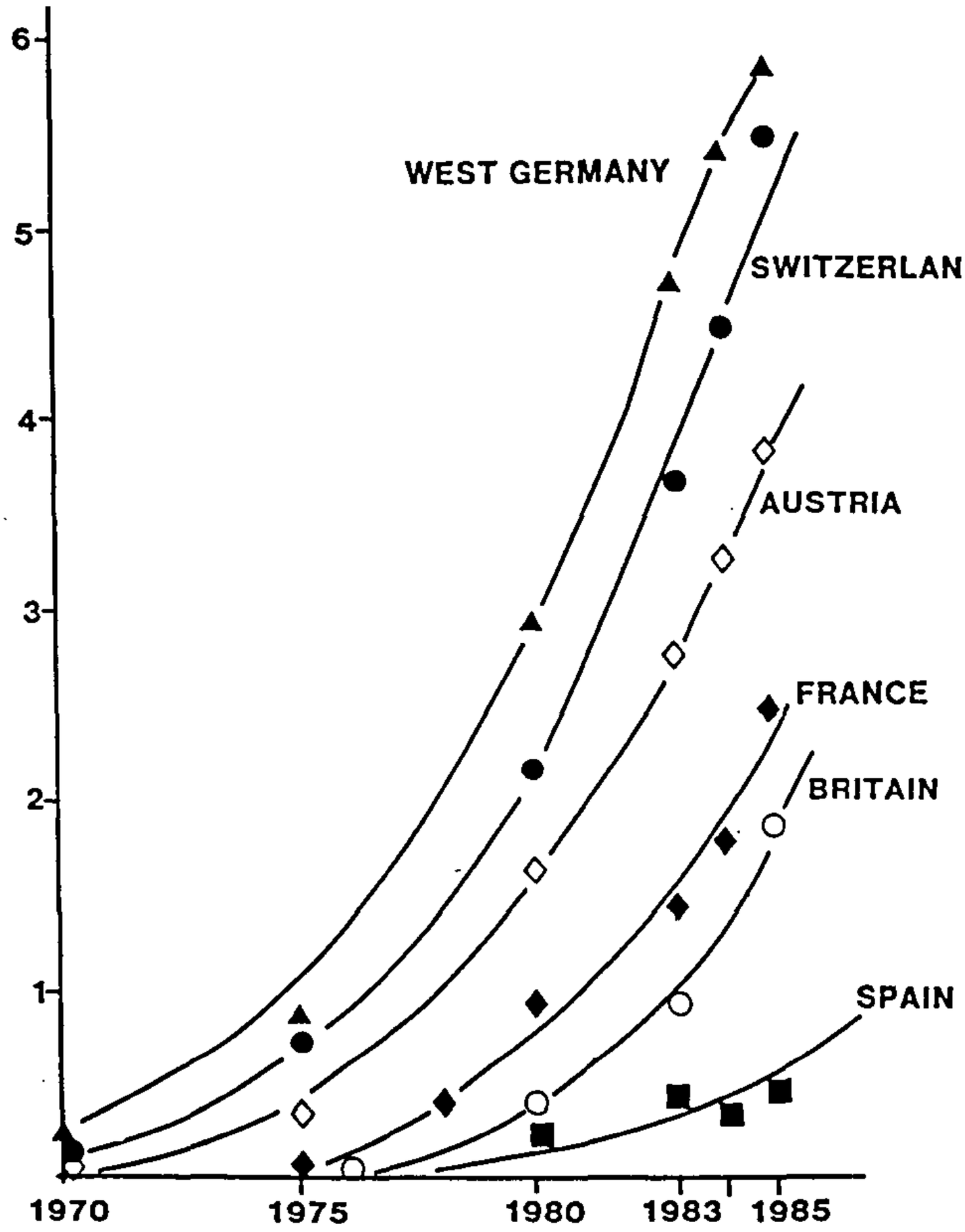

Figure 1. The per capita per country value of Dutch horticultural exports to several European countries from 1970 to 1985.

The development of the market provided the opportunity for a new product to enter without too severe competition from established wares. The same conditions may have given some micropropagation companies a false sense of success and shielded them from the disciplines that could have helped in facing the slower rates of increase and more stable conditions now prevailing.

In the last 10 years a huge list of plants has been cultured. Micropropagation systems are published frequently. Lists provided by the companies can be impressively long. Sadly, the majority of subjects are produced in small numbers.

Table 2, which is derived from Professor Pierik's data for Holland, shows that the industry is founded on a very narrow range of products. Cut flowers take 30 per cent of the output of microplants and pot plants 80 per cent, in the Netherlands. Closer examination finds the cut flower group to be almost wholly gerbera while 94 per cent of the pot plant group is made up by ferns (57 per cent), Saintpaulia (19 per cent), cordyline, syngonium, spathiphyllum and anthurium. Amongst the bulbs, lily shows the fastest recent growth. No other plants rise above the half million level. The same is true for other producing countries.

In the United States all of the stand-alone laboratories—those

Table 2. Microplant production in the Netherlands (after Peirik).

Total orchids (1984)	2.13 million
Total cut flowers (1986)	12.6 million
of which gerbera is	12
Total bulb (1985)	2.027 million
of which lilies are	2
(1986 est. = 7 million)	
Total pot plants (1986)	19.8 million
*Nephrolepis	11.19
*Davallia	0.34
*Saintpaulia	3.7
*Cordyline	0.78
*Anthurium	1.75
*Ficus	0.15
*Bromeliads	0.25
Syngonium	0.603
Spathiphyllum	0.512
Balance of 27 plants = 0.525 million	
*Always listed from 1980–86. The others appear in occasional years.	
Total vegetable (1984)	60,040 plants
Potato & sugar beet (1984)	180,000 plants

without associated nurseries—are heavily dependent upon foliage pot plants. A combination of oversupply and competition from third world imports has depressed prices and led to the closing or sale of several laboratories in Florida.

There are estimates—but no good figures—for the total output of the industry. These vary from 100 million plants per year to 300 million, or a value of between £20 million and £60 million world-wide. Total US production is unlikely to be more than 60 million microplants. Although there are thought to be 100 laboratories, it is difficult to distinguish state-funded research, special purpose (i.e. owned by seed or chemical companies) and propagation adjuncts of existing nurseries from commercial producers.

There are 14 well known American microplant factories and six of these are capable of producing around 5 million plants per year. Various figures are quoted for new laboratories opening each year but in this dynamic industry many close unnoticed. This familiar pattern of many setting out on the race and few surviving is illustrated in Table 3. The pattern is one of 80 per cent of the production arising from 20 per cent of the factories. This may well be an underestimate. Small laboratories are inclined to overestimate their production, often inflating the figures well beyond the numbers which their facilities and staff could possibly sustain. In general a sterile cabinet, when fully worked results in 130,000 plantlets for sale, or 170,000 if a twilight shift is worked. Growth room holding capacity must be 10 per cent of total output allowing for only a 2 per cent contamination rate. I doubt that there are more than 25 commercial laboratories in the world with the capacity to produce more than 1 million plantlets per year.

Table 3. Number of laboratories in Britain and Holland and estimates of their productivity [from Harper (GB) and Professor Peirik (NL)].

Annual production of microplants	No. of labs.	Total production
Great Britain		
>4 million	1	4.3 million
2 to 3	1	3
1 to 2	1	1
<1	8	est. 1.5
		9.8 million
Netherlands		
<5 million	3	15 million
1–5	7	21
0.5–1	2	1.5
100–500 thousand	6	1.8
10–100	18	0.81
<10	14	0.07
		42 million

For the future, large nursery businesses can be expected to integrate micropropagation with their normal propagation departments. The mix of conventional and tissue culture will supply the range they need. Independents are in a more fragile state. Price levels do not give them the opportunity to make enough to support the research and development that could take them up into the next level of technology and production. Too many small laboratories, especially the back room operators of East Europe and the low labour cost operations of Asia, are price cutting to obtain a share of the market. For a time seed companies and agro-chemical businesses would buy up micropropagation units as a useful adjunct or a gentle introduction to bio-technology. These have proved to be unreliable parents. At best, they shed the less profitable activities and integrate the residue with a plant breeding or chemical screening unit, at worst they offer a quick termination.

As this phase is passing, and with it the opportunity to build a business over 3 to 5 years before selling on, it is difficult to attract venture capital.

The future for truly independent companies in Europe and America is not likely to be easy, but it is very hopeful for those who can stay the course. For investment they will look to sources with a longer term in mind. They will seek out niche markets which allow them to concentrate on long runs of fewer clones. Increasingly the units will be run by professional managers and sales staff rather than by horticulturists and academics.

After the shake out when prices rise to sensible levels and some surplus cash is generated, expansion and mechanisation can be tackled.

In the near and middle term it is unlikely that somatic embryogenesis (artificial seed) or robotics will be of any significance in ornamental horticulture. The factories will be equipped, as nurseries are, with labour saving devices to move materials and products around. Better control of sterility and of the environment will help to provide the uniformity at present lacking.

Investment needed for this advance will be in the region of £3 to £4 million per factory. The present ceiling on production which is set by management and contamination problems is around five million plants per year. The improvements we look for would demand that production be in the region of seven to 13 million plants per year.

Robotics and vision analysis would take development costs and capital investment far beyond these estimates. Commercial ornamental horticulture will not sustain the astronomical output needed to justify this. Forestry and plantation crops in the third world might demand the numbers but are not likely to pay the price.