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Getting rich or going broke?

*Economic considerations to guide research
decisions on microbial pest control products*

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Outline of presentation

- ▶ Market overview
- ▶ Cost of development
- ▶ How to pick a winner
- ▶ Potential show-stoppers
- ▶ Economic considerations
- ▶ Summary & Conclusions

Microbial pesticides - a success story?

- Idea has been around for a while
- Numerous potential strains discovered
- Many marketed
- Relatively few successful products

**DEL MAL DEL SEGNO
CALCINACCIO o MOSCARDINO**

Malattia che affligge

I BACCHI DA SETA

E SUL MODO

DI LIBERARNE LE BIGATTAJE

ANCHE LE PIÙ INFESTATE

Opera

DEL DOTTORE AGOSTINO BASSI

DI LODI

*la quale oltre a contenere molti utili precetti intorno al miglior governo
dei Filugelli, tratta altresì delle Malattie*

DEL NERONE E DEL GIALLUME



LODI
DALLA TIPOGRAFIA ORCESI
1835

B. bassiana discovered in 1835

Market overview

Microbial biopesticides market (2007):

400 M\$ worldwide

126 M\$ in North America

7 M\$ in Canada

Annual growth rates estimated at 10-20 %

Canadian figure could triple by 2020

1 % of total pesticides market worldwide

-> Lot's of room for growth!

Comparison with conventionals

Benefits

- Lower cost of development
- Lower registration cost
- Narrower target range
- Work well in IPM systems
- Lower REI and PHI
- New modes of action

Challenges

- More expensive to produce
- Specialized consultant needed
- Narrower target range
- Integrated approach required
- More precise timing needed
- New expertise required for success

Conditions for success

- Performance comparable to current standard
 - Cost must be comparable
 - Product should fit into current IPM system
- > if not, must have other added value:
- Resistance management
 - Reduced PHI
 - Better compatibility with beneficials
 - Value in niche market
 - etc.

Cost of biopesticide development

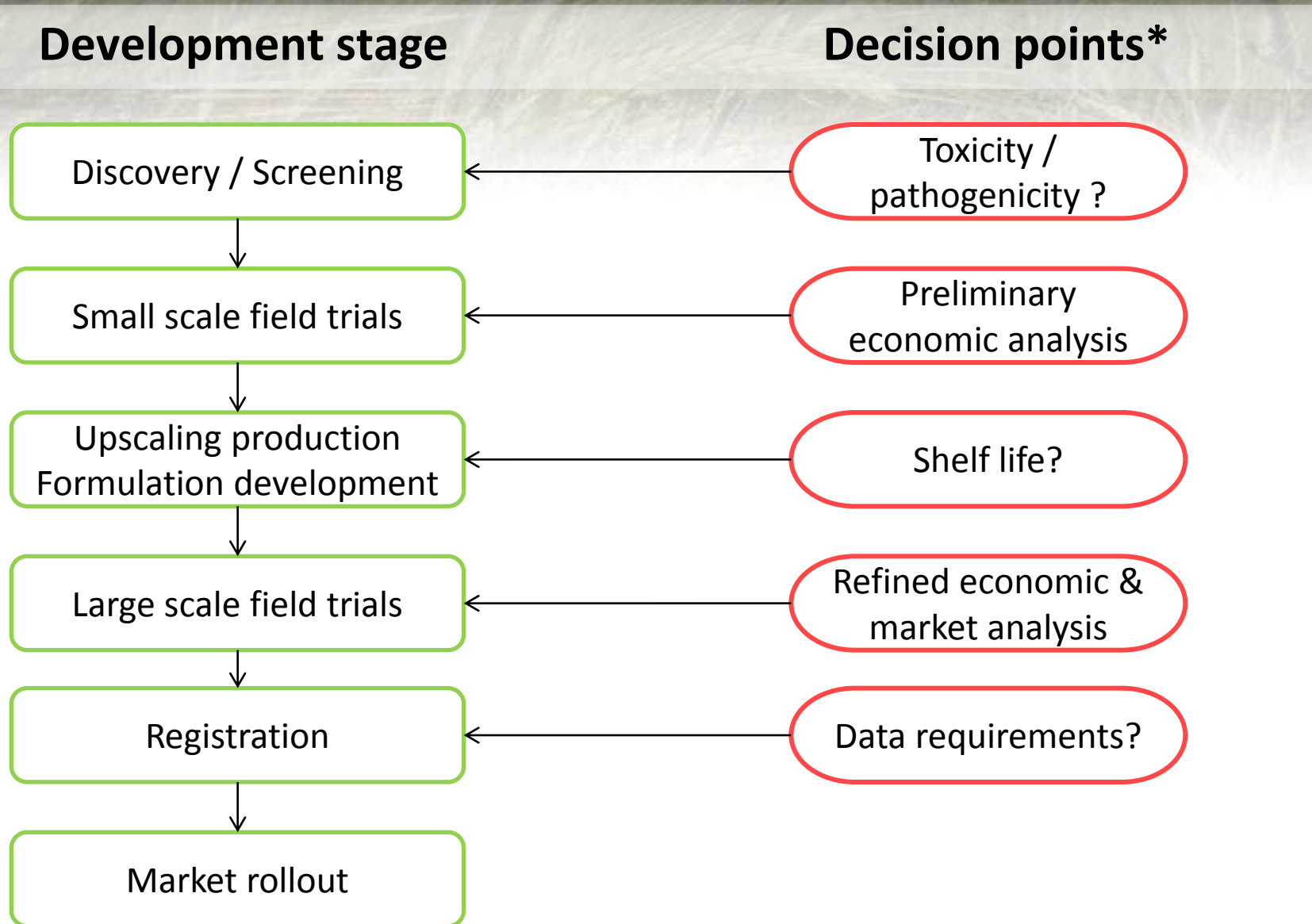
Estimates vary...

- At least 3-5 years of development
- Minimum 2-3 M\$
- Up to 10-15 M\$ until for globally registered product

-> a lot cheaper than cost of developing new conventional product (>200 M\$)

-> still a substantial investment

How to pick a (potential) winner?



*Efficacy is considered a given, but has been the sole focal point in many cases

Toxicity & Pathogenicity potential?

This could be a showstopper...

- Clear taxonomic identification of isolate essential
- Pathogenicity concern in related species?
- Potential of problematic metabolites (genotoxic, etc)?

Consider formal testing (rat limit test ca. 1000\$)

Shelf life

Considerations:

- Storage requirements
 - cost of cool storage, transportation much higher
- Structure of demand
 - Grasshopper control: large quantities needed infrequently
 - Greenhouse pest management: continuous need for product

Ideally, product stable at RT for > 1 year
Less than 6 months probably not acceptable

Data requirements

Typically required data

Quality control data

Physical Chemical Properties

Human health and safety data

Environmental fate and toxicology

Value and efficacy

-> Depending on waiver acceptance:

100-250K\$ (Canada)

Possible show-stopper: Higher tier data required

Key factors affecting economics

- Efficacious rate/concentration
- Production cost
- Growth rate
- Inoculum yield
- Acceptable farm level cost
- Cost of distribution

Economic analysis

Microbial Pesticide Cost Analysis

Application parameters

Efficacious concentration (cfu/ml)	Application rate (L/ha)	Rate/ha (g/ha)	Rate/ha (cfu/ha)
5.00E+06	150	150.00	7.50E+11

Product parameters

Product concentration (cfu/g)	Production cost (\$/kg)	Production cost per hectare (\$/ha)
5.00E+09	63.46	9.52

Market parameters

Acceptable Farm level price (\$/ha)	Distributor margin (% of distributor price)	Retailer margin (% of retail price)
30.00	40%	30%

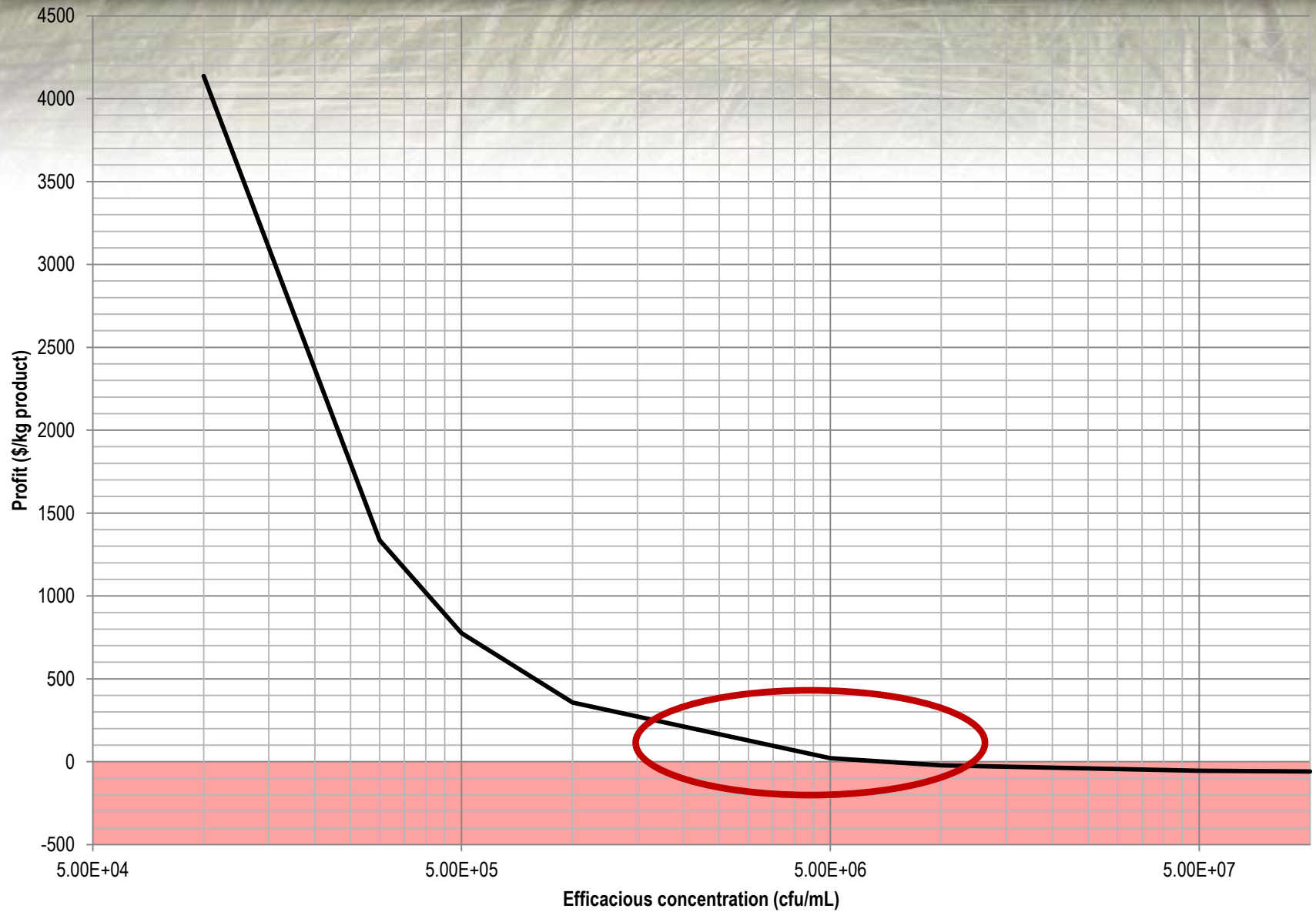
Bottom line

Distributor margin	Retailer margin	Gross Profit (\$/ha)	Gross Profit (\$/kg)
8.40	9.00	3.08	20.54

Production costs

	A	B
1	Production cost	
2	Variable costs (per production run)	
3	Raw materials	\$ 7,500.00
4	Other consumables (energy, etc.)	\$ 500.00
5	Packaging materials	\$ 1,000.00
6	Margin (for overstock, fermentation failures, etc.)	10%
7		
8	Fixed costs (per year)	
9	Building rent/depreciation	\$ 50,000.00
10	Equipment depreciation	\$ 150,000.00
11	Labour for production	\$ 500,000.00
12	Overhead (admin, management, marketing)	\$ 700,000.00
13	Idle time (days)	0
14		
15	Calculation	
16	Time for production run (days)	7
17	Yield per production run (kg)	750
18	Variable cost per kg product	\$ 13.20
19	Fixed cost per kg product	\$ 50.26
20	Cost per kg product	\$ 63.46

Efficacious concentration



Growth rate

Slower growth rate = higher cost per unit of product

Faster growing organism – production run takes 7 days:

Bottom line

Distributor margin	Retailer margin	Gross Profit (\$/ha)	Gross Profit (\$/kg)
8.40	9.00	3.08	20.54

Slower growing organism – production run takes 14 days:

Bottom line

Distributor margin	Retailer margin	Gross Profit (\$/ha)	Gross Profit (\$/kg)
8.40	9.00	-4.46	-29.71

Inoculum yield

Microbial Pesticide Cost Analysis

Application parameters

Efficacious concentration (cfu/mL)	Application rate (L/ha)	Rate/ha (g/ha)	Rate/ha (cfu/ha)
5.00E+06	150	150.00	7.50E+11

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Inoculum yield

Microbial Pesticide Cost Analysis

Application parameters

Efficacious concentration (cfu/mL)	Application rate (L/ha)	Rate/ha (g/ha)	Rate/ha (cfu/ha)
5.00E+06	150	750.00	7.50E+11

Product parameters

Product concentration (cfu/g)	Production cost (\$/kg)	Production cost per hectare (\$/ha)
1.00E+09	63.46	47.59

Market parameters

Acceptable Farm level price (\$/ha)	Distributor margin (% of distributor price)	Retailer margin (% of retail price)
30.00	40%	30%

Bottom line

Distributor margin	Retailer margin	Gross Profit (\$/ha)	Gross Profit (\$/kg)
8.40	9.00	-34.99	-46.66

Conidia: size matters...

Typical conidia sizes (depending on species)

Beauveria conidia: ca. 2 μm x 2 μm x 2 μm

Fusarium conidia: ca. 50 μm x 6 μm x 6 μm

So how many fit in 1 mL, i.e. about 1 g of product?

Beauveria: 1.3×10^{11}

Fusarium: 5.6×10^8

Acceptable farm level cost

Depends on how much a grower has to lose...

Strawberry: 24 000 \$ / ha

Potato: 7 500 \$ / ha

Wheat: 560 \$ / ha

Acceptable farm level cost (cont'd)

Fusarium Head Blight management in Wheat:

- 1 fungicide spray per season
(~ 40 \$ / ha / application)

Late Blight management in Potato:

- Up to >10 fungicide sprays per season
(15-25 \$ / ha / application)

-> may be able to sell more product in potato, but not necessarily better margins

Market analysis is a must!

Key questions:

- What is the total potential market?
- What initial and final penetration is realistic?
- Is my target market open to biological products?
- What marketing efforts are needed?
- How much product do I need to sell to recoup costs?
- How long before I am profitable?

Summary & Conclusions

So am I getting rich with my wonderful isolate or what?

- Good chance for profitable product if diligent
- Estimate conservatively!
- Talk to commercialization expert
- Think about IP protection
- Better to make tough decision early
- Consider licensing your invention to someone experienced
- Need to start slow and build market over time
- A good distributor is worth a bigger piece of the pie

Resources used

Ravensberg 2011: A Roadmap to the Successful Development and Commercialization of Microbial Pest Control Products for Control of Arthropods. Progress in Biological Control, Vol. 10 (Springer International).

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Lüth, 2009: Fungal Biopesticide Development and Modern Solid State Techniques for Biopesticide Production. BPIA Semi-Annual Meeting, Washington, DC.



Thank you!



Canada