Can You Earn $90,000/A Using IPM & Polyculture

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Goals

- Integrated Pest Management
- Marketing & Economic IPM
- Ecological Pest Mang. Principles
- Polyculture Experiment

Integrated Pest Management (IPM)

Science based system (not a romanticized view)

Goal: to reduce the Environmental, Ethical and Economic (E,E,E,) risk of managing pests (weed, disease or insect)

Naturalize pest management systems

- Evaluate new technology

IPM Methods

- Monitoring - scouting, thresholds
- Forecasting - models
- Cultural Control - resistant varieties.
- Biological Control - predators, antagonist
- Chemical Control - pesticides, pheromone

Economic IPM and Marketing

Product = Bundle of Benefits

Marketing Strategies

How to differentiate your product?

1) Price - more efficient, less cost

2) Quality - characteristic that customers want

Selling Strategies

- Not all customers are alike
  - The old days of Henry Ford when “You can have any color you want, as long as it’s black” are long gone.
- Use different strokes for different folks
- The Law of the Slight Edge

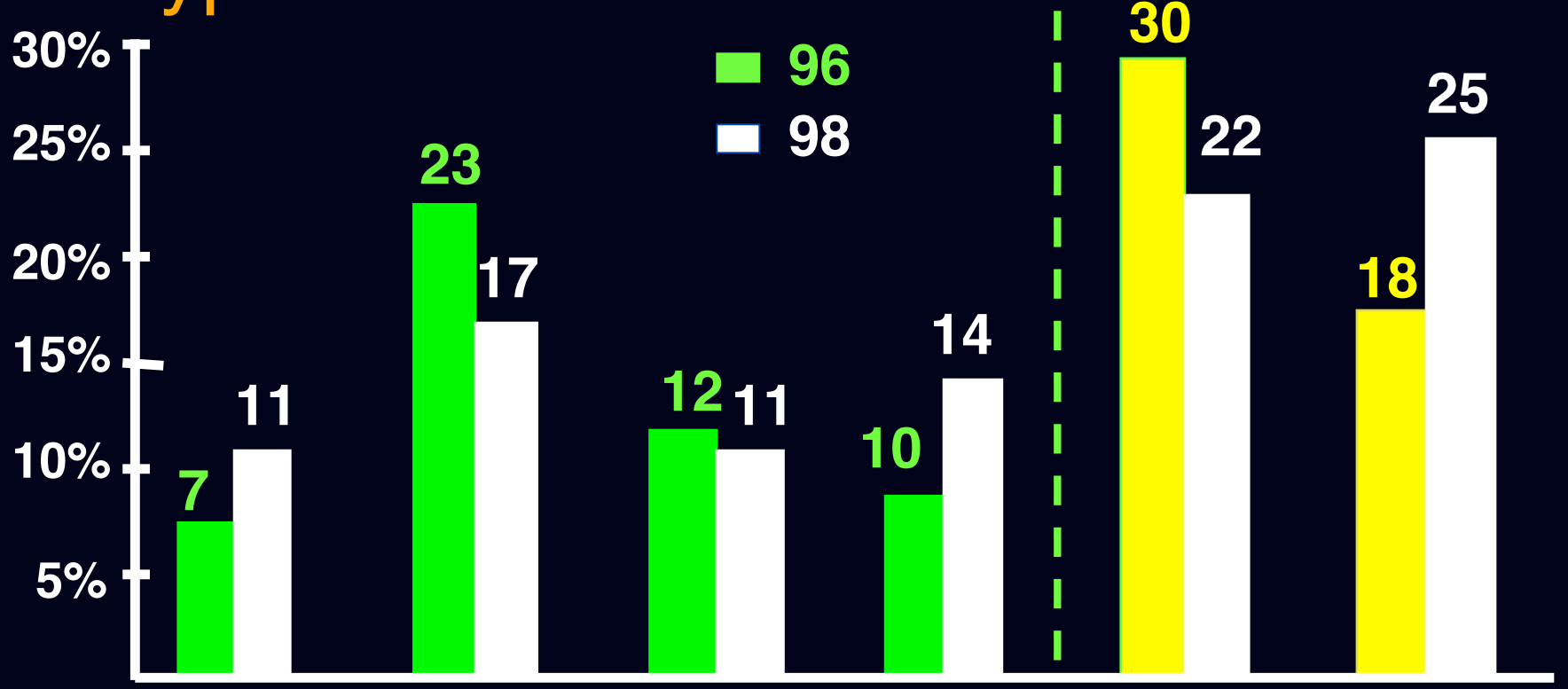
  Once established, difference between a champion and an also-ran, more often than not, is a very slim margin

Models for Differentiating Potential Consumers

- Environmental Consumer
- Lifestyle - Health Consumer (LOHAS)

- Mainstream consumer

Types of Environmental Consumers



True Natural

- Deep Env concern
- Will pay
- Female
- Low& upper income

New Green Mainstream

- Heartbeat of Am.
- Interested in Env.
- Need a "reason"
- Only when convenient

Affluent Healers

- Well Ed.
- Upscale
- Personal well being focused
- Family & goal orient

Young Recyclers

- Young
- Never married
- Reject paying a premium
- Solid waste

Overwhelmed

- Not optimistic
- Economically "just getting by"

Unconcerned

- Apathetic
- Reject that chemicals harms the environment

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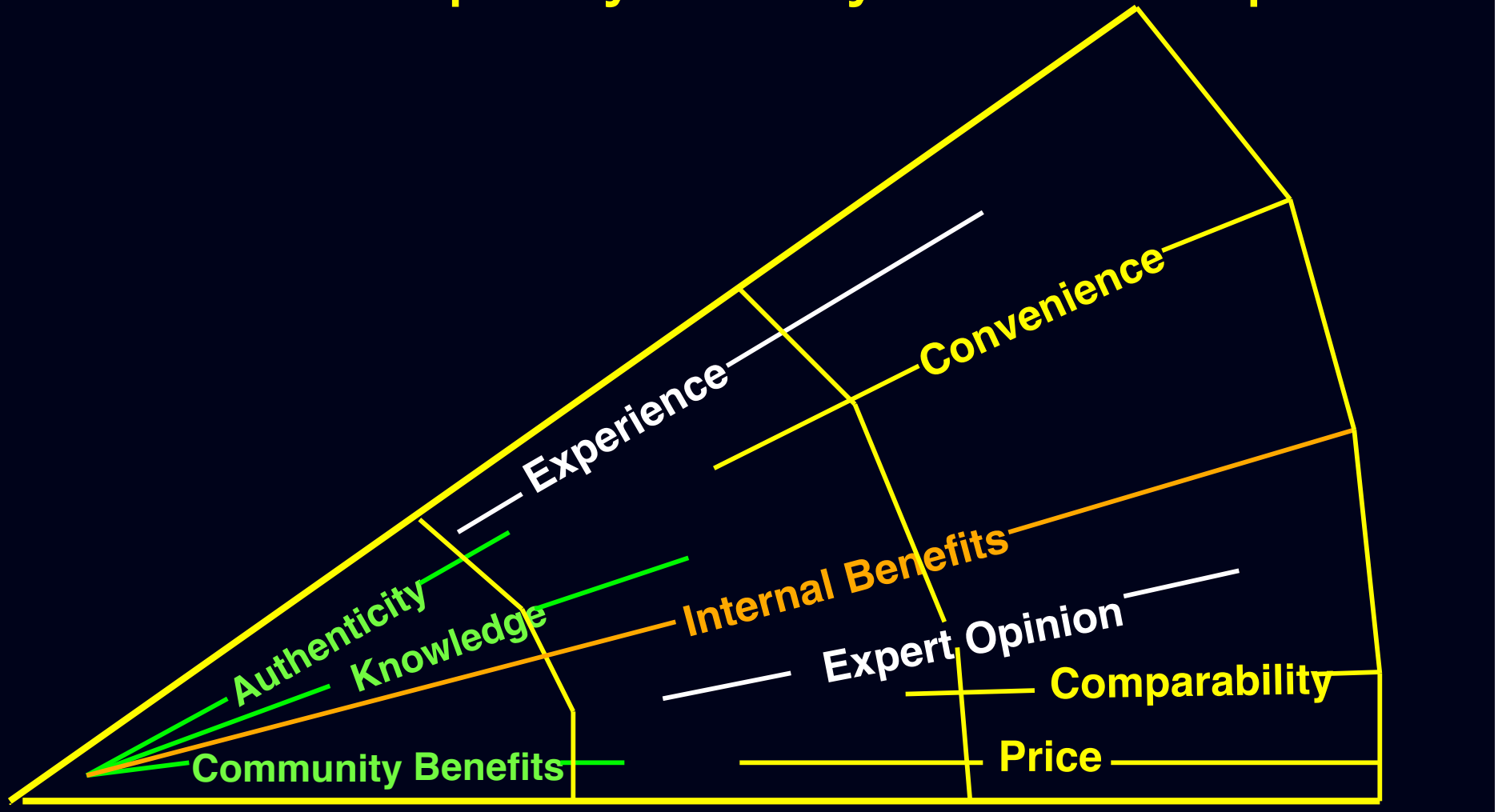
Core to Periphery Lifestyle Model Sphere



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Lifestyle and Economic Potential

- Cities are where the money is
- City dwellers are clamoring for good food
- To get top dollar target LOHAS

LOHAS- Lifestyles of Health and Sustainability

- 1/3 US pop. - 63 million adults
- Goods & Services
  - Health and Fitness
  - Environment
  - Social Justice
  - Personal development
  - Sustainable living

Mainstream Consumer

- Should we market to green consumer?
  - Marketing to green consumer has been difficult
  - Most consumers need to satisfy personal needs before planet
- Focus on green behaviors that everyone can aspire to
  - Old saying "people that buy drills don't need drills: they need holes."
- Consumers want solutions to their day-to-day problems that also make sense to our environment.
  - Create real products that tell an environmental story

Harvard Business Review

Can we design a food production system that is close to consumers and

- Simulates natural systems
  Ecomimicry
- Uses Ecologically Based Pest Management
- Economically viable ≈ $90,000/A
  = $ 10 per ft of row

Some Principles of Good Farming

- Plan your farm and goals
- Look at the whole picture (water, soil, crops, goals)
- Learn and grow through reading and meetings
- Fertility and slope of land
- A farm must be profitable

Ecologically Based Agriculture

- General Principles of Ecomimicry
  - Select and grow a diversity of crops that have natural defenses against pests
  - Choose varieties with resistance or tolerance
  - Build the soil with organic matter

Ecological Based Pest Management

Builds on strengths of natural systems

- Three concepts
  - Ecosystem Stability
  - Biodiversity
  - Biological Control

Ecological Pest Management
Ecosystem Stability

- Ecosystems with more diversity
  - Are more stable
  - Greater resistance
    - Ability to avoid or withstand disturbances
  - Greater resilience
    - Ability to recover from stress

Ecological Pest Management
Ecosystem Stability

- Reduce tillage/cultivation - fewer weeds
- Reduce mowing - less disruption, increase beneficials
- Maintain "permanent" ground covers
- Add organic matter - substrate for good MO's
- Use cover crops - inc. moisture retention
- Use crop rotation - breaks pest cycle
- Increase crop diversity - more difficult to find
- Create corridors - highways of habitat

Ecological Pest Management

- Tries to apply stress to the pests
  - Interrupt their life cycle
  - Remove alternative food sources
- Enhance beneficial population
  - Avoid agrochemicals where possible
  - At least better timing

Ecological Pest Management

- Is a preventative approach
  - Uses little "hammers"
  - Instead of one big "hammer"
- Relies on Biological Control (as much as possible)
  - Beneficial predators and parasites
  - Disease-causing organisms
  - Beneficial fungi and bacteria that inhabit roots

Ecological Pest Management
Enhancing Beneficials/Biocontrol

- Characteristics typical of fields with plenty of beneficials
  - Fields are small - a lot of edges, natural vegetation
  - Cropping systems are diverse
    - Include perennials and flowering plants
  - Crops are managed with minimal agrichemical inputs
  - Soils high in organic matter, biological activity during off season
    - Covered with mulch or vegetation

Ecological Pest Management
Biodiversity

- Spatial diversity - across a landscape, within fields
- Genetic diversity - different varieties, different crops
- Temporal diversity - different crops at different stages of growth

Ecological Pest Management Fertility

- Slow release of nutrients the best,
  - any compost is good compost (yard waste, dairy barn, vermicompost)
- Pests seem to follow the Nitrogen (plant suckers i.e. mites & aphids)
- Too much synthetic fertilizer cause nutritional imbalances

Goal - to determine optimal layout of an intensive fruit & vegetable polyculture system that mimics natural systems & can be used by the small periurban or urban farmer.

Economics

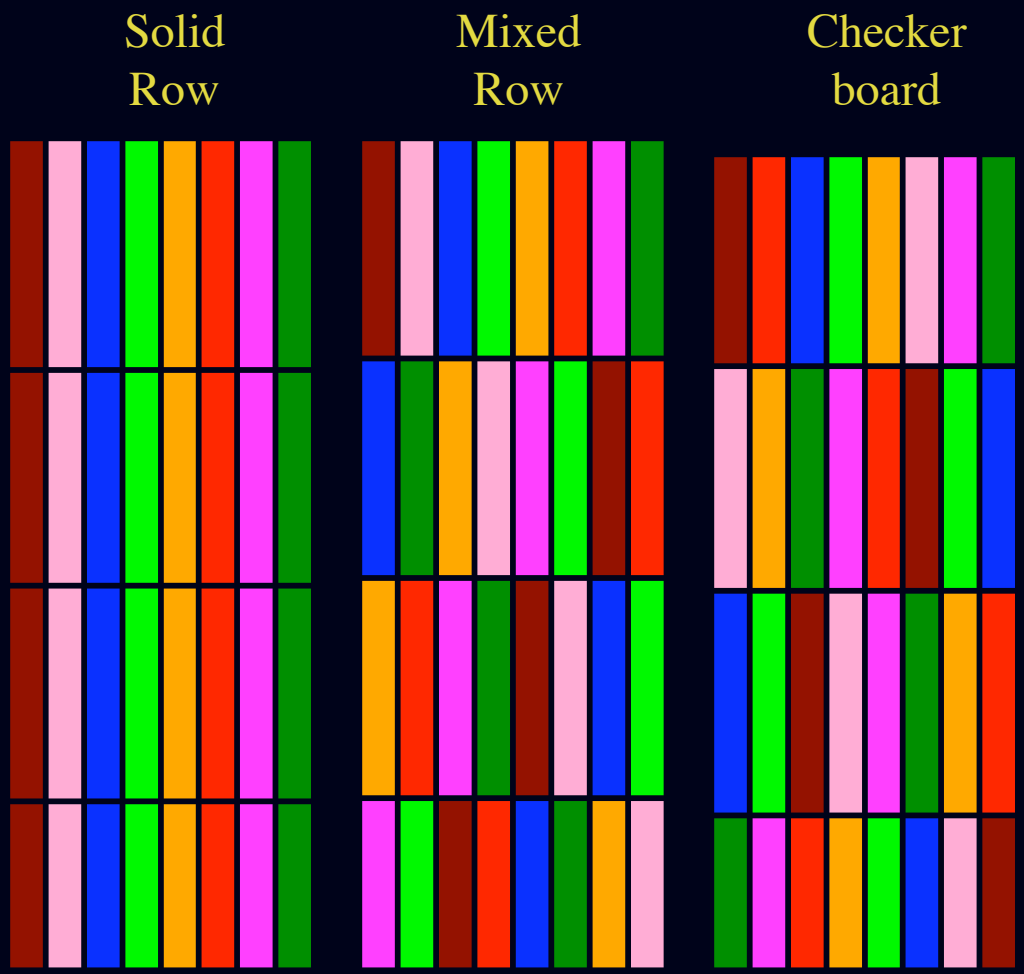
Pest density

Efficiency

Modular Ecological Design

-scale up for needs (1, 3, 8)

Commodities and Treatments



Early, Mid, Late cultivars

4 trees/shrubs

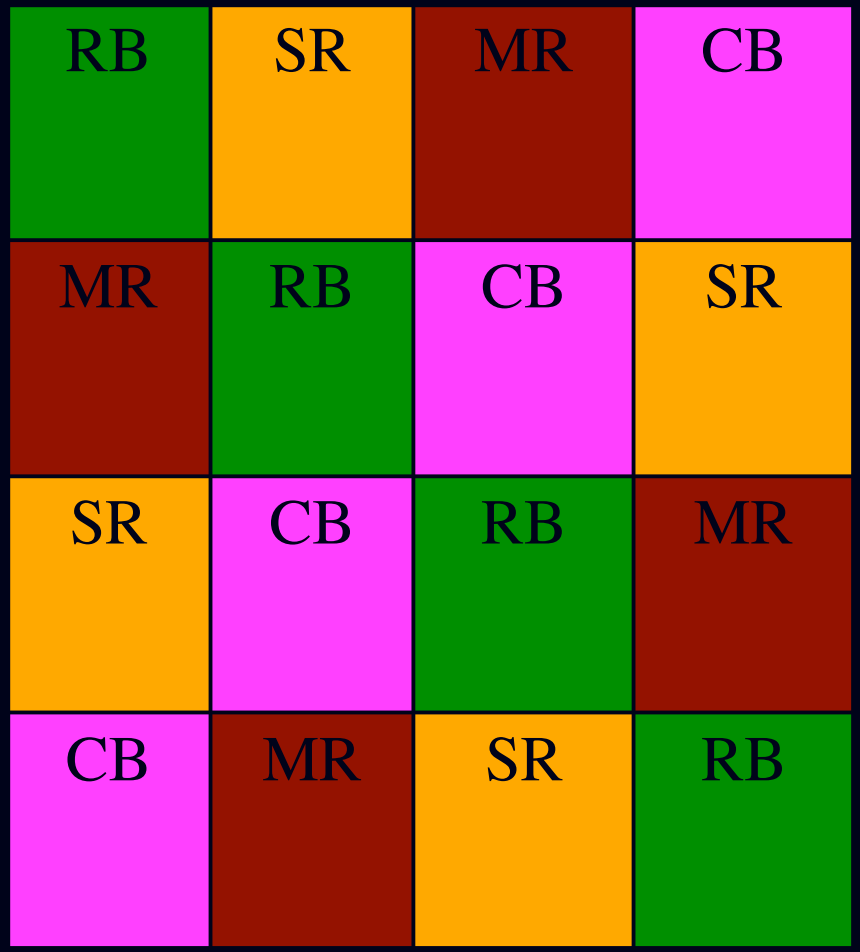
- I. Apples(SwC)
- II. Peaches
- III. Blueberries
- IV. Raspberries

4 herbaceous

- Strawberries
- Edamame soybeans
- Tomatoes
- Green beans

The fourth treatment(not shown) is a mixed row configuration on raised beds.

Layout of plots



RB = Raised Bed

SR = Solid Row

MR = Mixed Row

CB = Checker Board

Each plot - 44’ x 60’

Total Acres - 1.4 A

2006

April 2005
Land Preparation

April 2005

April 2005

Raised Beds

April 2005

($1.20/ft)

April 2005

Yard Waste Compost
May 2005

May 2005

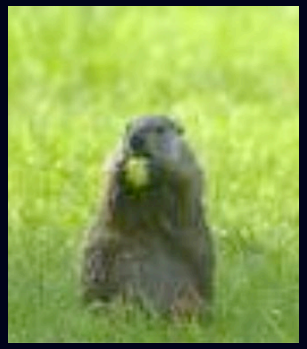
May 2005

Tree and Bush Planting

May 2005

Groundhog, Rabbit, Deer Fence

June 2005



June 2005

Raised Bed Mixed Row

2006

June 2006 - Weeding Cost

2005 Weeding Costs - $1.35/ft

Labor hrs (760 hr) = $6,080

2006 Cost - $0.37/ft

Landscape Cloth = $1,250

Labor (214 hr) = $1,612

Total = $2,862

2007

2007

HT= $9.50/ft

High Tunnel Growth Differences (cm)

Trt	All	Ap	Blue	Rasp	Peach	Soy	Stra	Apples Aph/M
No HT	172 a	232 a	118 a	142 a	271 a	74 a	41 a	19% a
HT	196 b	243 a	123 a	185 b	333 b	86 b	44 b	38% b
Inc.	14%			30%	23%	16%	7%	

High Tunnel Yield Differences (g/m)

Trt	Straw	S Rasp	F Rasp	Tom	Soy	Blue	SnP
No HT	4673a	2276a	2086a	6806a	1147 a	706a	269a
HT	3779b	1162b	3736b	8764b	1348 b	951a	387a
%	-19%	96%	79%	23%	16%	-	-

Tunnels have a shading impact and reduce wind

Strawberries are primarily wind and gravity pollinated

Problems - 2006, 2007

- Straw. - Voles, Botrytis
- Tomato - Septoria
- Apples - Potato leafhopper
- Peaches - Japanese beetles, OFM
- Raspberries- Japanese beetles

- High Tunnels - mites, aphids on apples, powdery mildew on strawberries, raspberry sawfly on raspberry

Japanese Beetle

(July-Aug)

Year	No. JB
2005	15,000
2006	60,000
2007	283,000

Trt	
High Tunnel	11,300 (4%)
No HT	271,700 (96%)

Japanese Beetle

(July-Aug) 2006, 2007

	2006		2007	
Crop	No. JB	%	JB	%
Rasp	30,146	52	109,292	39
Peach	22,789	38	11,047	4
Soy	1,851	3	108,239	38
Straw	1,652	3	20,232	7
Blue	1,486	3	32,115	11
Apple	488	1	2,801	1
Tomato	0	0	110	0

Japanese Beetle Raspberry (JB/5ft/date)

Trt	2006	2007
MR	10.4 a	35.0 b
CB	11.7 ab	29.8 c
RB	13.3 bc	43.6 a
SR	15.3 c	37.8 b

Cultivar	2006	2007
Royalty	3.1 a	15.5 a
Carol	12.0 b	36.4 b
Prelude	22.9 c	57.7 c

Royalty

Prelude

Japanese Beetle Peaches (JB/5ft/date)

Trt	2006	2007
MR	13.8 a	4.3 ab
CB	10.1 bc	3.6 b
RB	11.5 ab	2.5 c
SR	7.7 c	4.9 a

Cultivar	2006	2007
Flam. Fury	16.8 a	5.6 a
Bounty	8.1 b	3.0 b
Glow. Star	7.3 c	2.8 b

Japanese Beetle
Blueberry (JB/5ft/date)

Trt	2007
MR	10.0 a
CB	9.9 a
RB	11.1 a
SR	13.6 a

Cultivar	2007
Duke	14.7 a
Bluecrop	13.9 b
Elliot	4.9 b

Arthropod Collections 2005-06

Sweep net samples

Jun, Jul, Aug, Sep

	Total	Beneficial	Pest	Incidentals
Families	96	28	16	52
Indiv '05	25,256	16%	53%	31%
'06	16,202	21%	50%	26%

Mean individuals

Trt	2005	2006
SR	57.8 a	25.1 a
MR	55.0 a	21.3 a
CB	50.0 a	24.7 a
RB	34.4 b	19.9 a

Shannon's Diversity Index

Treatment	# Ind 05	H' 05	# Ind 06	H' 06
Checkerboard	50.0 a	1.88 ab	24.7 a	1.51 a
Mixed Row	55.0 a	1.86 ab	21.3 a	1.48 a
Raised Bed	34.4 b	1.96 a	19.9 a	1.44 a
Solid Row	57.8 a	1.80 b	25.1 a	1.44 a
(Mono) Check	-	-	10.3 b	1.20 b

Shannon's Diversity Index

Crop	Biodiv 05	Biodiv 06
Strawberry	1.69 d	2.22 a
Peach	2.24 a	1.91 b
Raspberry	1.829 c	1.59 c
Blueberry	1.64 d	1.46 c
Apple	-	1.17 d
Soybean	2.07 b	1.01 de
Potato	-	1.08 d
Tomato	1.61 d	0.84 e
Corn	2.18 ab	-
Green bean	1.89 c	-

Insect Individuals (2006)

Crop	% Pest	%Nat. E.
Strawberry	50.3	15.6
Peach	35.7	24.7
Raspberry	51.2	12.5
Blueberry	44.6	23.2
Apple	61.4	17.4
Soybean	48.3	10.5
Potato	73.8	13.6
Tomato	49.5	11.1

Harvest Evaluations 2006

Trt	Soy	S.Rasp	Straw	Tom	Pot
SR	32 a	381 a	1407 a	2338 a	486 b
CB	59 b	279 a	1310 a	2083 a	300 a
MR	47 b	289 a	1314 a	2420 a	275 a
RB	56 b	505 a	1619 a	3086 b	475 b
% inc	67	81	24	48	73

Harvest Evaluations 2007

Trt	Straw	S.Rasp	F.Ras	Tom	SnP	Soy	Blue
SR	2984	903	1512	3685	170	1021	882
CB	2707	1034	1429	5429	250	694	551
MR	2542	797	1685	4193	260	880	661
RB	3287	1403	1424	6965	512	1064	662
% inc	20	54	-	57	125	-	-

Total Hours to Harvest all Crops 2005

(green beans, tomatoes, sweet corn & soybeans)

Treatment	Hours/Meter/Person
CB	7.31a
MR	6.82a
RB	6.44a
SR	5.78a

Means followed by the same letter are not significantly different (LSD, P>0.05)

Labor Cost = $1.00/ft for $8/hr for 6 months

Economics ($10/ft goal) Best plots

Crop	Price/ft
Gr. Bean'05	1.99
Sw. Corn'05	2.25
Ed. Soy'05'06'07	3.35, 3.65
Tomato'05	11.83
Tomato'06 (cupid)'07	26.67, 25.52
Straw'06 '07	9.21, 12.65
Sum. Rasp'06 '07	8.80, 13.27
Fall. Rasp'06'07	7.46, 15.36
Blueberry '07	5.67
Snap Peas '07	0.85
Peaches'06, '07	0.00
Apples'06,'07	0.00

Retail Price Used = current price crop being sold at local supermarket

Establishment Costs

2005	
Establishment	
Soil prep	$ 176
Plants	5,015
Fencing/Irrigation	1,956
Sub total	7,147
Weed Control	
Labor - 760h (weed, mulch)	6,080
Mulch (17 truck loads)	4,250
Sub total	10,330
Raised Beds	
Materials	2,280
Total	$19,757

2006	
Seeds	$ 484
Harvest material	
(qts, pts, container)	292
Weed Control	
Landscape cloth	1,033
Staples	216
Labor -182h	1,456
Sub total	2,705
Trellis	
T-post	290
Lumber	310
Screws, wire	49
Sub total	649
Misc.	590
Total	$4,720

Total investment $24,477

per plot 1,530 (+ RB $1.20)

$/ft $3.20 (+ HT= $9.50/ft)

Conclusions to Date

- Jap. Beetles were a big problem in ‘07 especially on rasp and soybeans
- High Tunnels Crops - had the fewest JBs, best growth, nicest fruit ($ 9/ft)
- Strawberry & Peaches had the most biodiversity
- Peaches had the lowest % pests & highest % natural enemies
- Potatoes had the highest % pests

Conclusions to Date

- Raised beds ($1.2/ft) - seems to have fewer arthro. easy to harvest and the best yield on some crops
    - Staff wanted solid rows on raised beds
- Paid for capital improvements (plants, fence, irrigation, etc.) after year 2
- $ 10/ft may be obtainable when under full production, with the correct market & certainly would be easier with a higher price than in grocery stores


Questions?