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# Evaluating Economic, Health, and Environmental Impacts of IPM: Approaches and Results from IPM CRSP

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# Audiences (& purposes) for IPM Impact assessment

- Farmers (for IPM adoption decisions)
- Scientists (for priority setting)
- National and International Funding Agencies (for accountability, resource allocation, generating political support)
- Outreach organizations (for making recommendations to farmers)
- General public

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Multiple purposes implies multiple **levels** of benefit analysis, multiple **indicators**, and multiple **methods** of analysis

<u>Level</u>	<u>Benefit Indicator</u>	<u>Method of Analysis</u>
1. Experiment, Project	<ul style="list-style-type: none"><li>○ Yield change, cost reduction, profitability</li><li>○ <b>Reduction in Pesticide use per hectare</b></li></ul>	<ul style="list-style-type: none"><li>○ Budgeting</li><li>○ <b>Calculate changes in lbs. of a.i.</b></li></ul>
2. Market	<ul style="list-style-type: none"><li>○ Adoption, changes in production, prices, trade, income</li><li>○ <b>Change in pesticide risk</b></li></ul>	<ul style="list-style-type: none"><li>○ Surveys, model mkt. changes &amp; econ. surplus</li><li>○ <b>Relate a.i. changes to risk and value them</b></li></ul>
3. Human Welfare	<ul style="list-style-type: none"><li>○ Poverty reduction</li><li>○ <b>Improved rural nutrition</b></li><li>○ Reduced environmental and health problems</li></ul>	<ul style="list-style-type: none"><li>○ Change in poverty index</li><li>○ <b>Calculate share malnourished</b></li><li>○ Medical assessments, etc.</li></ul>

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# IPM CRSP Conducts Impact Evaluations at all 3 Levels



# Level 1: Economic assessment -- Budgeting

- Standardized form for data collection by scientists – Input and output quantities and prices by treatment
- Partial budgeting for each practice





# Sample of budgeting results:

<u>Commodity and country</u>	<u>Percent increase in profits with IPM</u>
Eggplant IPM (FSB) in Philippines	20
Onion IPM Philippines	25
Eggplant grafting (BW) Bangladesh	200+
Soil Amendments Bangladesh	61
Pheromone traps in gourds, Bangladesh	52
Hand-picking cabbage insects, Bangladesh	32



# Sample of budgeting results (continued)

<u>Commodity and country</u>	<u>Percent increase in profits with IPM</u>
Olives , Albania (harvest timing, vegetation management, pruning, pheromones)	14-29
Sorghum, Uganda (Striga management)	15%
Potato, Ecuador (late blight resistant potato variety)	35%

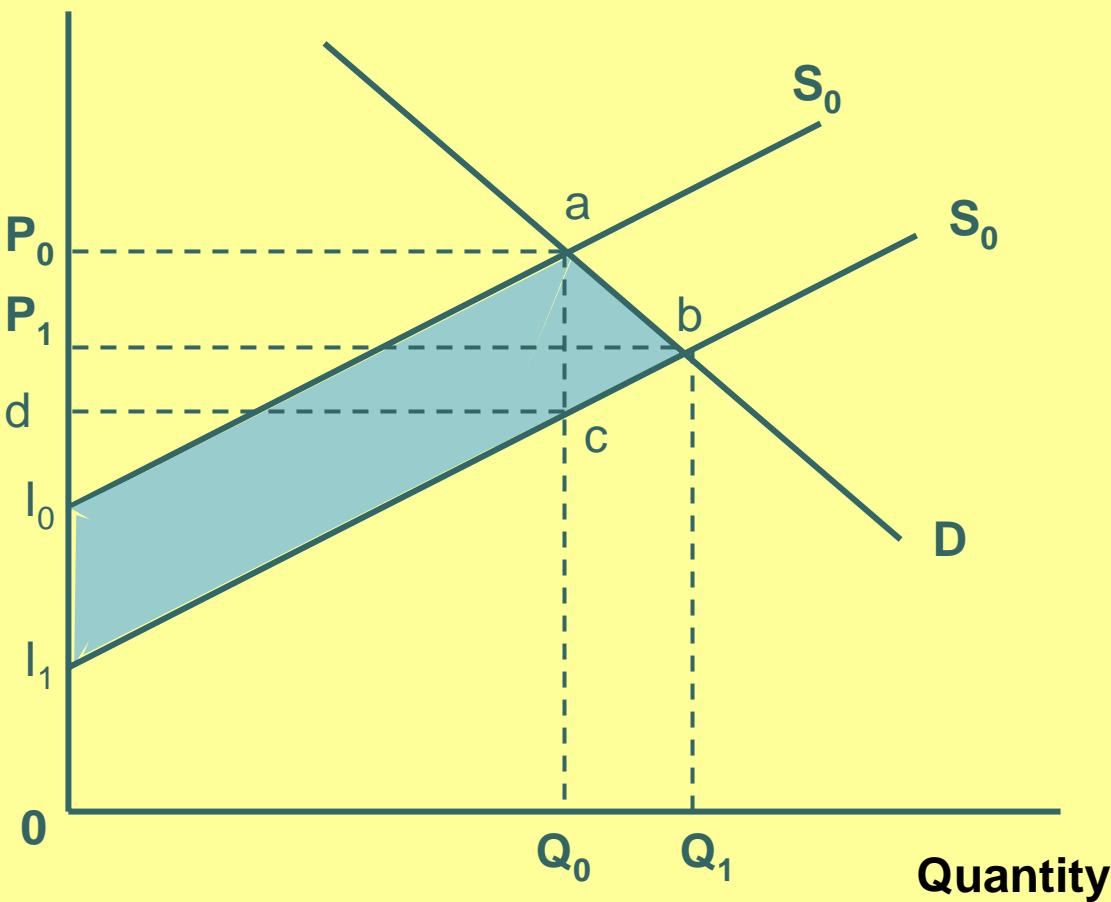


## Level 2: Aggregate Economic Assessment – “Economic Surplus Analysis”

- Considers quantity produced, price, nature of market (traded product or not), effects of IPM practice on yield and cost changes, and extent of adoption to estimate changes in “Economic Surplus” (income)



Price



# Sample of Results of Aggregate Economic Benefits

- Example: Olive IPM in Albania:  
\$53 million in total economic benefits (net present value) from 4 technologies and an internal rate of return of 56% on the research investment  
(Source: Daku, 2002)



# Example: Bangladesh

- Net present value of \$14-29 million for soil amendment work, \$15-26 million for weed research
- Most benefits spread over 2 of the 4 regions, with one losing

(Source: Debass, 2001)



# Example: Ecuador

- Rate of return on research investment in IPM for Andean Weevil: 44% in the southern mountains and 200% in the northern mountains



# Example: Philippines

- Rate of return to research for IPM practice for onion weed management was 29-45% in Bongabon
- Fruit and shoot borer control on eggplant: 30-70%

Source: Francisco, 2002



# Levels 2: Environmental impact Assessment





# Steps used for Philippine environmental evaluation for onion IPM

- Expected pesticide reductions based on on-farm trials (IPM CRSP)
  - Adopters reduce pesticides for Thrips (50%), weeds (65%), cutworms (50%), pink root disease (25%)
- Risk level assigned to each active ingredient
- Willingness to pay to reduce risk assessed through a farmer survey
- Risk and willingness-to-pay info combined

Risk scores for onion pesticides applied in the study area/affected by IPM practices (5 = high environmental risk ... 0 = no toxicity).

Active Ingred.	Human	Animal	Birds	Aquatic	Beneficial
Benomyl	4	4	3	5	5
Mancozeb	3	3	3	5	5
Fluazifop	4	4	0	5	5
Glyphosate	4	4	3	3	3
Oxyflourfen	4	4	1	5	5
Chlopyrifos + BMPC	3	3	5	5	5
Cypermethrin	3	3	5	5	5
Deltamethrin	4	4	3	4	5
Lambdacyhalothrin	3	3	3	4	5



# Willingness-to-pay for and Economic Benefits from Risk Avoidance

Category	Mean WTP (pesos per season)	WTP adjusted for % of pesticides on onions	Economic benefits (WTP adjusted by % risk avoided)
Human Health	680 (219)*	476	305
Beneficial Insects	580 (197)	406	248
Birds	577 (200)	385	231
Animals	621 (198)	434	278
Aquatic	551 (210)	404	250

Standard deviation in parentheses



# Impact on local area

- Environmental benefits of IPM program worth about \$150,000 per year to the 4600 local residents in six villages



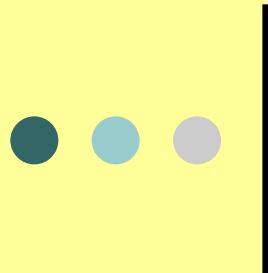
## Level 3: Nutritional and poverty impacts

- Nutritional: Calculate changes in calories consumed per day as a result of
- Poverty: Calculate changes in poverty indicators such as number people below the poverty level



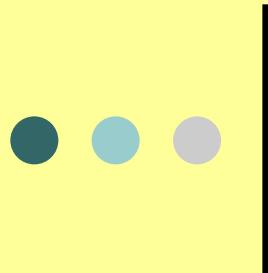
# Example of Nutritional Impact Assessment

- Grafted eggplant seedlings in two provinces in the Philippines
  - Production changes shift supply curve resulting in price reductions and adjustments in foods consumed.
  - Projected increase in calorie consumption by at least 90 calories per day. Household survey data used to estimate consumption changes by income class.



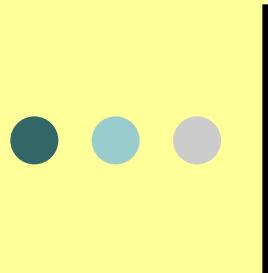
# Example of poverty impact

- Example: Peanut CRSP/IPM CRSP joint impact assessment: Rosette virus resistance
  - Data collected for economic surplus estimation of the technology benefits was combined with farm-household survey data from IFPRI to calculate reduction in poverty



# Poverty impact assessment (continued)

- Poverty indices used to measure poverty in the region before and after technology adoption
- Poverty reduced by 1.3% in the region where adoption is occurring, once adoption reaches 50%



# Institutional Impacts

- 75 students on IPM CRSP received MS and PhD training in: Agricultural Economics, Plant pathology, Entomology, Weed Science, Nematology, and related fields
- 80% of students were from host countries; all but 6 returned home
- 25 scientists or students received short term or undergraduate training, not including conferences



# Conclusion

- Multiple levels of impact assessment
- Multiple indicators of benefits
- Level 1 completed by all projects
- Levels 2 and 3 are more targeted
- Evidence of significant impacts