Environmental Benefits of IPM: Evidence at home and abroad

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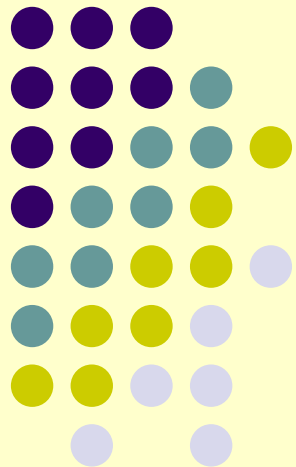
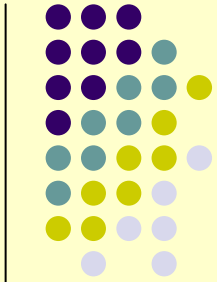


Measuring environmental benefits of IPM can be difficult

- physical or biological effects of pesticide use are hard to assess
- most environmental benefits are not priced in the market
- Environment is multi-dimensional

Several methods for assessing environmental benefits of IPM



- Pesticide reduction – changes in a.i.
- Location specific models such as GLEAMS or CINDEX – require detailed field information
- Non-location-specific indicators/models such as Environmental Impact Quotient (EIQ) – discrete ranking scale for categories of environment
- Cost of damage or illness assessment
- Productivity loss assessment
- Contingent valuation
- Experimental economics
- Environment-Economic tradeoff models

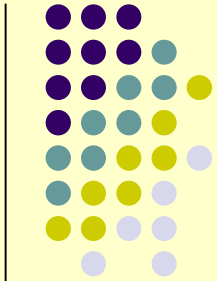
Steps in basic environmental assessment of an IPM program that attempts to monetize the benefits

- Risk assessment
  - Identify pesticide risks to the environment
  - Assess effects on pesticide use of adopting results of the IPM program
- Valuation
  - Estimate society's willingness to pay (WTP) to reduce pesticide risks
  - Calculate reduction in risk due to IPM and apply WTP estimates

Assessing risks

- Classify environment into impact categories
- Identify risks posed by the individual pesticides
- Define the degree of IPM adoption
- Assess effects of IPM adoption on pesticide use

Environmental Categories Based on Non-target Organisms



- Chronic and acute human health effects
- Other mammals
- Birds
- Aquatic species
- Beneficial insects

Identify risks posed by individual pesticides (5 = high environmental risk … 0 = no toxicity). Example for onion pesticides in the Philippines:

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

Assess effects of IPM on pesticide use

- Use_{ijs} = f(IPM adoption, acreage of the study crop, pest severity, farmer characteristics)

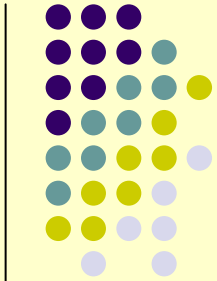
  Where: i = environmental category

  j = risk level

  s = study crop

- Compare Use_{ijs} with and without IPM

Willingness to pay to reduce pesticide risks



- Can use (**contingent valuation**) survey to obtain hypothetical estimates of value people place on reduced pesticide risks.

or

- Can use **experimental economics** (auction) to obtain the estimated values using real money to remove hypothetical nature of the questions

Example of Willingness-to-pay for and Economic Benefits from Risk Avoidance (the Philippines)

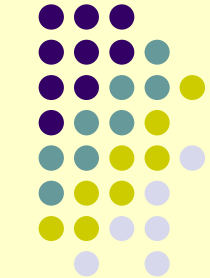
Category	Mean WTP (pesos per season)	WTP adjusted for % of pesticides on onions	Economic benefits (WTP adjusted by % risk avoided
Human Health	680 (219)*	476	305
Beneficial Insects	580 (197)	406	248
Birds	577 (200)	385	231
Animals	621 (198)	434	278
Aquatic	551 (210)	404	250

Standard deviation in parentheses

Examples of Completed environmental assessments

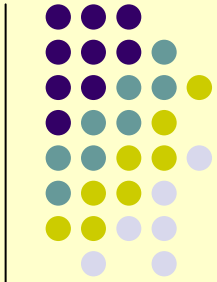
- Contingent valuation
  - Higley and Wintersteen, 1992
  - Mullen et al., 1997
  - Swinton et al., 1999
  - Cuyno et al., 2001
- Environmental indices
  - Kovach et al., 1992
  - Penrose et al., 1994
  - Benbrook, 1997

Completed environmental assessments (continued)



- Cost of damage or illness
  - Pimentel, 1978, 1980, 1991
  - Pingali et al, 19994
  - Antle and Pingali, 1994
  - Crissman et al, 1998
  - Abdalla, 1992
- Hedonic approach
  - Beach and Carlson, 1993

Sample results of environmental assessments of IPM

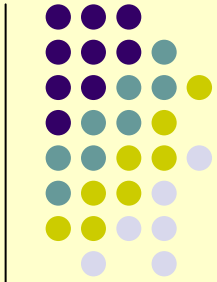


- Indicies – Environmental hazard indices calculated for each of several pesticides allowing relative risk (reducing) comparisons of IPM programs (i.e., EIQ)
- Willingness to pay (CV) studies
  - 20% willing to pay no more and about 25% willing to pay 15% or more for food products with no pesticide risk (Weaver, et al., 1992)
  - Households willing to pay $14 per year for groceries if all pesticide risk eliminated (Mullen et al., 1997)
  - Environmental value of eliminating pesticide risk in onions in the Philippines was worth $5-8 per person per season

Results (continued)

- Cost studies
  - Medical assessments and a survey of farmers exposed to pesticides found that a 10 percent increase in use of hazardous pesticides raised a health impairment index 3.7-7.5%. A 10% reduction in farmers' health results in a 3.6% increase in average cost of production. (Antle and Pingali, 1994)
- Hedonic – water quality effects and user safety are small determinates of the value farmers place on herbicides (Beach and Carlson, 1993)

Current research on environmental assessments



- Experimental techniques
  - Removes hypothetical questions
  - Smaller sample
  - Better assurance of understanding the question