D. IPM Evaluation and Impact Assessment

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The August 2001 GAO report (GAO-01-815) recommended establishing objectives for IPM programs and developing a methodology for measuring those objectives. Since that time, USDA's draft IPM Roadmap document has identified three potential outcomes of using IPM programs: 1) increased economic viability; 2) a healthier environment; and 3) improved public health. The session discussions summarized below discuss ways to measure these outcomes and are divided into: Economic Assessment; Adoption and Pesticide Use; Environmental Assessment and Health Risks. Where possible, we link directly to the speakers' power point presentations and papers. These notes were taken by Ann Sorensen and are not meant to be verbatim. We apologize for any inadvertent omissions or errors in meaning or attribution.

DAY 1: APRIL 9, 2003

OVERVIEW

IPM Assessment and Risk: Framing the Issues and Vocabulary

Scott Swinton; Michigan State University

Assessment: When we talk about assessment, we're talking about 1) scoring systems to motivate adoption and 2) detached evaluation of the effects of doing IPM:

- Motivation encourages adoption, shows growers they can do it, gives them psychological boost for doing it: e.g. Hollingsworth scoring system (points for IPM practices); some programs are used for certification; it is difficult to measure how much IPM you get or what the outcomes are
- Program assessment: Document progress towards specific goals; ensures public funds are well spent

Risk: Risk can refer to danger (point estimate, e.g. 2 percent risk) or the probability of undesired outcomes (refers to probability distribution curve)

Audience discussion:
The perception of growers is that IPM increases the spread of risk probability distribution but our data shows IPM decreases the variability of profits.

We have a four-year data set in MN cabbage that shows the farmers' IPM strategy clearly narrows distribution of profits similar to Scott's graph.

We aren't documenting failures and this could be creating a bias in the literature. If so, indices based on literature are not credible. Also, IPM is more information intense and

maybe more subjective than conventional pest control methods so the probability of making errors is higher.

Defining and Measuring Reduction of IPM Adoption Risk
Tom Green, IPM Institute of North America, Inc.

Risk is a key barrier to adoption of IPM, including sampling errors, weather risks, and just the perception of risk. Insurance for consultants and federal crop insurance don't adequately address all risks. Many consultants don't carry insurance and the federal crop insurance has very high deductibles, 15 percent or more. Risk becomes a barrier to adoption, farmers are reluctant to use crop advisors and too many inputs are used "just in case."

Audience Discussion
Is anyone working outside the agricultural sector to address risks?
I'm not aware of any efforts.

What about the probability of pesticides not working effectively e.g. when it's too wet, too dry, etc.?
This is a problem. Some pesticide companies offer unwritten, informal risk programs to cover unexpected events. No one will cover the use of reduced rates of pesticides, even when recommended by university researchers.

What about risks of cultivation versus herbicides?
In our work, we did not look at that. However, these bigger picture risks need to be addressed.

Opening Remarks
Harold Coble, USDA

We need to promote the adoption of IPM programs and measure the adoption rates. But the General Accounting Office (GAO) review put measurement in a different light for us. We also need to determine the outcomes of IPM adoption and measure those outcomes. If we don't do this, IPM might not be around in five to seven years. We have to do a credible job of measuring levels of IPM adoption (define it by tactics and measure adoption of tactics on a regional basis) and then determine what outcomes we anticipate or desire and measure those. This is where the roadmap comes in. We need to measure risk reduction and document it. What do we use to measure health effects, environmental effects and economic effects to generate the real numbers we need?

Audience Discussion:
Pesticide use statistics (in Oregon) show reduction early on but general pesticide use tracks outbreaks of pests and diseases. A measure of an IPM system might well be a reduction in pesticide use but it needs to track outbreaks. We will probably have spikes rather than a general decline and we need to train people to expect this. Reduction is just too crude. We need a better tracking of chemical use that links it to pests.

Nothing in the roadmap refers to reduction in pesticide use because our review showed that we actually increased pesticide use by four percent but reduced risky pesticides by 14 percent. That was just too hard to explain.

Is the pesticide use data being collected sound?
The National Agricultural Statistics Service (NASS) data is fairly good but there are certain crops where we don't have enough samples to do a good enough job.

How much progress has the U.S. made in terms of designing and implementing environmental farm plans that incorporate Best Management Practices, IPM, nutrient management, etc. (whole farms plans)?
I don't know.

With whole farm plans, how are we assessing the effects of IPM embedded in the plans? And are we measuring public good benefits as well as individual benefits?
This is a very important point that is currently under discussion.

There are disagreements across the three major pesticide use databases available to us: the NASS data, Giannessi's pesticide use data and the California pesticide use database. In addition, we don't know the total pesticide use on given fields. To do credible assessments on risks and economics, we need data at field level that we can easily access. As IPM shifts to a biointensive, diverse tactic system, we need to know the costs of these tactics. NASS should track this and we should give them a list of standard IPM practices so they can collect data on costs.

The Pesticide Action Network has done a survey of state pesticide use reporting system and comparisons. That study is now available from PAN.
We need to note that field data is going to be difficult to obtain. Privacy needs to be protected.

California does have pesticide use data on a field level.
We're trying to measure the appropriate use of pesticides.

There is poor delineation of non-agricultural uses of pesticides. We need to develop datasets for non-agricultural sectors. How would NASS respond?
NASS has been approached about collecting chemical use data outside of agriculture (households, schools, golf courses). They may be able to study pieces of it.

Again, we need to emphasize non-agricultural IPM and its ability to address risks, particularly public health risks. Can we ask USDA to require record keeping in urban sector e.g. golf courses, nurseries, schools, etc.? Some of these sectors would be willing to fill out forms. You might be able to use sales data
Sales data tends to be unreliable.

SESSION I: ECONOMIC RISK

Scott Swinton, Michigan State University
Economics is more than profitability for an individual. It offers a variety of tools for looking at non-market values, public goods, environmental and health effects. Adoption is not a final outcome. The outcome is what results from changing practices.

User-level profitability can be determined in several ways:

- Partial budget or partial enterprise budgets: Changes in costs and benefits of changing from one practice to another
- Capital budget: Does investment in IPM over time generate benefits that cover costs?
- Risk analysis: Changes in probability distributions

We can add risk and environmental benefits to a profit analysis e.g. assign cash values and factor into money measures or use non-money measures and evaluate the trade-offs (multi-criteria analysis). Examples include ground cover in tart cherry orchards and nitrate leaching tradeoffs in tart cherry groundcover systems. Here, we're not putting a money value on systems but are mapping them to determine trends.

We can also look at cost reductions versus reductions in use-adjusted environmental impacts.

There are a variety of non-market evaluation methods including contingent valuation (how people value benefits) and hedonic analyses. These are tailored to specific groups and outcomes and are very expensive. There is also an emergent literature on benefit transfer (from prior studies.)

Another challenge is how to aggregate different environment and health benefits. Sometimes, the benefits are not directly additive.

As we scale up from the individual to society, it is especially difficult to get down to the specific, concrete measures that individuals are using. If you ask "are you using tactic A, B, C and D" you will turn up every possible combination of adoption.

As we aggregate to groups of users, if lots of people adopt a particularly technology, it will translate into a reduction of market prices or increase of market prices. If growers' income changes, this will impact their ability to adopt additional techniques. If IPM increases yields, it will shift the supply curve.

The current state of the art (summarized in the IPM CAST report):

- Can do benefit-cost analyses
- Adoption trends
- Market-adjusted net benefits per adopter
- IPM public program costs
- Environment and health benefits (valuation and trade-offs)

There are many challenges ahead. We need more cost effective assessments:

- Expert opinion is cheap but can lead to error
- Surveys are costly but cooperation with NASS can cut costs
- Benefit transfer research is developing new tools
- Innovations in ecological pest management call for bioeconomic modeling. We will need to move beyond the evaluation of pesticide thresholds to habitat management for beneficials.

Deana Sexson, University of Wisconsin
We need to link economic assessments to producers. In other words, what is the economic viability to the farm, the cash flow? What does an enterprise budget look like? What are fair grower returns? In Wisconsin, our potato growers need a return of $6.10 per acre on average just to break even.

Can IPM programs be profitable to growers? Yes and No. Yes, early adoption can be very profitable. Scouting costs, on average, $15/acre but if it reduces pesticide applications by one to two sprays, you've made money. You can save about $70/acre with IPM on potatoes. But the answer is also no. Advanced biointensive IPM may cost more to growers because both materials and managerial time may cost more. Initial investments may be high but could pay benefits over time. In addition, increased productivity and quality can maintain economic returns but increased yields may drive market prices down.

Lyons and Stevenson have looked at the cost/benefits in conventional versus reduced risk materials (measured by toxicity units) in Wisconsin potato production. The bottom line for growers was that the reduced risk program cost 8.5 cents/100 lbs more. The net loss from reduced risk was $32/acre. However, reduced risk programs did quite well because increased yields offset costs.

In our EPA/AFT potato analysis, we analyzed the economic returns to high IPM adopters in the Wisconsin potato eco-label program. We worked with 15 growers and designed a tool for farmers to track their own costs and toxicity units. Toxicity units went down over time but costs trended up slightly because of higher costs of low toxicity materials. We saw no clear trends.

We are still collecting data that is going into a Wisconsin farm management information system. The database tracks pesticide use, toxicity programs, costs, etc. for WI potato and vegetable growers and is being maintained and held by the Wisconsin Potato and Vegetable Growers.

<u>Audience Discussion</u>
Most conventional systems are working well. Growers typically get interested in change when conventional systems start going wrong. Are we capturing the instability and increased risk in conventional programs that is driving conversion to IPM?
(Scott) New information can drive change (e.g. toxicity effects) and so can consumer preferences (translated to buyer preference for supermarkets).

We need to look at functional ecology. We're really looking at disrupted ecosystems. We need measurements of guild structures on plants and carbon sequestration in plants and the soil. All have attributes that can trend to stability or disruption. I propose a guild structure of arthropods that represent key environmental indicators to track progress towards long-term sustainability (Mark Whalon, Michigan State University)
(Scott) I agree.

In dealing with farmers, have you recognized time and labor criteria? They can maybe redistribute some of their time-labor constraints.
(Deana) Our growers and farm managers just consider this is part of their job and will take the additional time needed for IPM adoption. It would be interesting to look at this.

I want to raise a slight cautionary note. We have a limited number of surveys that show that the impacts of pesticide use on natural habitats bordering farm fields could be greater than what is going on in those fields.
(Deana) Wisconsin is starting to go to ecosystem management and we're looking at natural areas and comparing them to production fields.

(Scott) The value of natural habitat is not currently factored in to the value of land but it could be in the future if we consider water quality and proximity to streams and water bodies.

Is resistance management factored into the Wisconsin system?
(Deana) Yes, it is factored in and growers are required to rotate materials and the environmental community has agreed to this.

The economics of IPM has to include how well the grower is doing it in time and space. You can screw up conventional programs and still get results. For bio-intensive IPM programs, everything has to been done with a lot more precision and skill. We have to find ways to introduce this skill factor since it greatly impacts the performance of IPM programs.
(Scott) Skill should also drive decision thresholds. We need to think about the way IPM practices are used and the level of success we want.

Are there methods that take into account longer-term impacts like secondary pest outbreaks?
(Deana) We're seeing secondary pest outbreaks because of changes in materials and this is impacting the IPM programs.

If you are dealing with perennial crops, longer-term impacts have to be built into the system.
((Scott) A teams of researchers can help ask these harder questions and maybe anticipate these kinds of problems.

How do you deal with competing eco-labels?

(Deana) Growers were looking for a value-added label and they were the drivers behind the Wisconsin eco-label.

Do you worry about confusion on the part of consumers?
(Deana) No. A useful analogy is toothpaste brands. There are over 100 brands yet people don't get confused.

Have you been able to identity any dollar benefits to Wisconsin potato growers? What is the return on investment?
(Deana) The public investment in our project has been huge, about $500,000, and there haven't yet been any direct benefits to growers. However, Wisconsin potato production is beginning to be known as an environmentally sound growing region and the growers are seeing this as a good public relations benefit. Jason Clay, from the World Wildlife Fund (IPM Symposium plenary session) said there was a great public investment that needed to be made if we want to achieve biointensive IPM adoption. He estimated that it would take $500,000 or more per crop and region and Wisconsin is a good example. The Wisconsin growers want to stay ahead of the curve and push the envelope.

SESSION II: ADOPTION AND PESTICIDE USE

Bill Coli, University of Massachusetts: Surveying for IPM Use
Our work on IPM started because growers wanted to know what it meant to be doing IPM. There are many reasons why should we measure IPM adoption:

- Funding sources want us to
- The results can help us understand if we need to shift emphasis of research or outreach
- The results can indicate important new directions for research or outreach
- It provides an educational opportunity
- It can provide grower recognition
- It helps us measure impacts

However, we need to keep in mind that we're measuring activity, not impact.

One method to measure adoption is to develop commodity-specific IPM definitions (see University of Massachusetts website), implement well-designed surveys to generate statistically-valid samples and develop a continuum of adoption. There are countless definitions of IPM. The challenge is how we measure whether farmers are using a whole system and the philosophy of IPM rather than collection of tactics or practices. This concern has led to the practice-based definition or measurement you see with Benbrook et al., Cornell, the IPM Institute, the IOBC standards for integrated production, the IPM guidelines from Massachusetts and NASS.

There several inherent problems with self-assessment because growers interpret terms differently and the actual adoption of specific practices is often much lower than the growers think it is. NASS survey questions may not be applicable due to their need for

standardization. They are not generating data on scouting for individual pests and their statistics may overstate adoption.

So can we use survey systems to measure adoption? The Dillman Method has generated good results. It is a cookbook to get very good response rates (up to 75 percent) and includes tidbits on statistically valid samples, social utility argument cover letters, showing appreciation for responses, keeping responses strictly confidential, keeping surveys interesting and brief, using first class postage, using a personalized address and signature and doing multiple mailings.

Our survey of 2,687 growers in Northeast with point values assigned to individual grower responses showed levels of adoption of IPM on a number of crops including apples, potatoes, sweet corn and strawberries. Our survey showed larger growers are using a larger number of traps than smaller growers and are monitoring more beneficials. Our results show that growers are trending to reduction in pesticide use. Our current IPM survey gives points for avoiding use of certain material and has new categories on pesticide selection, worker toxicity, etc.

Dennis Keeney, Institute for Agriculture and Trade Policy: The Challenges of GMO Crops

Because of the acreage and rapid adoption of genetically modified crops, we are likely to see impacts on our corn/soybean production system from glyphosate-tolerant soybeans (Roundup Ready) and corn, Bt corn for European corn borer, and Bt corn for rootworm complex. With Roundup ready soybeans, we've seen a very rapid adoption rate, up to 80 percent nationwide this year. This may be the most rapidly adopted technology in the history of agriculture. The use of Bt corn for European corn borer control is up and down, now up to about 25 percent of the corn acreage. There have been some profit problems.

We may have issues with resistance as a result of using the Roundup and Bt varieties. We could see more corn on corn cropping systems because GMO varieties make that possible. This will adversely impact the diversity of rotations. Scouting and monitoring for pests and/or beneficials may drop off. Over time, the GMO varieties may be tough on biodiversity, soil quality, soil biology and we need to ask these questions. Hypoxia in the gulf is another systems impact from the corn/soybean cropping system that may or may not be impacted by GMOs. So far, the use of Roundup Ready soybeans seems to increase the acreage under conservation tillage.

If we get development of weed resistance, we may see adverse impacts on land values.

So far, profit margins don't seem to be there with GMOs plus there is an impact from losing European markets. We are seeing GMO crops filling a demand for larger operations. These approaches are not part of bio-intensive IPM programs. Over time, other preventative strategies will need to be developed as resistance develops. The global marketplace is giving our commodity systems trouble. Reliance on GMOs may be at our economic peril.

Larry Wilhoit, California Department of Pesticide Regulation: Using Pesticide Use Data

Pesticide use data can help define risk reduction as determined by various lists of pesticides (e.g. high risk pesticides, low risk pesticides). There are multiple sources of pesticide use information including pesticide sales data (European counties, NY and CA), pesticide use surveys (Belgium, Netherlands, UK, Wisconsin) and pesticide use reporting (NY, CA).

The California Pesticide Use Report (PUR) started in 1950s with full use reporting since 1990. We keep two types of data: production agriculture and all other kinds of application by commercial applicators. Our database includes information on product used, amount used, crop treated, area treated, date of treatment, location and type of treatment.

Probably about 10 percent of actual use goes unreported in agriculture. The error rate is less than 0.5 percent. Our data compares closely to most other data sources. However, we've found that data from 1990 and 1991 have far more errors than later years.

There are different measures of pesticide use including active ingredient, total lbs used, cumulative acres treated, etc. In CA, the use of high-risk pesticides has decreased since 1998. Low risk pesticides are a low percent of acres treated but their use is increasing. There has been a large drop in use of high-risk pesticides on cotton and apples. Almonds show definite impacts from the adoption of IPM practices with a large drop-off in high-risk pesticides and concurrent increase in low risk materials. We can use PUR to track the use of different types of pesticides, pest control systems and how effective growers seem to think they are. We can also look at pesticide resistance problems. PUR data can also be used to evaluate IPM programs but it must be supplemented by other data sources. Most of the pesticides used in CA are still high risk.

<u>Audience Discussion</u>

How many farmers are making the choice to use GMOs because they have actual problems with pests versus a prophylactic decision to plant just in case they have problems?

(Dennis) It: seems like their managers are making the decisions because they want the technology (They may be experiencing pressure from absentee landowners). The technology does seem to increase yields. There are no practical scouting methods for European corn borer to target the GMO varieties. There is a recommended scouting method for corn rootworms but it may not be used to target the technology. In Kentucky, farmers are using Bt corn for later plantings. They aren't using thresholds but they are using the Bt varieties to address some risks.

Is there a lot of use of the California PUR data? How many IPM researchers a year access this data?

(Larry) There are a couple of researchers in CA that use the database but most of the use is by government agencies. Environmental and commodity groups have also used it but it hasn't been used to analyze IPM programs. The CA Dept. of Food and Agriculture has

the largest database on pesticide residues in the U.S. You have county-level use and residue data available. Some people are using the data to study health effects.

(Bill) In MA, pesticide use is only required on restricted use pesticides so it hasn't been of much use to the researchers. There was an effort to tie records to zip codes but it was resoundly defeated.

Who enters the PUR data?
(Larry) The growers fill out the forms and the counties enter the data. There are a lot of inefficiencies in the system.

The Pesticide Action Network is making the CA PUR data available by commodity by year e.g. the Napa Valley wine grape growers are working with PAN to track reductions in risk and have been able to document significant reductions in wine grapes. As a result, there was a debate about sulphur use within the wine grape growers. PAN is also looking at the systems in the European Union. It took PAN two years to make the PUR data user-friendly. The full database actually has even more fields available and so you need the entire dataset to do meaningful analyses. You can ask us (PAN) for this database.

How do you make the tracking of IPM adoption attractive to hardcore researchers in the field? There are funding issues involved.
(Bill) Department heads don't seem to appreciate the need for this and it really does come down to money. If USDA really wants this done, they need to make funding available. In terms of internal program justification, the surveys have really helped because you can see a return on investment. The hard part is putting a dollar value to the level of IPM adoption. Right now, those who are doing it are just interested in doing it. At least one of the regional IPM Centers is considering making some limited grant funds available for surveys.

Do the people who respond to IPM surveys skew your results because the people who are adopting these practices are those who are more likely to respond?
(Bill) You can make your survey less transparent and put questions in to see if their answers are consistent. It is still a valid concern but there are ways to check to see if their answers make sense and seem to track.

The Society of Environmental Toxicology and Chemistry attracts the researchers who collect pesticide use data and carry out toxicology/risk/exposure studies. We need to make the IPM community aware of this progress and information.

EPA has the Pesticide Environmental Stewardship Program; USDA has its competitive grants program. Each program should require the principle investigator to explain how he or she will provide baseline information on risk, how practices will change as a result of their work and what the impacts will be on this baseline. The Request for Proposals need to be much more explicit about what they want to see. CA will probably do this.

The biopesticide community is trying to increase use. Should we really be focusing on pesticide use?
(Larry) No. We're trying to focus on risks, not use and on economics.

So what do we do about the cheap generic pesticides that are now entering the market and make conventional pest control even less expensive (mentioned by Scott Hutchins, Dow AgroSciences, in the plenary session)?
(Larry) That's a problem.

It is important to focus on economics but we still need to factor in the social and environmental components. You can show growers that they will make a profit with a particular tactic and they still don't adopt the method. Economics is not enough. We need to focus on the integration of all of the components.

SESSION III: ENVIRONMENTAL ASSESSMENT
Chuck Benbrook, Benbrook Consulting: Tracking Pesticide Use Trends and Tradeoffs
The paper and power point slides from this presentation can be found at:
www.wisc-fla-ramp.info

We can now develop crop/state/region-specific indicators. The indicators aren't perfect but they are accurate enough to show the difference between the high risk and low risk systems.

Changes in chemistry have changed risks and adverse risk outcomes have shifted from human health concerns to more localized ecological impacts. We must take context or where and how the pesticide is used into account (amount times risk) but context will determine actual risk if you can minimize exposure through application and timing.

We need to refine individual risk-specific indicators and customize our indicators to include appropriate target species. We have to look at formulations, application methods, timing and application rates. Problem areas include beneficials, a huge challenge because they tend to be region specific and crop specific.

Our system uses Access software to enter data so we can customize our model. Our ecological risk index includes fish, avian and invertebrate factors and we have just added a surface water adjustment factor based on our work in Florida. When we don't have data, we try to replicate the Mineau data (avian toxicity). It is rare to have a complete data set. All of our data sources are documented and 90 percent are from technical sources. We recognized the need for maintaining as consistent a data set as possible. Our system takes into account acute worker exposure factor based on dermal LD50s. We also incorporate dietary risk indicators into the database. We can track trends in toxicological units on crops, for regions, and for growers within projects, provided you have an accurate field by field pesticide database.

Joe Kovach, Ohio State University: Putting an Environmental Price to Pesticide Use ("a trial balloon")

Our first attempt at creating an environmental indicator model was the Environmental Impact Quotient. We looked at over 200 pesticides and 13 different criteria, clumped into groups with a 1-3-5 rating system. For environmental impacts, we created a farm worker component (applicator effects and picker effects) combined with effects on fish and birds. We then generated an EIQ field use rating to pick the least toxic pesticide and compared the results crop to crop, state to state.

If we're using more biological control and more cultural control, we should be using fewer pesticides in lower amounts. If this is the case, changes in IPM adoption behavior should be directly linked to changes in pesticide use. Can we come up with a single number? The following calculations attempt to do this.

Price equals raw materials, capital, production, transportation, profit. If we can incorporate environmental impacts, we might be able to generate a single number. How do we calculate the total environmental costs of pesticides? We need some sort of environmental risk rating system and we need to know the total amount of pesticide used. Based on estimates from Pimentel and Giannessi, I've calculated that a pound of a pesticide's active ingredient is worth about $11 in environmental costs. However, each pesticide should have a different cost. To figure out these different environmental costs, I used the costs estimated by Pimentel. I determined the relative environmental impact of each chemical for each category. Because the EIQ was criticized for not having a wide enough range, I modified the EIQ from a 1-3-5 ranking to a 1-10-100 spread. I then calculated the average field costs. For example, the environmental cost of atrazine comes out to be $10.72 (impacts on groundwater, aquatic organisms, bird, bees, beneficials, applicators and consumers)

When you calculate the environmental cost of growing soybeans, it comes out to be about $4/acre. In Ohio, soybeans cost $15.9 million, corn $70 million, strawberries $0.2 million, apples $265/acre, the highest per acre cost.

Once we determine the potential environmental costs of pesticides, we can use pesticide taxes or use positive incentives like pesticide credits or marketing bonuses to change behavior. For example, in Denmark, their "polluter pays" philosophy is changing behavior. Using this logic, and given its environmental costs, atrazine should be increased in price to address environmental impacts to $51.

Another possibility, once we determine potential environmental costs, is for farmers to trade pesticide use credits with one another. For example, apple grower #1's use of pesticides costs $414/acre, grower #2 costs $171/acre and grower #3 costs $29/acre. Maybe grower # 3 could trade $50 with grower #2 and grower #1.

Can we develop a program of planting trees to defer environmental costs? For example, in soybeans, the environmental costs of pesticide use average $4/acre and trees return

$44/tree to the environment so maybe soybean growers have to plant one tenth of a tree per acre to compensate for their use of pesticides.

In summary, I think we can use the environmental cost of pesticides to discuss issues and to compare between commodities and between growing practices. It is up to society whether we use positive and negative incentives.

Robert Luttik (The Netherlands): The International Perspective
The EPPO (European and Mediterranean Plant Protection Organization) has published a lot on impacts on beneficials.

The Dutch environmental indicators use sales data, aquatic indicators, terrestrial indicators and groundwater indicators in fairly simple formulas. We only have indicators for acute toxic effects. Birds tend to be more sensitive to pesticides than mammals.

We've learned that policymakers just want one value. We need data on dosage and drift of pesticides and we do have sales data available, adjusted with other data. The sales of pesticides have decreased by 50 percent in The Netherlands. Aquatic risk indicators indicate a similar reduction over time and so do terrestrial indicators (although more variability can be seen). Most of the compounds we now use do not contribute to risk to birds. Parathion is the most risky pesticide, making up 25 percent of the risk. Validation of indicators is problematic but we've tried to validate the aquatic indicators. We did find some rough correlation.

The OECD started a project on risk indicators in 1997. They have reported on aquatic indicators. They want scientifically robust and easy to use indicators. They need to link hazard and exposure data with use data. They are currently studying the Dutch indicator, Norwegian index, Danish index of load and Danish frequency of application. The Dutch, Danish and Norwegian indicators are showing the same trend but there are small differences. This is because the indicators are not measuring the same thing. The Dutch indicator is a single indicator but looks at individual fields. The Norwegian indicator is the sum of several indicators. If the calculated value is higher, the risk is lower. They also assign weights (e.g. earthworms more important than bees). The Danish indicator is also a single indicator and is based on sales data and the toxicity to the species of concern for the whole country.

In the future, the Netherlands is going to GIS based indicators, dividing the country into 136,000 cells of 500 x 500 meters squared. We can now look at "hot spots" of pesticide use and risk in the Netherlands. We're still trying to address chronic risks.

Joe Bagdon, USDA NRCS: Reducing the Environmental Risks of Pest Management
Pest management can impact soil, water and air quality and have direct and indirect impacts on plants, animals and humans. The USDA Natural Resources Conservation Service is charged with protecting natural resources. We assume that biological control is low risk and that there are some risks associated with cultural controls (for example, tillage may challenge the soil resource by leading to soil erosion and reductions in soil

quality). We are trying to get into air quality risks. We focus a lot on water quality. We see tremendous variation in water quality from year to year and watershed to watershed, depending on run-off and weather. Because of the variability, we monitor thresholds of health advisory levels for pesticides and nutrients and look at practices over the long term.

For additional information on trend analysis, the national NRCS website has environmental indicators of pesticide leaching and runoff from farm fields. Between 1960 to1997, our programs have had some success but if you look at the risk to fish, it is still substantial and the risk to algae and crustaceans is still quite high. National maps show that the highest potential risk to drinking water is still in the Midwest but they also show a lot of progress. We have mapped changes in runoff risk to drinking water over time. We still need to factor in the highest risk reduction potential for producers.

NRCS is implementing new policies to focus on environmentally sensitive pest management for site-specific conservation planning. Our mitigation techniques include IPM and we are integrating IPM into the rest of the farmer's conservation plan. In other words, IPM is a component of conservation planning. The Pest Management Standard (595) applies wherever pests will be managed and requires IPM where it is available. These standards include environmental risk analysis and the identification of appropriate mitigation techniques. In addition, Resource Management Strategy (RMS) plans must address all pest management related resource concerns. At least two farm bill conservation programs, the Environmental Quality Incentives Program (EQIP) and the new Conservation Security program (CSP), can be used to help producers adopt IPM.

The NRCS Windows Pesticide Screening Tool is used to measure soil/pesticide loss ratings and hazard ratings and deliberately errors on side of the resource base. We use the soil rating and pesticide rating with an interaction rating and exposure adjusted toxicity rating to come up with WIN-PST hazard rating. This takes into account topography and application technique and gives ratings for leaching, movement and toxicity. We also consider distance to water body, characteristics of watershed, flushing rate, buffers around water body, etc.

In the future, we will need to come up with package of mitigation techniques, practices to reduce impacts on water quality and other natural resources. We can tailor practices to fit the site-specific risks that are identified. Currently, there is tremendous variability in how RMS plans are being applied in the field.

Thomas Greitens, Esther Day, American Farmland Trust: Pesticide Environmental Risk Indicators

We have analyzed a number of environmental indicator models using actual field data from Florida and Wisconsin.

The environmental indicators models calculate risk scores based on active ingredient in pesticides. Most of the models track reductions in potential risk consistently over time. The ranking systems are easier to use because they are less data-intensive. The pesticide

environmental concentration (PEC) models are more data-intensive but may be giving us a fuller picture. All of the models calculate risk for aquatic organisms but some exclude soil organisms. The PEC models look at groundwater concentration. Most of the models can be used at farm level

We have several research concerns with all of the models including the absence of data, adaptability of models, and the use of nontransferable standards (e.g. European drinking water standards are used in European models and are different than U.S. drinking water standards). The model that appears to be the most robust and useful is the German model, SYNOPS. This model calculates predicted environmental concentrations in the environment over time It lends itself to larger scale evaluations.

Audience Discussion

Prediction models need to be validated. Is paraquat really a leacher as shown by SYNOPS with the Florida farm use data?

(Esther) Paraquat numbers are very low so "leaching" doesn't mean very much.

(Robert) To validate ranking methods, you need some sort of pesticide concentration prediction. You also need large farm system studies. We have 16-20 studies overseas that track reduction over at least five years. You need five- year data studies here in the U.S. The danger of just numbers is that we chose the model we like. We need to connect these models to reality. Farming systems research is critical.

(Chuck) What we can begin to do now in rankings is figure out thresholds where impacts are negligible or probable. We need to establish these thresholds and use field work to test them (e.g. 500 toxicity units will impact bees).

This brings up the usability factor. Are we developing systems that growers care about or that scientists care about? Chuck's system makes sense to growers and is simple enough to use.

(Joe) My system is dollars and cents and farmers can understand that.

(Chuck) We're trying to identify the high-risk pesticides and low risk pesticides for farmers. This allows us to target those pesticides that need to be removed from the system. This is not meant as a regulatory system with those types of scientific standards.

If you are identifying the "mega-nasties," how does that differ from getting rid of the organophosphates, carbamates and endocrine disrupters?

(Chuck) Not all mega-nasties are created equal. There are three orders of toxicity represented by carbamates. If it has four zeros in the reference dose, get rid of it.

So does your program have policy implications?

(Chuck) Yes.

IPM deals with ecology but these indicators don't always equate to ecological processes. Scale is really important. Less toxic pesticides can be ecologically damaging on a larger scale. It isn't just about toxicity.
(Joe). Basically, just planting the field screws ecology up more than the pesticides we apply. The fewer acres and pesticides we use to crop crops, the better off we are.

So that argument is we can use plutonium on fields? We should combine minimizing the areas with less toxic materials.

With the Benbrook system and adjustment factors, are you taking into account adjustments for all factors?
(Chuck) Yes, we're trying to take into account exposure levels. There can be a theoretical risk but if there is no exposure, there is no risk. We will probably miss some risks in Florida but the ones we identify will be big because exposure is there. We deliberately overestimate risks in Florida.

How is Joe calculating pesticide price? You did something with Pimentel's big number. Are you looking for validity based on human economic behavior.
(Joe) I used an overall dollar figure plus all pesticides used plus field use EIQ values and then calculated a number for each pesticide. My method tries to assign an environmental cost to pesticides.

(Chuck) There has been a recent attempt in Great Britain to determine environmental costs. They concluded that environmental costs represent about 50 percent of growers' costs.

(Directed to Chuck) What should this symposium recommend back to the department (USDA) as being feasible?
(Chuck) Instead of trying to comprehensively measure every component of an IPM system, we need to focus in on the pests that are the "risk drivers" for the pest management systems and the pesticides used to control them. We need to start thinking about general criteria and processes to identify all risks (e.g. corn soybean pest management systems may be driven by the need to control corn rootworm and European corn borer)

(Scott) I just attended a meeting about performance based incentives for environmental policy convened by Winrock International. There are so many different dimensions you can measure that the workable solution is to identify the key drivers and measure those and don't worry about the rest.

How much work would it take to flesh this out – by crop and region?
(Chuck) We need to think about risk driver pests and then identify sentinel practices, comparing bio-intensive farms to conventional farms. What makes it possible for these guys to survive – maybe six sentinel practices that you track annually.

One problem is that this is a moving target that will change year by year – sentinel practices will evolve.
(Chuck) Resistance will drive dramatic changes year by year.

(Robert) As shown by the OECD evaluation, it always boils down to what we expect from the indicators. If you use it as a policy tool, it can't be too specific. There is no silver bullet. Decide what you expect first.

An example of tracking sentinel indicators in the Central Sand area of Wisconsin is Colorado potato beetle control with imacloprid. However, we may miss landscape issues if we look at farm level because many farms avoid using controls because neighboring farmers are controlling the beetles.

George Norton, Virginia Polytechnic Institute and State University: Concluding Remarks
There are different audiences for our evaluations. We need to increase IPM adoption and account for IPM program outcomes. There are different levels to look at, including the minimum data required routinely for impact assessment and the data and methods needed for more in-depth assessments.

Steps in IPM Impact Assessment include defining IPM measures, measuring the degree of adoption and estimating farmer/use economic impacts, aggregate economic impacts and environmental and health impacts. We can undertake these steps with different levels of detail (time/credibility). In measuring health and environmental impacts, several levels of detail are possible. There is location specific data versus non-location specific data. We need to address three questions: 1) the effects of IPM adoption on pesticide use; 2) changes in health and environmental risk as pesticide use changes; and 3) weighting or valuing the various risks (e.g. EIQ) (note: a study by Higley/Wintersteen used contingent valuation to develop weighting criteria with growers).

The bottom line is we need to determine the minimum we need for growers, for GAO, etc. and proceed to collect that information.

DAY 2: APRIL 10, 2002

SESSION IV: HEATH RISKS

David Pimentel, Cornell University: Pesticides and Public Health
There are 6.2 billion people in the world and more than 3.5 billion are malnourished. The U.S. population is 285 million and projected to double again. The average American consumes 2,200 lb food /year. Worldwide, we use 6 billion pounds of pesticide annually. Despite this use, pre-harvest, we lose 40 percent of our crops to pest damage and post-harvest, another 20 percent is lost to pest damage. In other words, 52 percent of what we produce is lost to pest damage.

Pesticides have impacts on fish, birds and other organisms. It's been estimated that maybe 72 million birds killed/year in U.S. Pesticide use in India has doubled in six years and 70 percent is DDT and BHC.

Pesticide residues in U.S. food average 35 percent detectible residues, 1-3 percent above the allowable residue. This compares to a 98 percent detectible residue level on food in India, with 25 percent above the allowable residue.

The livestock population in the U.S. outweighs the human population by a factor of five.

Worldwide, 99.7 percent of our food comes from land and 0.3 percent comes from the oceans.

We have estimated that the amount of pesticide reaching target pests from all types of applications is less than 0.1 percent. USDA has estimated that it would cost $1.3 billion to monitor groundwater annually (the USGS estimates the cost at $50 billion). One hundred and ten thousand people are poisoned by pesticides in the U.S. each year and 25 die (Benbrook). There are 12,000 cases of cancer/year in U.S. due to pesticides. The estimated cost of pesticide poisonings includes a cost of $15 million for hospitals, $30 million for outpatient treatment and $2 million in lost work. Estimates on the annual costs of cancer treatment are $1 billion with fatalities estimated at $1.8 billion annually. Children are 10 times more susceptible than adults to cancer (EPA). The annual environmental impacts from pesticides in U.S. are estimated at $8.5 billion. The annual health impacts from pesticides in U.S. is $2.8 billion. This generates a conservative estimate of $11.3 billion in impacts from pesticides annually in the U.S. (Pimentel). The World Health Organization estimates 26,000,000 poisonings per year. In Sweden, they have reduced pesticide use by 68 percent and have seen a 77 percent reduction in human pesticide poisonings.

Bob Krieger, University of California at Riverside
Pesticides have been portrayed as "elixirs of death" (Rachel Carson, 1962)

There are several sources of information about pesticides that IPM practitioners can use including:

- Pesticide Use Reports (chemical specific, crop specific),
- Worker Health Data. This data is abundant but uneven. We need the change the current emphasis on illness data. There are uneven case definitions and medical evaluations. We should instead look at IPM worker wellness and track workers by zip code digit. The perfect audience to monitor are those taking pesticide applicator training or other worker training opportunities. We can then ask them we can monitor their health through surveys. Our experience is that most will agree.
- Market Basket Surveys. We should continue these but report the results as positive, not negative.

The pesticide illness rate per 100,000 in California where it is well documented is three to six, including "possibles" and "probables." Because of the availability of data, we can take a crop-oriented look at health: grapes, tomatoes, almonds, cotton, oranges, strawberries, carrots, rice sugar beets, and collect health data along with pesticide use data. We have access to lbs applied, no. of applications, and acres treated across the board in CA. The number of applications is the critical one for worker safety because it is correlated with mixing and handling accidents

By tracking chemicals, you can see variability over time and changes in patterns of use. You can look at exposure and look hard as new chemicals come into the picture. For example, in Riverside County in CA: 3,400,000 lbs of pesticides, 54,000 applications and 1,500,000 acres for the five top crops can be related back to worker wellness.

We definitely have a perception problem. Worker exposure to pesticides is much greater than consumer exposure, on the magnitude of ug/kg body weight versus ng/kg body weight yet consumer risk seems to be our focus.

Paul Ruther, Center for Health, Environment and Justice
I'd like to present some stories of parents who sent their kids to schools and the kids came home sick. These parents didn't know anything about IPM but they are now ardent activists for IPM because IPM helped their kids recover and get well.

In the late 1990s, about 30 percent of the calls to the Center for Health, Environment and Justice came from schools, either schools near superfund sites, schools with severe in-door air problems or because children were being exposed to pesticides or were chemically-sensitive. Because of these calls, we created and published *Creating Safe learning Zones: The ABCs of Healthy Schools: A Primer of the Child Proofing our Communities Campaign.*

Story One: A woman taking her two young sons to school noticed a guy in a hazardous materials suit spraying the weeds near their school. Some of the herbicide drifted onto the kids. When her son got home that night, he suffered a severe asthma attack. The mother contacted Cornell University and found out that the herbicide was very toxic. She became an activist and convinced the Los Angeles school system to go from using over 300 pesticides to using less than 30 within a year by implementing IPM. Her six year old son is now 12 and pesticides are no longer applied in his school. They use pesticidal soaps on the weekend with a 72 hour notification of parents. He has had no more incidents of asthma attacks.

Story Two: This story involves a private school student in upstate New York. She was eight years old and her parents were concerned about the mosquito control spraying being done to control West Nile virus. Despite their concerns, she ended up near an area that was sprayed and that night, they noticed she had neurological problems, dizziness, and other alarming symptoms. As a result, she missed the last three months of school and the entire next year. The parents kept looking for a reason and finally took their child to a doctor who recommended they get the information about the pesticides used in the

school. They decided to withdraw their daughter if the school continued to use pesticides. She was able to return when the school converted to IPM.

Story Three and Four: These stories took place in Howard Co., Maryland. The stories involve two girls in one family and two boys in the other family who are now chemically sensitive. The older girl developed severe exema and could not attend school. The mother did not consider exposure to pesticides for months but then approached the school about using IPM techniques. The mother worked with the Howard Co. Parent Teacher Association to get two schools to use IPM techniques (in conjunction with the adoption of IPM law in MD). The story with the two boys is similar. The older boy was exposed to pesticides over time and is now chemically sensitive (rashes, vomiting, double ear infections, etc.). He has now transferred to a school using IPM and is healthy. Because these kids are now chemically sensitive, they can't go to theatres, restaurants and sports fields where pesticides have been applied but they can go to IPM facilities.

We need to capture this information. There is one report available: *Unthinkable Risks* (Oregon) that looks at the exposure of children to pesticides and the development of chemical sensitivities.

<u>Audience Discussion</u>
Where do parents go to find out what is toxic?
(Paul) EPA has a list of toxic pesticides to avoid and so does the group, Beyond Pesticides. They produced the Poisoned Schools Report a few years ago that identified 48 pesticides.

Were any of those pesticides in schools used off-label, wrong rates, wrong areas, etc.?
(Paul) Most of the incidents have involved kids who are chemically sensitive, probably because of exposure over time.

Bob, what do you mean by "wellness?"
(Bob) By "wellness," I mean a physical exam before beginning to apply pesticides by a physician to determine state of health (baseline), blood levels or cholinesterase depending on what pesticides they may encounter during work. These will be the people on the frontlines, actually mixing and applying the pesticides. This will tell us whether or not these peak exposures actually cause problems.

Dave, a lot has happened in the last 20 years and you need to update your information. We have made the most progress in reducing pesticide dietary risk and exposure to children. There is an incredible richness of information about where the risks are in the diet. It is tougher to deal with pesticides in the drinking water because of so many routes for contamination. To determine worker exposure, we can use patches, etc. to monitor risks. How can we help the agricultural people better understand this new science?
(Dave) There are a lot of new chemicals that we don't yet fully understand nor do we understand the exposures. We particularly don't understand the phenomenon of chemical sensitivity. In Mexico, they estimate as many as 20 percent of their citizens are chemically sensitive.

(Paul) No doubt there will be more kids in the years to come that develop chemical sensitivities. In Maryland, you can get a physician to determine whether you are chemically sensitive and then you must be notified if pesticides are going to be used near your vicinity.

Is chemical sensitivity well-defined?
(Bob) Yes, there is a Physician guide or diagnostic that defined chemical sensitivity about four years ago however there is some questions about whether this has been finalized. Chemical sensitivity has been put forth as a disease in search of a diagnosis. It is kind of like diabetes – we still don't know what causes diabetes.

I also want to emphasize the following. The difference between exposure and an adverse effect is not well understood. Our no-effect level is based on no observable effect whereas we should be using a low observable effect as our standard. Exposures are aggregate (air, water, schools, food). The LOAEL for Chlorpyrifos is 10,000 ug/kg. When we tested for residues excreted in urine, we found:

Child (residential) 0.4 ug CP/kg/day excreted in urine
Parents: 0.2
Other adults: 0.03-2.1
Adults on turf: 0.1-1.0
Adults on carpets: 0.1-1
Adults and children: 0.07-3

You will not get any effects from the above exposures. The vast majority of our pesticide exposures are no effect exposures.

But isn't it this continual exposure to very low doses what matters, particularly young children?
(Bob) The cumulative exposure still won't mount up high enough to cause effects.

EPA funded childhood health centers around the country about four years ago and these centers are starting to publish new research on pesticides and kids. There is lack of agreement in the scientific community on what effects low doses are causing but we have new data on actual exposures in kids (e.g. organophosphate metabolites). The good news is the WA state Seattle team that did a large study of kids found that kids in pesticide-free homes that ate organic foods had a level of OP metabolites in blood that was eight times lower than kids eating conventional foods. I'm guessing this is mainly to just two organophosphates on just two crops, azinphos methyl in apples and dimethoate in grapes (Benbrook).
(Bob) I recently wrote a rebuttal to that report that criticizes their methods because these metabolites can show up just from eating plant materials that produce the same metabolites. Eight of the 12 crops have more breakdown product than the parent compound. Pesticides are now everywhere in the food, including organic food from the desert of Arizona. In Arizona, one the biggest exposures for paraquat is in dust.

I'm amazed with this discussion. In the Netherlands, pesticides are not used in schools.

ROUNDTABLE DISCUSSION: facilitated by Harold Coble and Eldon Ortman
Harold and Eldon presented the participants with a hypothetical situation and asked them to vote: You have $100,000 grant and some of it can be used to measure risks. How would you use those limited dollars? (rank of 1 being most important, 2, or 3 less important)

Number voting and (rank voted for). The most important risk measurements identified by the participants are bolded

	Economics	Public Health Risks	Environmental
Agriculture	10(**1**)	7(**1**) 2(2) 3(2)	10(**1**) 1(2) 1(3)
Natural Resource Areas	5(1) 8(2) 5(3)	3(1) 7(2) 5(3)	14(**1**) 3(2) 0(3)
Institutions	0(1) 3(2) 12(3)	12(**1**) 5(2) 0(3)	2(1) 7(2) 7(3)

Audience Discussion
(David Pimentel) Natural resource areas will depend on size and entity concerned. It will be important to know the impacts on birds.

(Chuck Benbrook) Can we work with USDA on the Request for Proposals for the RAMP, CAR, etc. programs to respond to what USDA would identify as a minimal baseline of measurements for IPM systems in all three risk categories and some language to direct them in the proposal to project the impacts of their work on all three systems and how they will do this? Maybe USDA could hold out some portion of the grant to be spent five years after the project is completed to determine its impact. You have to institutionalize some mechanism whereby a good evaluator goes back later to see what happened.

(Harold Coble) It's easy to write that in to the RFP.

(Eldon Ortman) Most of these programs last three years and then USDA has no clout. What about a separate RFA to study the impact of the projects funded six years ago?

(Jean Haley): Foundations are struggling internally as to whether they hire an evaluator or have the project hire an evaluator (for example, Pew Charitable Trusts and the Packard Foundation). Both foundations set aside some money to do these evaluations. In an RFA process, you need to let them know up front what kind of data to collect so evaluators can come back in. The evaluation questions must be up front and clarified at the beginning of the project. Otherwise it costs a whole lot of money.

(Frank Zalom) I agree with Jean. The challenge is defining the metric at the beginning of the project. It is the classic discussion of *ex post* versus *ex ante*.

(Scott Swinton) This is part of what was suggested in the roadmap. Can we identify a minimum data set to establish baseline data at the beginning of the project? Categories shouldn't completely be identified by principle investigators and should allow agencies to evaluate across projects.

(Chuck Benbrook) What is really important is for someone to evaluate the dynamics and personal relationships in the projects. Maybe we should station evaluation teams in the regional IPM centers that represent many disciplines and talents (e.g. similar to how the Kellogg Foundation has evaluated the results of their projects).

(Harry Wells) If the RFA is set up in an outcome format, it's a lot easier to evaluate.

(Scott Swinton) The personal dynamics are not as important as whether the outcomes were achieved. The focus should be on outcomes. Yesterday, Chuck recommended that our focus be on "risk drivers." I think we should begin by measuring the most important outcomes from the system rather than focus on the pests e.g. atrazine leaching into the groundwater. We'll be ignoring all of the elements in the chain if we're just focusing on toxicity.

(Jean Haley) The personal dynamics are about barriers. What allows the growers to adopt practices at a higher rate?

(Chuck Benbrook) I agree to Scott's friendly amendment. We knew we wanted to get Monitor out of Florida tomatoes and peppers and that's what we did. To do that, we focused on the risk driver pests.

(Ann Sorensen) I agree that the sociological information and information about barriers are important but let's not forget that we need to link what we learn from the evaluations back to the subsequent RFPs and RFAs. We have a huge literature on how and why farmers adopt best management practices but do we really use that information? If we link it to funding, we will.

(Tom Green) The Small Business Administration grants hold back $4,000 from your grant award that you can use to attend a workshop that talks about your successes.

(Harold Coble) We can bring in the successful recipients of CAR and RAMP grants to talk about evaluation with evaluators and planners before they start work on their projects to help them design and share databases. We can ask them to set aside 10 percent of their budget for evaluation work.

(Chuck Benbrook) Again, realistically, it takes time to document change, at least three years.

(Scott Swinton) An alternative approach is to specify minimum data categories and then designate some separate projects that purely focus on evaluation.

(Frank Zalom) What about possibility of identifying evaluators you can work with?

(Eldon Ortman) Doing evaluations project by project may not be as useful as evaluating an entire program. The grants are components of the program.

(Deana Sexton) What exactly is USDA interested in?

(Eldon Ortman) We're interested in outcomes. Example: fewer invasive species in the rangelands.

(Harry Wells) Consider life beyond CAR and RAMP grants and how we can include the Environmental Quality Incentives Program and Conservation Security Program

(Harold Coble) Any proposal that doesn't connect back to conservation programs will not be considered.

(Harry Wells) Can you co-mingle funds (CSREES and NRCS)?

(Harold Coble) We're beginning to look at this.

(Eldon Ortman) NRCS has $100 million in competitive partnership projects. CSREES is talking to NRCS about this and about including IPM.

(Scott Swinton) Talking about outcomes, one challenge in measuring is that the outcomes depend on where the project is on the continuum of basic research to technology development to implementation. What do we do about the research/technology development projects?

(Harold Coble) We have other ways to measure whether practices are being adopted over time. This challenge is more daunting for the National Research Initiative than for CAR or RAMP.

(Deana Sexson) Can an outcome be that we are developing tools to help growers?

(Chuck Benbrook) Outcome is: "we're going to reduce by 50 percent the costs of scouting for X pest".

(Harold Coble) We're most interested in that further outcome. We need 3-4, 5-7, 8-10 year outcomes from projects.

(Jean Haley) We can measure milestones along the way and key indicators that tell us we're getting there.

(Eldon Ortman) CSREES has just hired an accountability and planning person from GAO and she will have a staff of four. We are really ratcheting up.

(Chuck Benbrook) The IPM community is not terribly good at a lot of this. The percentage of funds going out will be almost all competitive in a decade.

(unidentified participant) We need much improved evaluation of all grants whether or not they are accepted. The review process needs to be improved. Without feedback, we won't be able to do a better job. What about a post reviewer that evaluates reviews and asks questions?

(Harold Coble) That's tough because there are so many programs, some small, with separate review panels and limited funds.

(unidentified participant) Maybe you can just point out areas that need to addressed and improved.

(Eldon Ortman) The review panels do get instructions about what they need to cover in their reviews.

(Harold Coble) Evaluation is the most important issue.

(Frank Zalom) I can recognize this as the wave of the future.

(Chuck Benbrook) Harold – I think your quiet and subtle burial of the 75 percent IPM goal is quite unacceptable. What we really need is a huge official funeral or wake.