Hits & Flops from a Tree Fruit Entomologist's Playlist Art Agnello, Entomology, Cornell AgriTech, Geneva

I've been spending a lot of time lately cleaning out old files and straightening up paperwork from all the research I've done since starting in this job in 1986. It's a sobering experience to confront the list of all your accomplishments during a career, as there's a natural tendency to ask just what they all amounted to, in retrospect. I've been involved in far too many projects over the past 35 years to try to assess each of them individually, but naturally some stand out in memory more clearly than others, for both good and – let's say – disappointing reasons, and, being somewhat compulsive about maintaining scorecards and grand-scheme-of-things observations, I thought it might be interesting to look at a few of these with an objective eye before I retire at the end of March. Here's a baker's dozen capsule takeaways from research projects I've been a part of, starting from those first hazy days in the orchard, along with a candid rating of how they turned out:

1986–1988 - Evaluated the effectiveness of apple maggot monitoring systems in 20 commercial orchards by testing various trap designs, volatile lures and dispensers, and different catch-action thresholds using volatile-baited sphere traps. Results were used in a grower-cooperator scouting program, and recommendations were incorporated into tree fruit pest management guidelines. Assessment: HIT - this work, which built on advances made by Ron Prokopy and Harvey Reissig, resulted in the commercialization of a trap and lure system that's now widely used, and is one of the only examples in tree fruits of a pest threshold directly based on trap captures.

1987–1989 - Implemented and evaluated a simplified sampling insect and mite management program in cooperation with 19 western NY apple growers and private consultants. The program used sequential and timed sampling procedures, plus new trap designs, to evaluate management strategies for spotted tentiform leafminer, obliquebanded leafroller, European red mite, and apple maggot. Assessment: HIT *and* FLOP - Our plan was to train growers to make these decisions themselves, in order to save time, money, and sprays. Growers were able to learn the techniques, but found it inconvenient to make them part of their regular work schedule. However, the sampling methods are still valid, and continue to be used to some degree by consultants and orchard managers, which probably makes more sense.

1988–1991 - Conducted laboratory assays on the effectiveness of high- CO_2 cold storage regimens for disinfestation of apple maggot eggs and larvae in apples destined for export. Assessment: Toss-up - The procedure was effective, but implementing it has been an ongoing effort to balance the right variety, market, destination, quarantine program, etc.

1989–1998 - Conducted field and laboratory trials on rates, timings, and programs using summer applications of highly refined horticultural mineral oil to control European red mite in apple orchards. Assessment: FLOP - We demonstrated that mites could be controlled using summer oil sprays, but most growers were unwilling to eliminate captan, which is incompatible with oil, from their summer disease control program. Also, oil retains a stigma of possibly having an adverse effect on fruit quality and yield (although I still believe this to be completely preventable, if it occurs at all).

1993–2018 (numerous studies) - Evaluated pheromone mating disruption of major moth pests as an alternative control tactic in N.Y. orchards, comparing different pheromone blends, placement of dispensers, release rates, integration with insecticide sprays, and effectiveness of disruption in different plot sizes. Assessment: HIT *and* FLOP - Depending on the species, success of MD ranged from zero (OBLR, since mated females still immigrate in from long distances), to OK (dogwood borer, depending on the site), to moderate/good (CM/OFM, with more improvements in the technology being made all the time), to great (peachtree borers).

1998–2007; 2013–2014 - Conducted a series of field trials to test arthropod and disease control sprays applied via different fixed in-canopy configurations of mini-sprinkler nozzles and supply tubing, dispensed from a central pumping point, in commercial apple orchards and greenhouse raspberry plantings. Assessment: FLOP (but wait for it...) - We showed that this approach can work in principle, but the technology to make it practical and economical isn't quite there yet.

2000–2011 - Investigated occurrence of and factors promoting infestations of dogwood borer in apple orchards, with subsequent field trials of insecticide trunk sprays, pheromone mating disruption, and physical barrier materials such as fabric trunk wraps, sprayable non-woven fibers, and rubberized paint. Assessment: HIT (mostly) - Our understanding of DWB has grown tremendously over the past 20 years, and most growers now understand the principles behind its successful control. The physical barriers were impractical, but improvements in pheromone blends and mating disruption have provided valuable tools and tactics to help manage it.

2002–2005 - Participated in a multi-state project to develop and implement apple pest management systems that reduce residues and worker exposure to broad-spectrum insecticides and to evaluate, on a regional scale, reduced-risk tactics that are economically viable and compatible with biological control. The programs incorporated new selective insecticides, pheromone mating disruption, sampling and monitoring, and assessment of natural enemies. Assessment: HIT - Conducted in response to the FQPA and the subsequent loss of many OPs and other industry-standard insecticides, this project, which featured the invaluable support of the agrichemical industry, demonstrated that successful insect control <u>is</u> possible using newer, selective chemistries, which now form the basis of most orchard spray programs.

2009–2010 - Developed a predictive apple pest management website that uses local degree day information based on historical records or user-entered biofix data to predict pest development, occurrence and damage by key insect pests. Models were validated on commercial farms by monitoring flights and weekly fruit inspections for fruit damage, and web predictions were compared with population trends observed in the field. Assessment: HIT - This project involved a number of collaborators, including Harvey Reissig and Kerik Cox, and the result is now incorporated into NEWA in the form of a series of Apple Pest and Disease Models.

2012–2017 - Conducted a series of laboratory and field trials to establish and evaluate effectiveness of persistent NY native strains of entomopathogenic nematodes for improved control of plum curculio in research and commercial apple orchards. Assessment: FLOP (mostly) - Nematodes are a novel and potentially helpful biocontrol tactic, but impractical for most orchards to rely on, since they only impact the resident PC larvae in the orchard floor and don't affect the adults that immigrate into the orchard from surrounding areas in the spring.

2015–2020 - Conducted a series of trials to document the biology and occurrence of an invasive ambrosia beetle in NY apple orchards, combined with field assessments of control treatments using preventive applications of insecticides, repellents, and host plant defense compounds. Assessment: FLOP (so far) - We've certainly learned a great deal about black stem borer in the past five years, but truly effective control measures are still not available. However, a new repellent product looks promising, once it gets registered...

2010–2020 - Participated in a pair of multi-state projects on the biology, behavior, development, and management of the invasive brown marmorated stink bug in specialty crops. Most recent efforts have focused on landscape-based infestation risk factors, implementation of biological control, management reduction of economic impact from damage, and optimized delivery of management information to stakeholders. Assessment: HIT - BMSB is not going away anytime soon, but the outlook is positive for effective biocontrol and practical trap-based insecticide treatments.

And finally,

1992-2020 - Editor and publisher of Scaffolds, a weekly newsletter on tree fruit pest management and crop development, 2002–2020, ~24 issues per year. Sent via e-mail to over 600 subscribers in 35 states/provinces and 6 countries. Assessment: HIT - technically extension rather than research, but probably the one aspect of my program that will be the most remembered. Weekly newsletters may soon become a thing of the past, but Scaffolds allowed me to keep connected with NY's remarkable tree fruit industry, and it kept me honest about what was happening out in the orchard and what we were able to do with that knowledge. I often got suggestions to update and improve this method of communicating with my extension audience, and I sincerely encourage the next person in this position to do just that.