



Slugs in Oregon

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SLUG SUMMIT



March 25, 2015
8.00 AM to 1.30 PM
Salem, OR

- 80 participants - Oregon agricultural and natural resource industries - growers, crop consultants, researchers from OSU and USDA-ARS, and ODA, NRCS, SWCD personnel
- Multi-million dollar problem affecting a wide array of seed growers, field crops, row crops, Christmas tree farms, and horticultural nurseries

Oregon crops affected:

- Grass seed - annual, perennial, various fescues, etc.
- Clovers - red, white, crimson, etc.
- Hops
- Vegetables
- Berries - strawberries
- Specialty seed - radish, turnips, etc.
- Nursery crops
- Christmas trees
- Pastures

... new seedlings of most crops

Examples of additional impacts:

- Hindrance to adoption of soil conservation practices
- Home gardens



Oregon has over three dozen exotic slug species

Examples:

- Gray field/garden slug - key pest
- Large spotted garden slug
- European black/red slug
- Black greenhouse slug
- Dusky Arion
- Brown banded Arion





Slugs in Western Oregon - the issue

- A problem over decades
- Several new pest species causing damage in recent years
- Problem a lot worse now due to phase out of burning, straw residues and improved drainage
- Problem exacerbated with adoption of no-till/minimum till for soil conservation

Slugs are present nationwide - why are they such a big problem in Oregon?

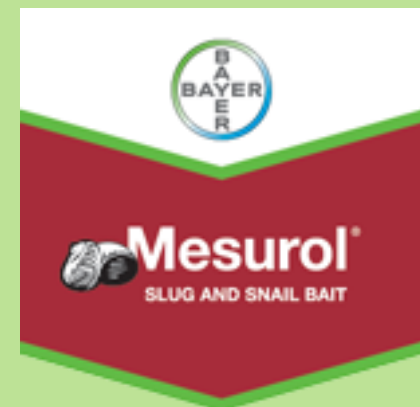


- Other regions - cold winters make slugs inactive
- Oregon - mild winters facilitate slug development
- Rain - reduces efficacy of control strategies

Slug Control: Slug Baits



- Several products - metaldehyde and iron phosphate and iron/EDTA baits
- Fields have to be baited frequently to be effective



Problems with slug baits:

The active ingredient is effective but there are challenges

Examples:

- Less attractive to juvenile stages than adults
- Slugs are not attracted from a distance so higher amounts are needed
- Slugs that survive poisoning appear to 'learn' to avoid baits
- Earthworms are attracted to the bait and take the granules to their burrows before the slugs get to them
- Bait degradation due to rain
- Half as effective when temperature are low (in 40s) compared to higher temperatures (70s)
- Bait companies recommend higher rates for effective control

Bottom line - growers encounter high costs and slugs are still not controlled adequately

Global slug control tactics:

- Cover crops - PA
- Oils - CA
- Natural enemies
 - Nematode - Europe; recently discovered in CA; not present in OR; expensive - may have potential only for high cash value crops
 - Predatory beetles - Europe; present in OR but killed with insecticides used for other pests

Slug challenges present an opportunity

OSU - A Center for Slug/Snail Research

Past slug research conducted by researchers who have retired or are working on other projects such as spotted wing drosophila or pollination due to availability of funding



Current need for Oregon crops:

- Think 'outside the box'
- Short term and long term strategies
- Secure funding for research and researchers

Research - short term

Examples:

- Compile - global literature for developing options for OR
- Assess:
 - Economic impacts across commodities
 - Impacts of soil, production practices, rotations, etc.
- Enhance bait efficacy - timing; increase attraction to slugs while decreasing attraction to earthworms
- Evaluate alternative control options:
 - Natural enemies - predatory beetles, slug pathogens
 - Trap crops
 - Essential oils
 - Pheromones

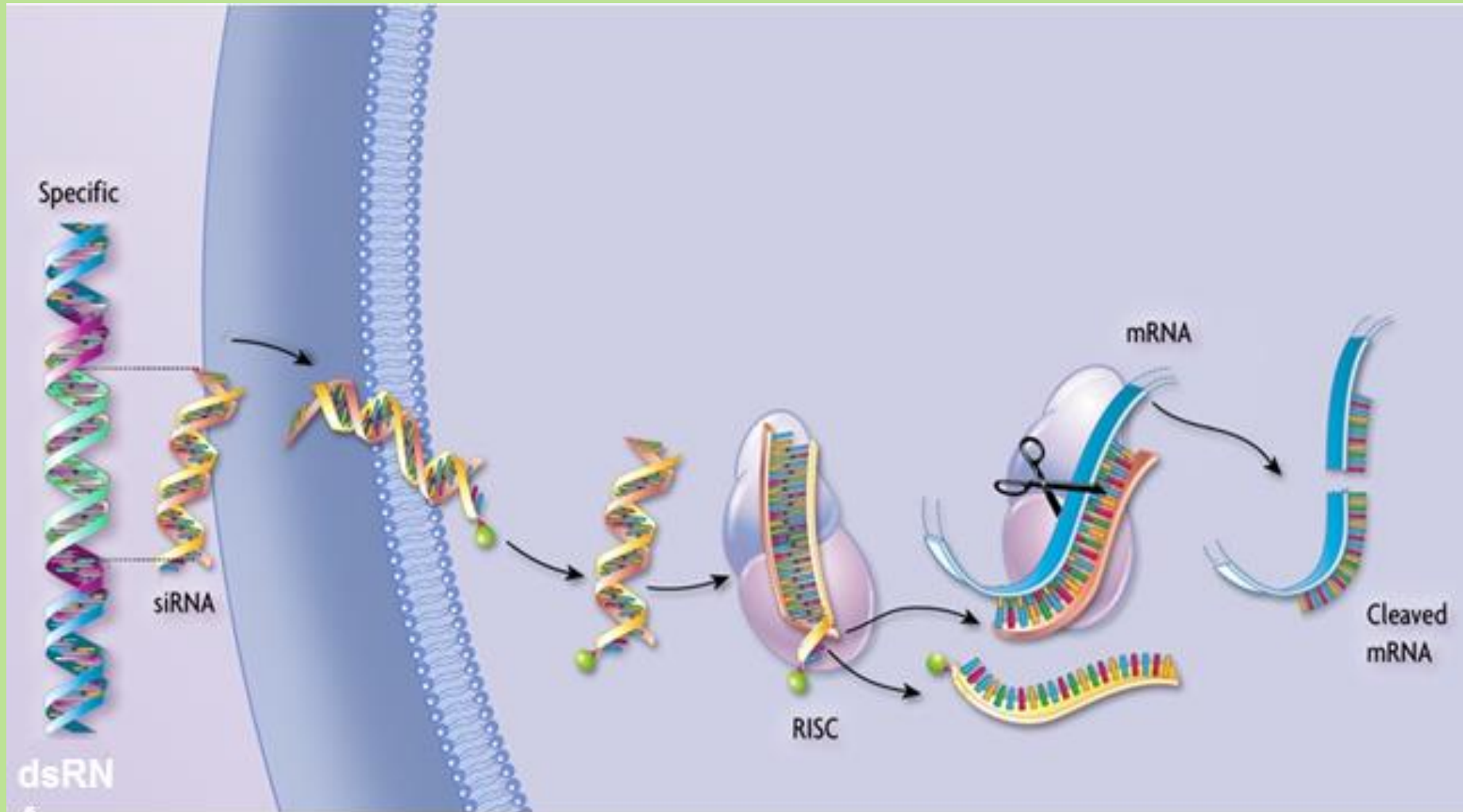
Research - long term

- Molecular - Environmentally Stable Inhibitors of Gene Expression
 - RNAi

Slugs and RNAi meeting, May 5, Tangent OR

- What is RNAi technology
- Use of RNAi pest management
- RNAi technology potential for slug management

Small Interfering RNAs (siRNA)



Commercial Interest in RNA Therapeutics

Company	Disease	Gene	Stage
Tekmira	Ebol Marburg Cancer	Ebola –VP35, L, NP MARV-NP PLK1	Phase 1 Phase 1 Phase 2
Alnylam	Hyprelipidemia Resp. Syn. Virus	PCSK9 RSV	Phase 1 Phase 1
Santaris (Roche)	Heart Failure Heart MI recovery HCV	miR-208/499 miR-15/195 miR-122	Preclinical Preclinical Phase 1
Eyetech	Macular Degeneration	VEGF	FDA approved

Advantages of the RNA Approach

- **Sequence specific by design:**
 - A sequence >14 only has one occurrence in the human genome.
 - RNAi contain 22 base sequence- only once per species
- **RNA sequence-specific**
 - Will not work on misspelled target- no off-target species activity
 - Eg. AUGGUUAGGG not AUGCUAGGG

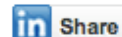
Safety, Specificity, Adaptability, and Profitability: RNAi products are coming

Global RNA Interference (RNAi) Market to Reach \$4.04 Billion by 2017, According to a New Report by Global Industry Analysts, Inc.

GIA announces the release of a comprehensive global report on RNA Interference markets. The global market for RNA Interference (RNAi) is forecast to reach \$4.04 billion by the year 2017. The market for RNAi is driven by the increasing use of this technology as a research tool in functional genomics, that finds applications in drug discovery, target validation, and drug development, in addition to agricultural and plant biotechnology sectors. The market for RNA interference in the long-term is expected to be primarily driven by the development of RNAi-based therapeutics for various diseases.

San Jose, CA (Vocus/PRWEB) April 13, 2011

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“ RNA Interference (RNAi): A Global Strategic Business Report ”

Contact

Public Relations
[Global Industry Analysts, Inc.](#)
(408) 528-9966
[Email](#)

Attachments



AGRICULTURE AND RNAi -

Preventing Bee Mortality with RNAi product, Remebee™ – Beeologics, LLC, Subsidiary of Monsanto

Bees naturally infected with Multiple Types of viruses, fungi, and mites.

Pathogens Contributes to 30-40% Honey bee losses each year!



Nitzan Paldi



Beeologics

Some of the Problems in Chemical Insect pest management:

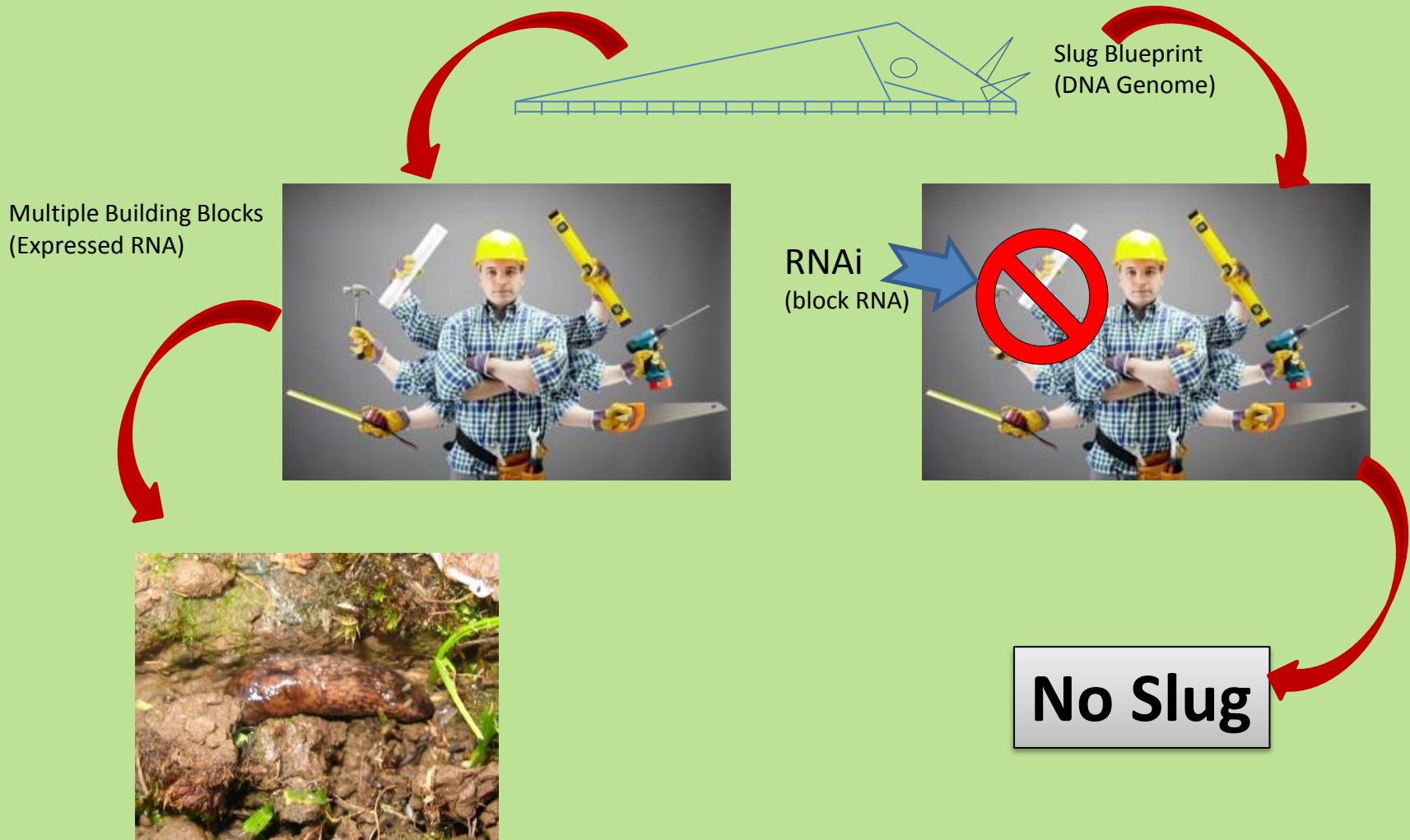
- *Insecticides are broad spectrum, kill many insect species, including beneficials.
- *Development of insecticide resistance, within 2-4 years of heavy use.
- *Emergence of secondary insect pests, due to loss of parasitoids and predators.

What would be a better pest management strategy?

- 1) Something that is **more specific** to the target
- 2) **not generate resistance** development
- 3) **not affect beneficials**, protects Pollinators- like honey bees, Predators, and Parasitoids.



RNA Approach



Alternate Approach



Genome Sequence: UCSB [Mascot]
\$20,000 Crowd Funding Project
Genome structure/gene sequences

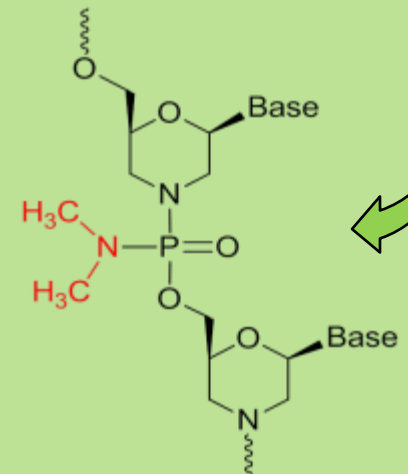
1. RNAseq- Which genes are active.
Select candidate target genes.
Identify endogenous miRNA.
\$20,000 and 3 months.

2. Synthesize and test environmentally stable oligomers. Identify lead candidate compound.
\$10,000 and 2 months.

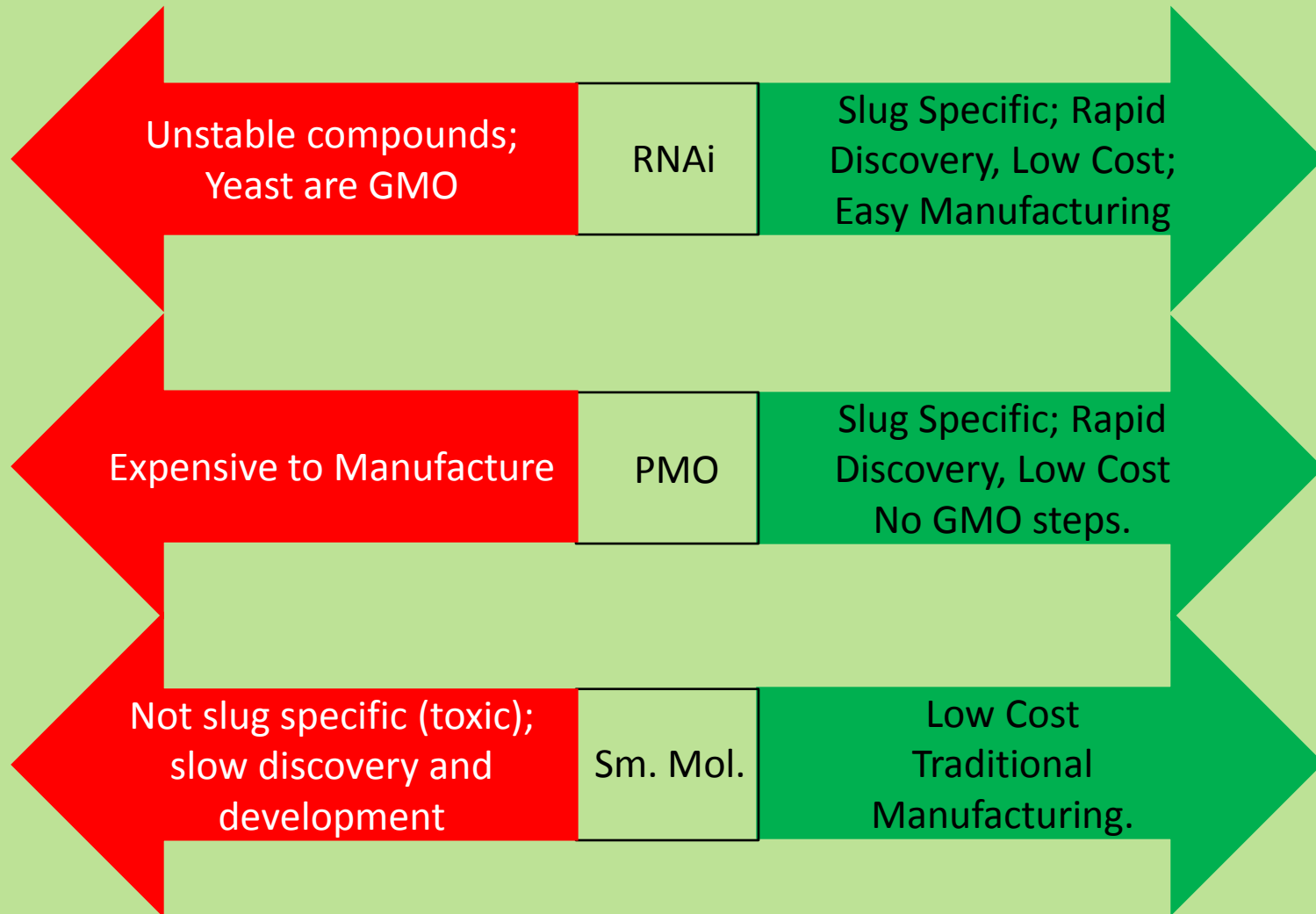
3. Develop slug delivery technology. Several possibilities

4. Deliver stable oligomers to growers.

Regulatory Process



Considerations



Slugs and Snails in Oregon - Plans

OSU's \$ 16 million budget request includes funding for a new faculty member to work on slugs and insect pests - research and outreach

Multi-prong approach with partners:

- Agricultural Community - Growers, Commodity Commissions, Industries
- State Agencies: ODA, Soil & Water Conservation Districts
- Federal Agencies: USDA-ARS, NRCS