Canadian Grain Commission | Commission canadienne des grains

Innovation in Fumigation

Blaine Timlick

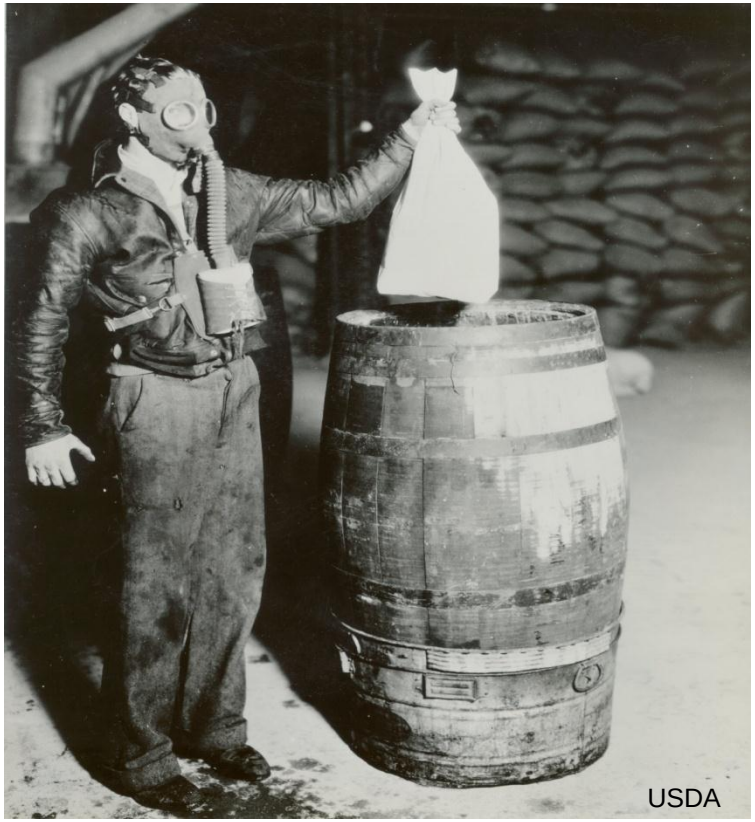
Canadian Grain Commission

Canada

Introduction

Innovations: A new method, device or technique to change the way of doing things

Introduction



Innovations in Fumigation: A relatively new method, device or technique employed to fumigate

Innovation in Fumigation

- **Fumigation is a very diverse topic**
  - Products, structures, conveyances, soil, growing commodities, post harvest commodities, processing facilities
- **Scope**
  - Will focus on post harvest commodities, conveyances and processing facilities
    - Evolution
    - Drivers
    - Potential going forward

Stored Product Fumigants - yesterday

- Carbon tetrachloride - weak insecticide, used to aid distribution
- Chloropicrin – broad spectrum fumigant (microflora, insects) – still registered soil fumigant
- Dichlorvos – heavy molecule insecticide, used in open space, non penetrant
- Ethylene dibromide – general fumigant, banned as grain and stored food fumigant, tmt for felled logs (US)
- Ethylene oxide – broad spectrum fumigant, phytotoxic, seed toxic
- Ethyl formate – fruit / dried fruit fumigant
- Hydrogen cyanide – ancient and not registered?
- Methyl bromide –
- Phosphine –
- Sulphuryl floride -

Stored Product fumigants - today

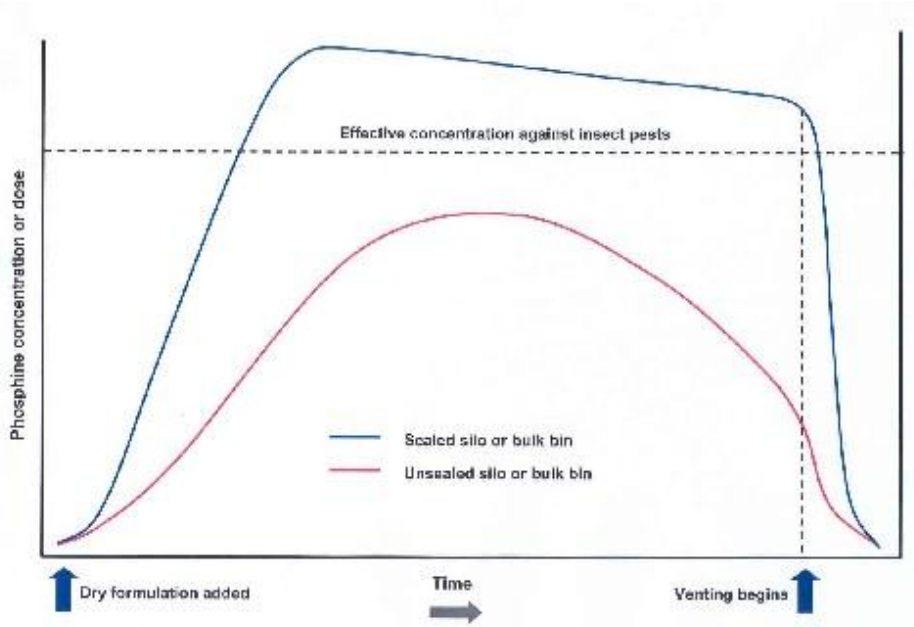
- Phosphine
- Sulfuryl floride
- Methyl bromide
- Ozone
- Controlled Atmospheres
- Modified Atmosphere

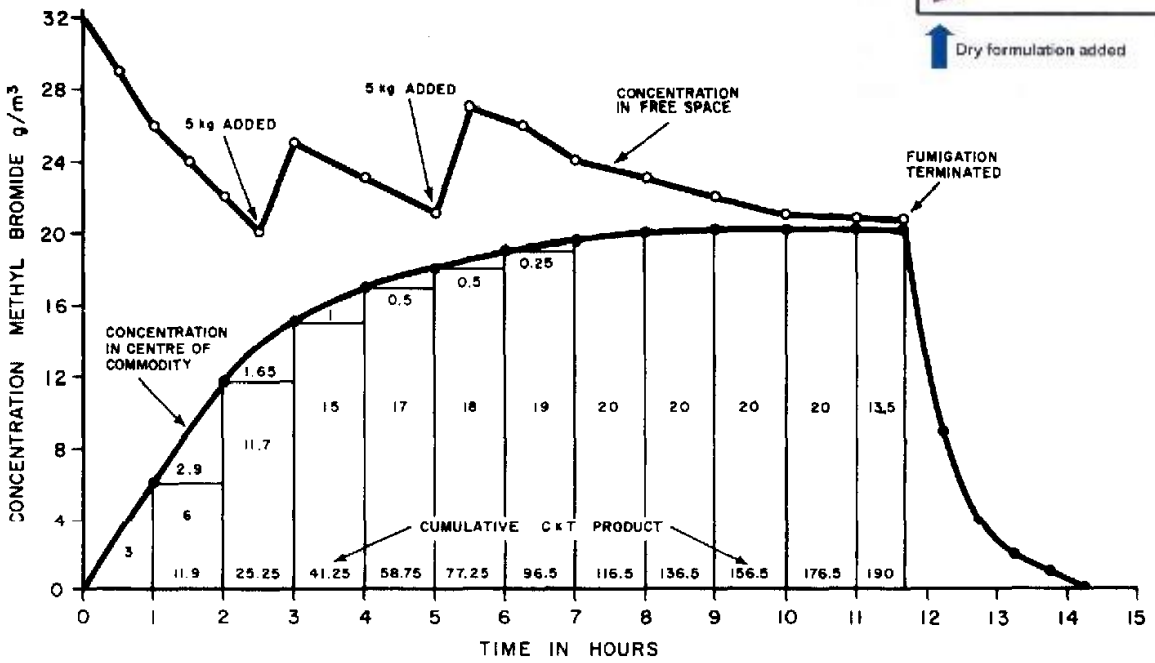
Stored Product Fumigants - Tomorrow

- New product development (time?)
- Mixtures – what are the possibilities?
- Bio-fumigants
- Enhancing methods and techniques

Phosphine

- Effective and easy to use
- Consideration should be to use it in smaller structures / situations


Effective concentration against insect pests
Phosphine concentration or dose
Sealed silo or bulk bin
Unsealed silo or bulk bin
Dry formulation added
Time
Venting begins


CONCENTRATION METHYL BROMIDE g/m³
TIME IN HOURS
5 kg ADDED
5 kg ADDED
CONCENTRATION IN FREE SPACE
FUMIGATION TERMINATED
CONCENTRATION IN CENTRE OF COMMODITY
CUMULATIVE CxT PRODUCT
3
6
11.9
2.9
11.7
25.25
1.65
15
41.25
1
17
58.75
0.5
18
77.25
0.5
19
96.5
0.25
20
116.5
20
136.5
20
156.5
20
176.5
13.5
190

Active application: Phosphine

Sulfuryl Floride

Dow

FP Alliance

-Used for many years on timber very good commodity penetration
-Active gas application – diligence required
-Not overly effective on insect eggs of some species
-Integration with other techniques?

Methyl Bromide

Instablog

-Highly toxic, very effective at all life stages
-Ozone depleter, alleged carcinogen
-Remains available as a quarantine treatment in many countries – (will this be availability stretch its use?

Ozone

Strong sterilant (insects, microflora) , very reactive, economical, requires time (purging), corrosive

Controlled Atmosphere – CO2

Concentrations @ 70% required, easy to maintain, temperature dependent – therefore can be timely

Controlled Atmosphere – N2

High concentrations required (>95%), time required for purging, relatively safe, sealing leaks an issue – consideration for mixture?

Controlled Atmosphere - mixtures

Controlled Atmosphere - uses

Modified Atmospheres

-Respiring commodities consume O2 and produce CO2 and create an anoxic environment – works when abiotic factors are suitable.
-May fit into innovative fumigation as a mitigation of infestation for incoming products
-Most useful in initial commodity storage and not in commercial handling .. yet

Temperature

• cooling used to treat commodities – not likely to be used with fumigants

•Heating used to treat structures – can be used in combination with fumigants

Bio-fumigants

-Much study over the past 30 yrs
- herbs, citrus, eucalyptus, acids (acetic)
-Mostly terpenes, - cineole, limonene and pinene.
-Each product seems to have varying success, depending on target species
- transfer of odors / tastes
-Maybe useful as repellants

Drivers for Innovation in Fumigation

- Efficacy & Efficiency Requirements
- HACCP
- Resistance
- Regulatory – commodity (SAGARPA, APHIS,CFIA) and product registration (SALUD, EPA, PMRA)

Efficacy & Efficiency

- Pressures of economics: Just in time shipments: both at export and import means bulk handling systems limit the time commodities are in position for fumigation
- Therefore, will this drive the development of new fumigants or maybe cause the return of calendar based treatments ‘just to be safe’
- Greater ‘upstream’ monitoring & treatment prior to having commodities in export position – smaller set-ups = easier to manage
- Increased levels of Stewardship by fumigant companies will drive effectiveness and efficiency by making others aware and therefore accountable

HACCP / Quality Systems

- Buyers of commodities require a level of diligence and proof in their ability to control pests
- Brokers need to be able to demonstrate registration to a recognized quality system that provides the buyer with a high level of assurance
- Brokers then demand their suppliers to provide this
- Eg. Walmart

BRC FOOD CERTIFICATED

NCS INTERNATIONAL
CERTIFIED
FOOD SAFETY
MANAGEMENT SYSTEM
ISO 22000

SQF INSTITUTE
One world. One standard.

Resistance

- Resistance to many pesticides has occurred and will continue to occur (PH3, Malithion from single selection pressures)
-Globally managing stored products will require info sharing and engagement in the integration of new approaches into current programs to keep insects at bay
-Innovations in fumigation strategies have assisted in extending product efficacy

Regulatory – trade and registration

- NAFTA agreements – will policies re trade in commodities become universal in North America?
- increased food safety (US FSMA 2011) regulations, risk reduction and impact on trade of agricultural commodities;
- enabled successful collaboration on reviewing scientific studies and coordinated registration decisions of new pesticides and uses;
- improved processes for exchanging information between industry and the three regulatory agencies.

Fumigation Innovations

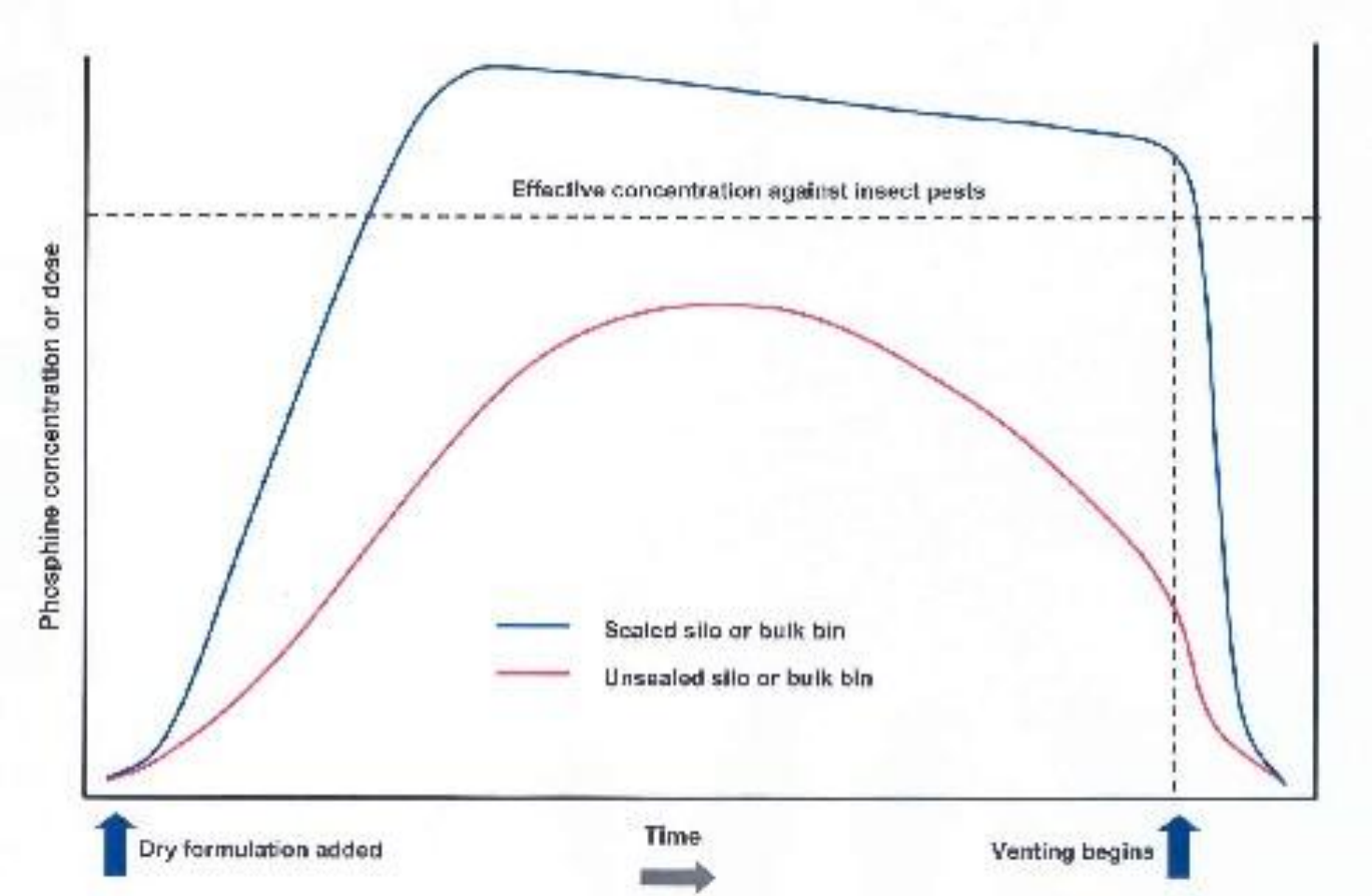
- **Sealing**
- **Application – piping , recirc, aerosols**
- **Measurement**
- **Testing – (sentinel insects)**
- **Monitoring**
- **Investigation (PCO's trying new things rather than just 'applying pesticides') and implementation**
  - New concepts to be implemented
  - New concepts specific to the situation

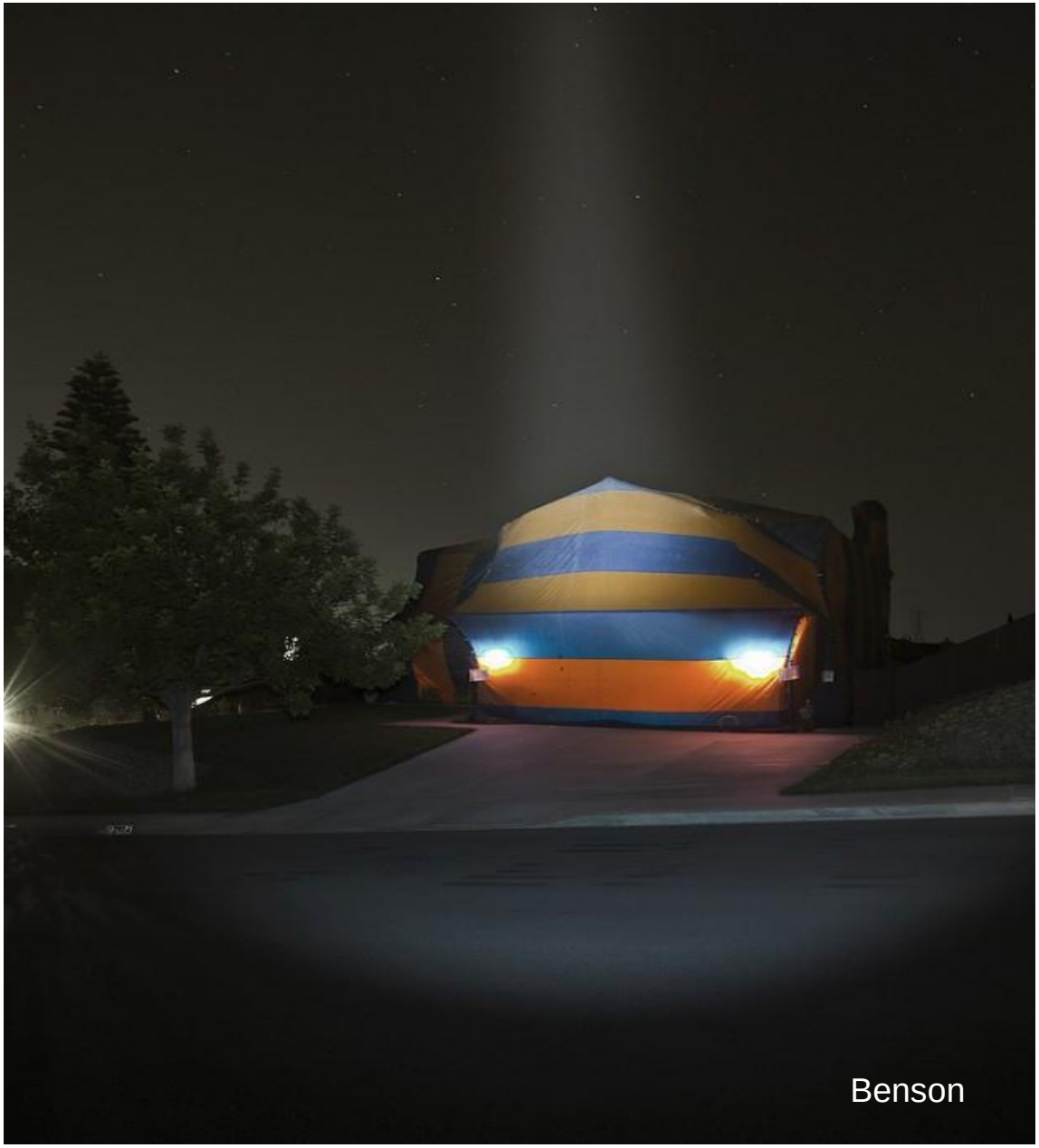
Sealing & Cleaning

Reed

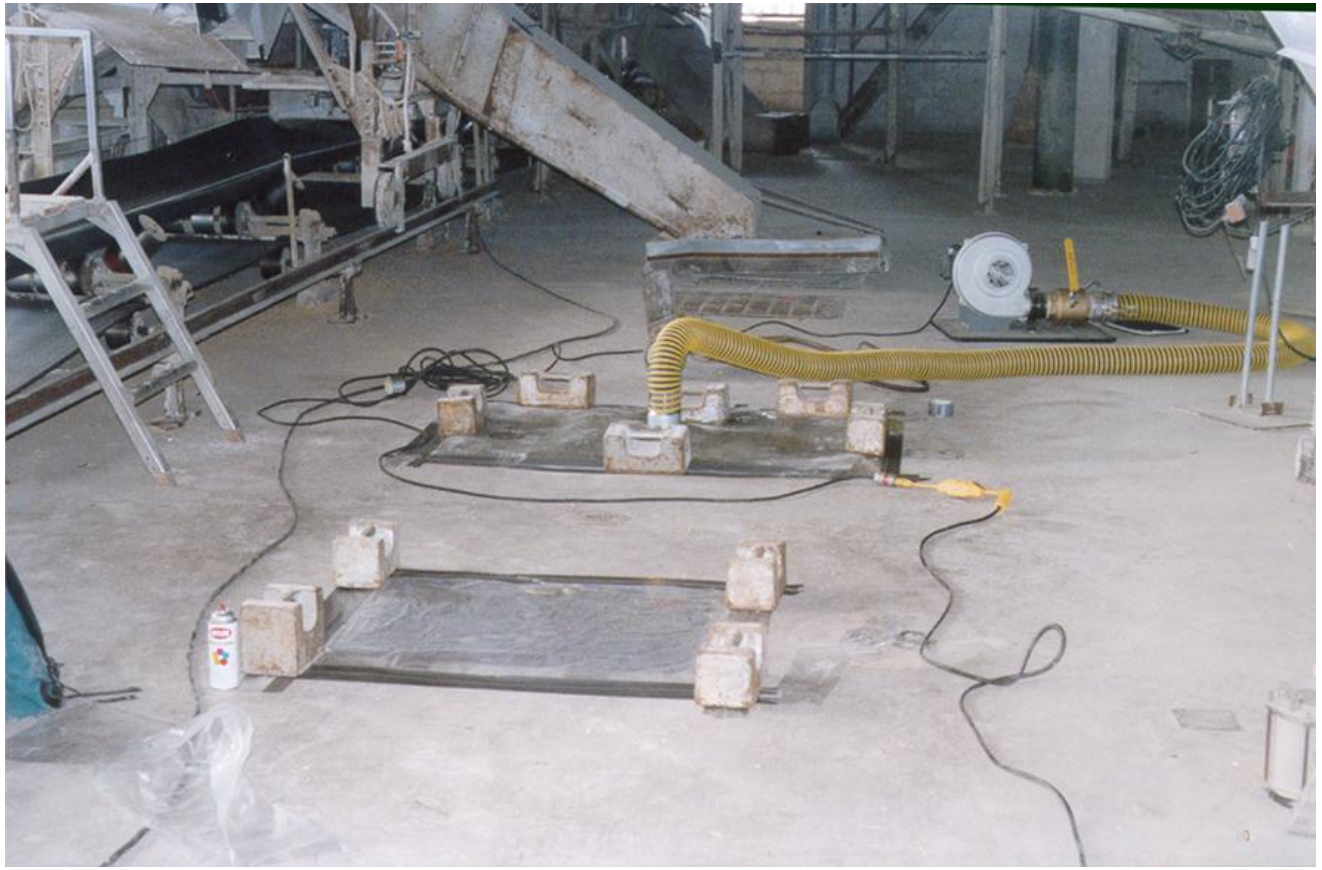
Sealing & Cleaning

Sealing


Effective concentration against insect pests
Phosphine concentration or dose
Sealed silo or bulk bin
Unsealed silo or bulk bin
Dry formulation added
Time
Venting begins

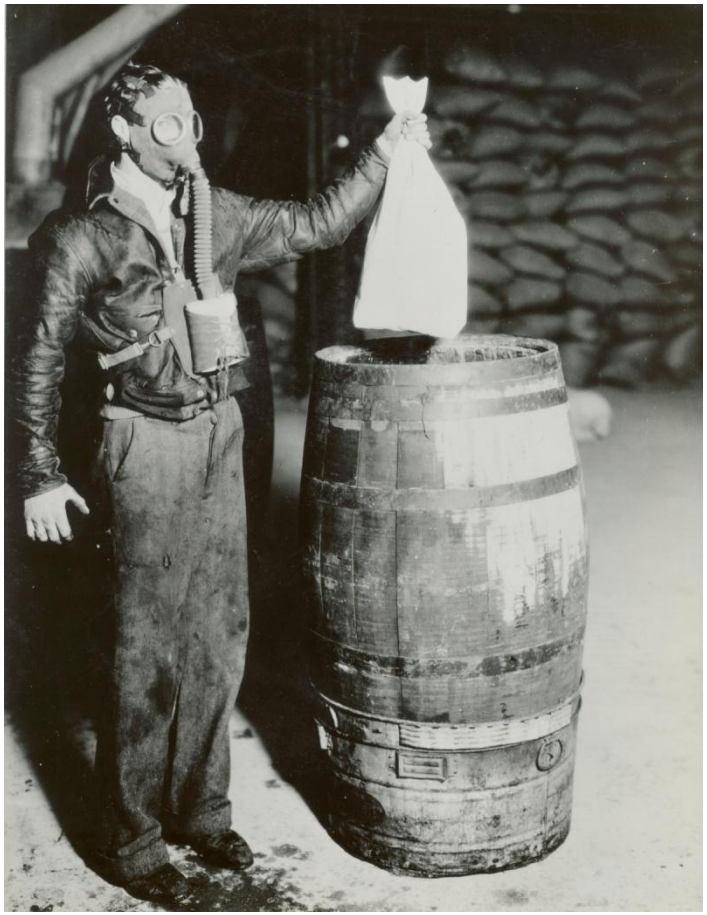

Benson

Pressure Testing

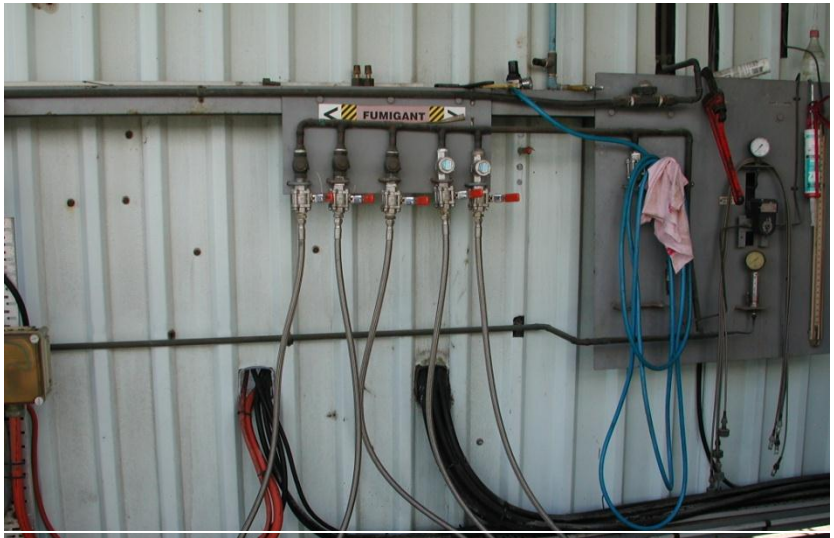


- pressure half life of 3 to 5 minutes

Application



Application



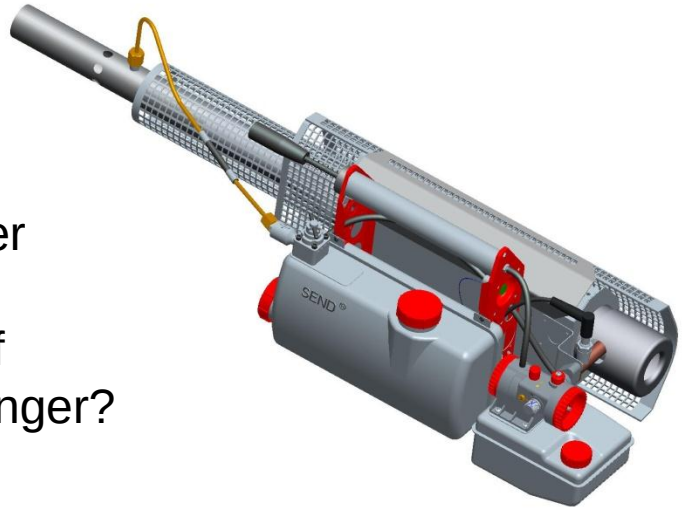
Permanent / well established shooting

Recirculation

Established processes / Trained Personel

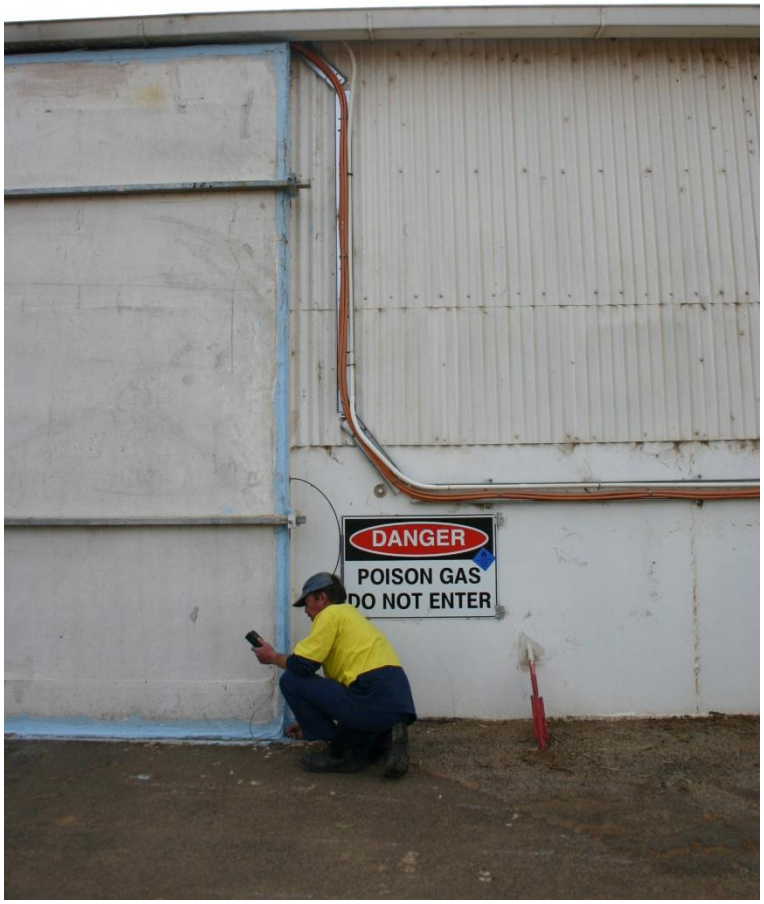
New techniques

Aerosols



- larger particle size than gas fumigants
- can aerosols be used in some instances over fumigants (space treatment)?
- can heat be used with (fogging) or as part of treatments keeping particles in suspension longer?
- can they replace commodity treatments?

Measurement / Testing



-Ability to ensure appropriate concentration is maintained
- Ensure safe for environment / staff

Monitoring

Agri-shop

- Monitoring for pests, both within the commodity and outside of it assists in knowing when to be ready
-

Ridley

Looking Forward

- Fumigation is a system made up of numerous components – each component could be the weakest link in the system – eg. pest population dynamics, tolerance/resistance etc
- System development needs to be specific for each (type) of fumigation

Canstock

Looking Forward

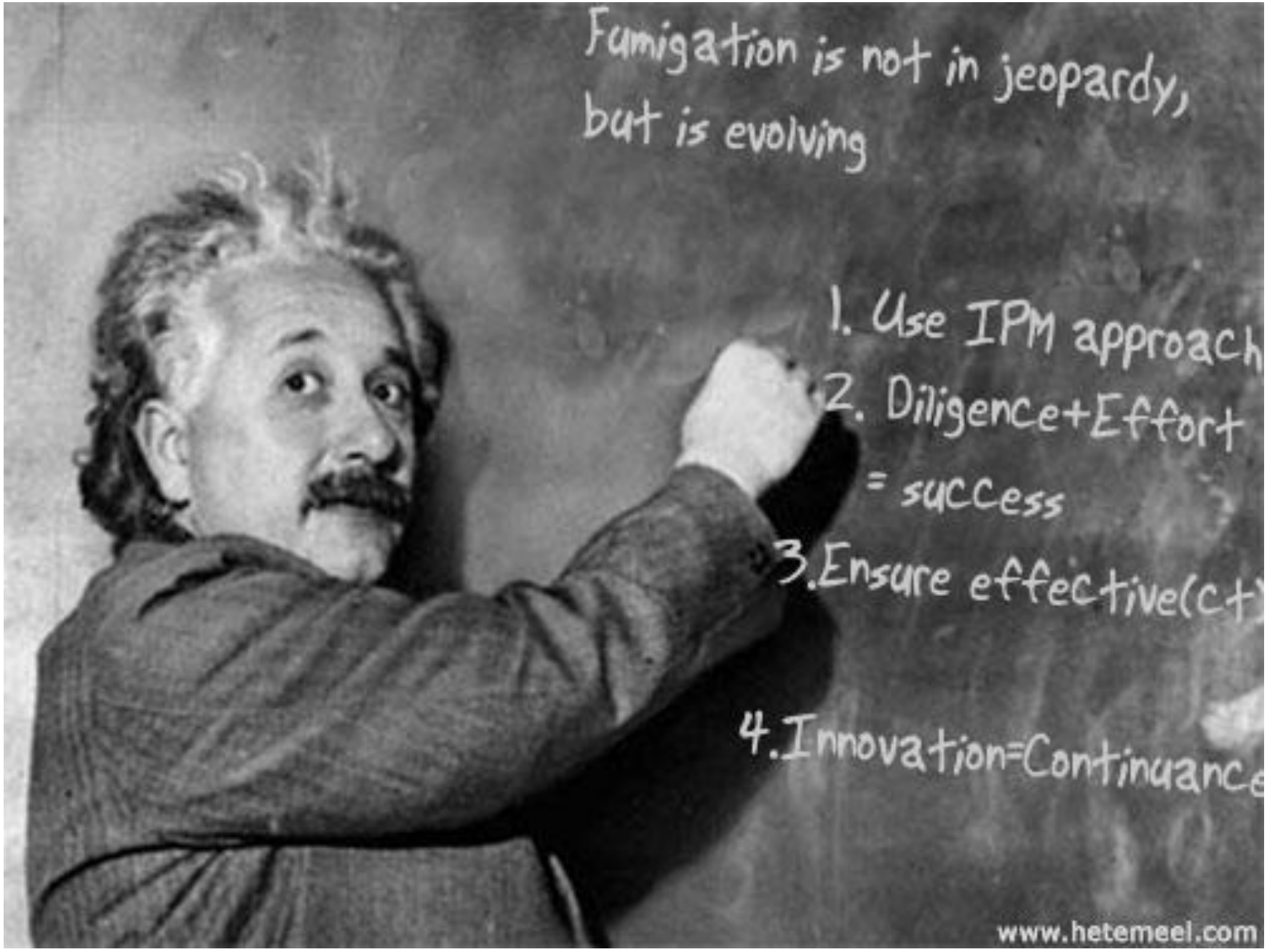
- **From international ag trade summit**

Trends in U.S. and Canadian Agriculture and Agri-Food Policy

- Harmonization of policy : will we see pesticide harmonization
- Increased food labeling demands : public demands on food quality increasing
- GM labeling
-Country of Origin Labeling: will there be treatment verification requirements
-Nutritional labeling
- Animal welfare and antibiotic issues
- Biotechnology challenges

Looking forward

- **Fumigation – an Endangered Technology – J Banks, 1994**
  - Some products deregistered or about to be or not working as well
    - MeBr, PH3
    - But have seen new products come into the market to replace those – SF, CO2
  - New products
    - O3 (commodities), isothicyanates (soil), biofumigants
  - Market & consumer forces – can work both for and against fumigants
    - Health concerns , environmental concerns
      - Changes in registered products
    - Hungry people and animals
      - Reliance on fumigants has changed – still used but with emphasis on quality and detail


Fumigation is not in jeopardy,
but is evolving
1. Use IPM approach
2. Diligence+Effort
= success
3.Ensure effective(ct)
4.Innovation=Continuance
www.hetemeel.com

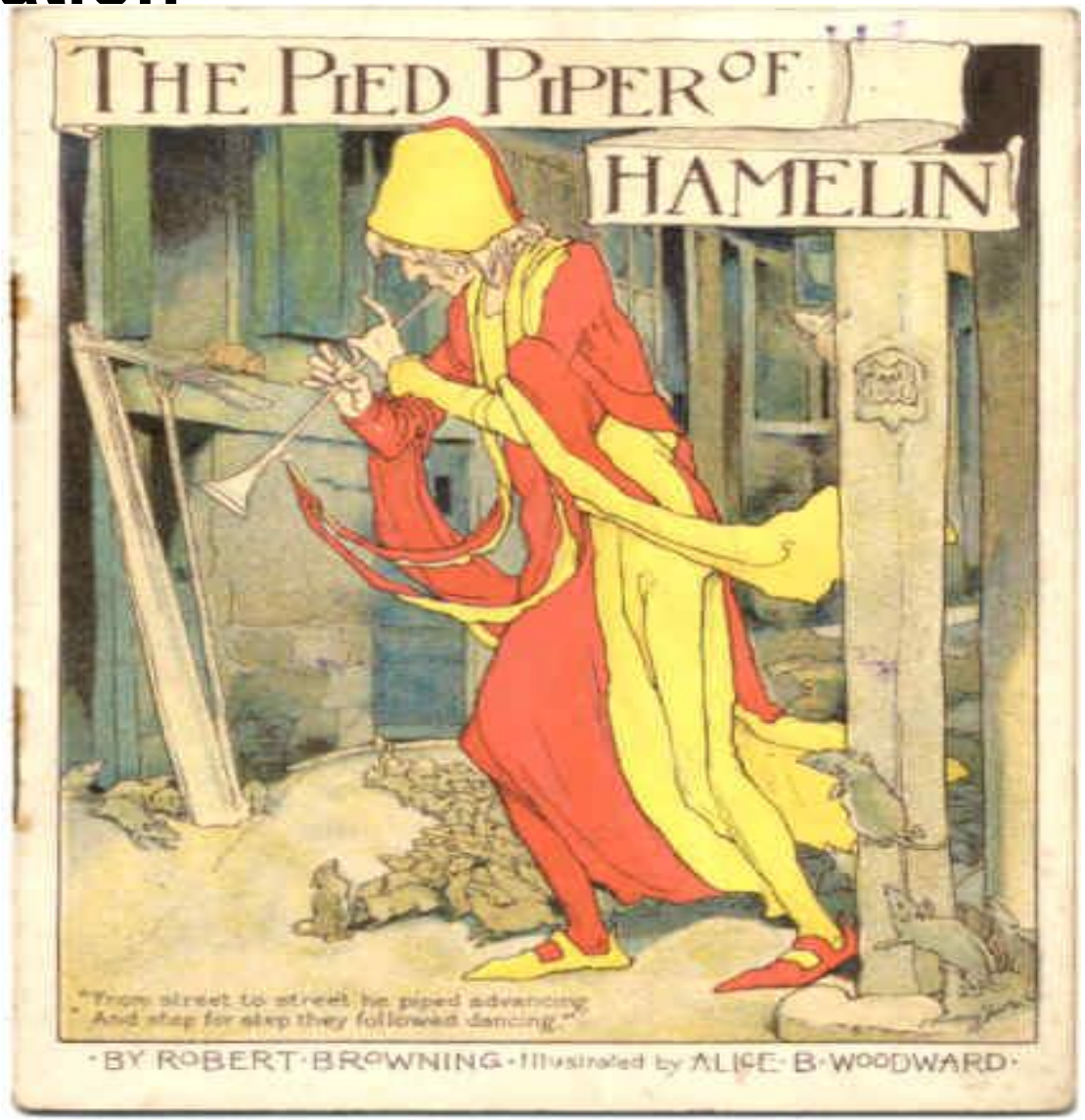
Questions?

Canadian Grain Commission

Commission canadienne des grains

Canada

Innovation


THE PIED PIPER OF HAMELIN
"From street to street he piped advancing
And step for step they followed dancing."
BY ROBERT BROWNING · Illustrated by ALICE B. WOODWARD