# History of IPM

University of Minnesota, Department of Entomology, logo
Scorpionfly

**Dr. Vera Krischik, Department of Entomology, University of Minnesota**

# What is IPM?

* A system utilizing multiple methods,
* A decision making process,
* A risk reduction system,
* Information intensive,
* Biologically based,
* Cost effective, and
* Site specific.
* Multiple tactics
    legal, cultural, physical,
    genetic, biological, chemical

# History of IPM

## IPM Control Methods

- **Legal control**: following state and federal guidelines that are designed to prevent the spread of pests

- **Cultural control**: using crop rotation, cultivation, sanitation, habitat modification, or removal of sources of pest infestation

- **Physical control**: using barriers, traps, trap crops; planting, fertilization, tillage, or harvest times

# History of IPM

## IPM Control Methods

- **Genetic control**: using plant varieties that are resistant to pest injury

- **Biological control**: conservation or introduction of predators, parasites, and diseases that suppress or attack pests

- **Chemical control**: select and use the least toxic, environmentally suitable pesticides in the lowest effective amounts to control pests

# History of IPM: 4700 to 1200 BC

**Pest management resource center home**
**http://www.pestmanagement.co.uk/culture/history.html**

**4700 BC Silkworm culture in China.**

**2500 BC First records of insecticides, eg. the Sumerians were using sulfur compounds to control insects and mites.**

**1500 BC First descriptions of cultural controls especially manipulation of planting dates.**

**1200 BC Botanical insecticides were being used for seed treatments and as fungicides in China. The Chinese were also using mercury and arsenical compounds to control body lice.**

# History of IPM: 950 BC to 13 BC

**950 BC First descriptions of burning as a cultural control method.**

**200 BC The Roman, Cato the Censor advocated oil sprays for pest control.**

**13 BC First rat-proof granary was built by the Roman architect.**

# History of IPM: 300 to 400 AD

**300 AD First record of the use of biological controls (predatory ants) in citrus orchards in China. Colonies of the predatory ants (*Oecophylla smaragdina*) were set up in citrus groves with bamboo bridges to move between trees to control caterpillar and beetle pests.**

**400 AD Ko Hung an alchemist recommended a root application of white arsenic when transplanting rice to protect against insect pests.**

# History of IPM: 650 to 1780

**1000-1300 Date growers in Arabia seasonally transported cultures of predatory ants from nearby mountains to oases to control phytophagous ants which attack date palm. First known example of movement by man of natural enemies for purposes of biological control.**

**650-1780 Burgeoning of insect descriptions (after Linneaus) and biological discoveries in the Renaissance.**

**1732 Farmers begin to grow crops in rows to facilitate weed Removal.**

**1763 Linnaeus won a prize for an essay under the name of C.N. Nelin on how orchards could be freed from caterpillars by mechanical and biological control methods.**

# History of IPM: 1800 to 1878

**Early 1800's Appearance of first books and papers devoted entirely to pest control covering cultural control, biological control, varietal control, physical and chemical control.**

**1840 Potato blight (*Phytophthora infestans*) outbreak in Ireland, England and Belgium leading to famine. Large numbers of predatory carabid beetles *Calasoma sycophanta* to destroy leaf feeding larvae of the gypsy moth.**

**1848-1878 Introduction of Grape Phylloxera, *Viteus vitifoliae*, from Americas nearly put an end to the French wine industry. The release of the natural enemy *Tyroglyphus phylloxerae* from North America in 1873 provided adequate levels of control.**

# History of IPM: 1750 to 1890

**1750-1880 Agricultural revolution in Europe; international trade promoted the discovery of the botanical insecticides pyrethrum.**

**1870-1890 Grape Phylloxera (*Viteus vitifoliae*) and powdery mildew controlled in French vineyards (by the introduction of Bordeaux mixture and Paris Green and the use of resistant rootstalks and grafting).**

**1880 First commercial spraying machine.**

**1883 *Apanteles glomeratus* was imported from the UK to the USA to control cabbage white butterfly.**

# History of IPM: 1888 to 1901

**1888 First major success with imported biological control agents the coccinellid beetle *Rodolia cardinalis* from Australia for the control of cottony-cushion scale in US citrus fruits.**

**1890's Introduction of lead arsenate for insect control.**

**1901 First successful biological control of a weed; *Lantana* in Hawaii.**

# History of IPM: 1899 to 1930

**1899-1909 Breeding program that developed varieties of cotton, cowpeas and water melon resistant to *Fusarium* wilt.**

**1915 Control of malaria and yellow fever carrying mosquitoes allowing completion of the Panama Canal after its abandonment in the late 1800's.**

**1920-1930 More than 30 cases of natural enemy establishment were recorded throughout the world.**

**1921 First aerial application in insecticide against Catalpa sphinx moth in Ohio, USA.**

# History of IPM: 1929 to 1940

**1929 First area-wide eradication of an insect pest against Mediterranean fruit fly in Florida, USA.**

**1930 Introduction of synthetic organic compounds for plant pathogen control.**

**1939 Recognition of insecticide properties of DDT.**

**1940 Use of milky disease to control the Japanese beetle as the first successful use of an entomopathogen.**

# History of IPM: 1942 to 1960

**1942 First successful plant breeding program for insect resistance in crop plants through release of wheat resistant to the Hessian fly. Rediscovery of the insecticidal properties of benzene hexachloride and in particular its gamma isomer ("-BHC) shared with DDT the credit for the dawn of a new era of insect control in agriculture, horticulture, stored products, timber preservation and public health.**

**1944 First hormone based herbicide - 2,4-D available.**

**1946 First report of insect resistance to DDT in houseflies in Sweden.**

**1950's-60's Widespread development of resistance to DDT and other pesticides.**

# History of IPM: 1950 to 1962

**1950's First applications of systems analysis to crop pest control.**

**1959 Introduction of concepts of economic thresholds, economic levels and integrated control by V.M. Stern, R.F. Smith, R. van den Bosch and K.S. Hagen.**

**1960 First insect sex pheromone isolated, identified and synthesis in the gypsy moth.**

**1962 Publication of "Silent Spring" by Rachel Carson.**

# History of IPM: 1967 to 1972

**1967 Introduction of the term Integrated Pest Management by R.F. Smith and R. van den Bosch. The relevance of ecology to IPM through the concept of "Life Systems" was introduced by L.R. Clark, P.W. Geier, R.D.Hughes and R.F. Morris. Release of pirimiphos methyl.**

**1969 US National Academy of Sciences formalized the term Integrated Pest Management.**

**1970's Widespread banning of DDT.**

**1972 Release of *Bacillus thuringiensis* insecticide based on isolate HD-1 for control of lepidopterous pests.**

# History of IPM: 1973 to 1987

**1973-1975 Development and release of the synthetic pyrethroid insecticides permethrin and cypermethrin.**

**1985 First resistance reported to *Bacillus thuringiensis* in the flour moth *Plodia interpunctella*. India and Malaysia declare IPM official Ministerial Policy.**

**1986 Germany makes IPM official policy through the Plant Protection Act. Indonesia Presidential Decree makes IPM official policy. Philippines - IPM implicit in Presidential declaration.**

**1987 IPM implicit in Parliamentary decisions in Denmark and Sweden.**

# History of IPM: 1988 to 1993

**1988 Major IPM successes in rice systems in Indonesia.**

**1989 First resistance reported to genetically engineered *Pseudomonas fluorescens* containing the delta endotoxin of *Bacillus thuringiensis*.**

**1991 IPM implicit in multiyear plan for crop protection introduced by Cabinet decision in the Netherlands.**

**1993 Greater than 504 insect species are known to be resistant to at least one formulation of insecticide and at least 17 species of insect species are resistant to all major classes of insecticide.**

# History of IPM: 1972 to 2002

**1972 Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA).**

**1996 Food Quality Protection Act (FQPA).**

**1999 US EPA and National Academy of Sciences release report indicating that risk analysis of pesticides need to be redone and reviewed based on effects on children and cumulative exposure. All pesticides being reviewed.**

**2002 Organic Standards developed by USDA.**

# Damage threshold

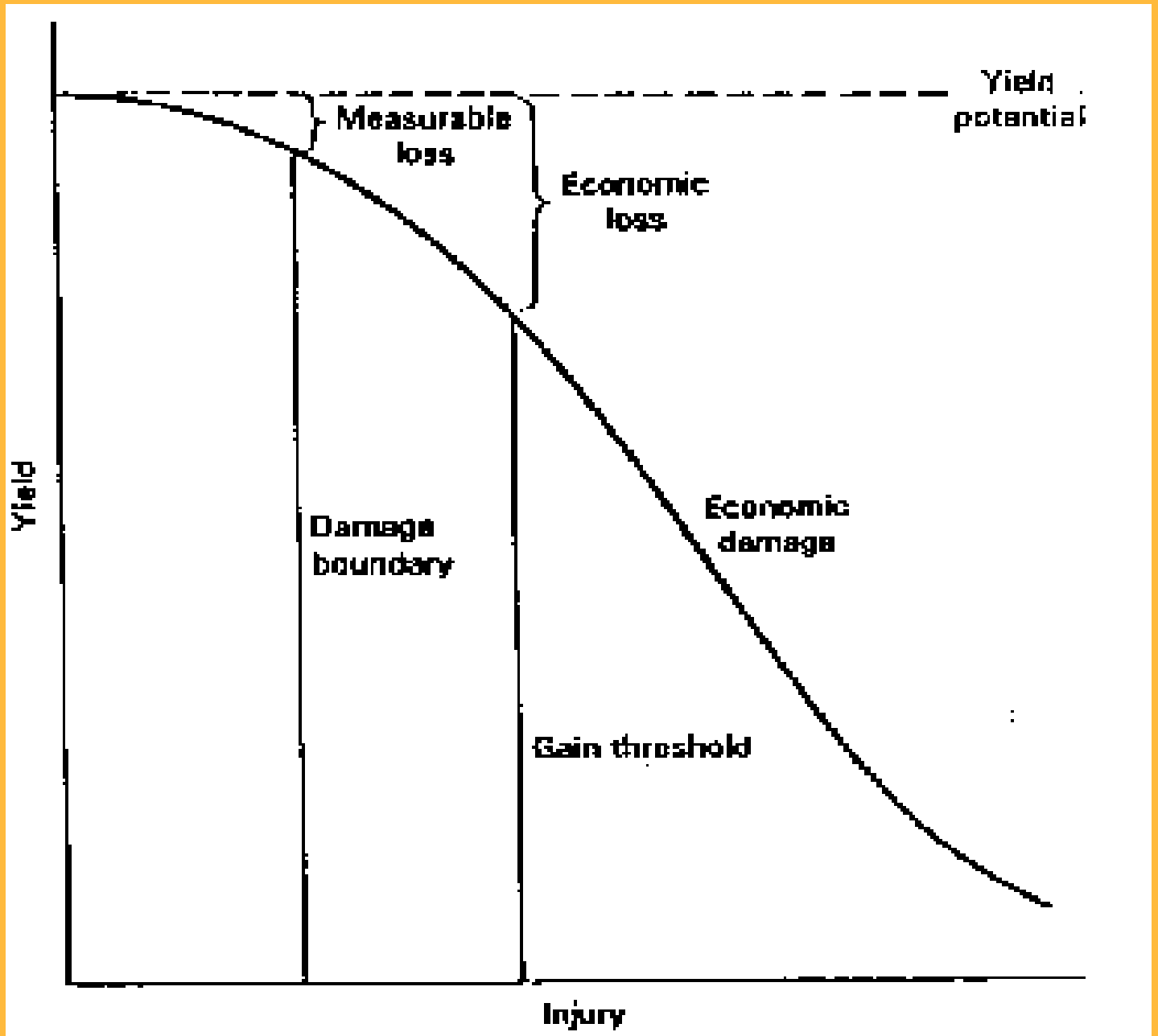
http://ipmworld.umn.edu/chapters/pedigo.htm

## Damage threshold

The damage boundary is the lowest level of injury that can be measured. This level of injury occurs before economic loss.

A basic IPM principle ensues from the damage boundary/economic damage relationship; it is that no injury level below the damage boundary merits suppression, but injury predicted to result in economic damage does.

# Damage threshold



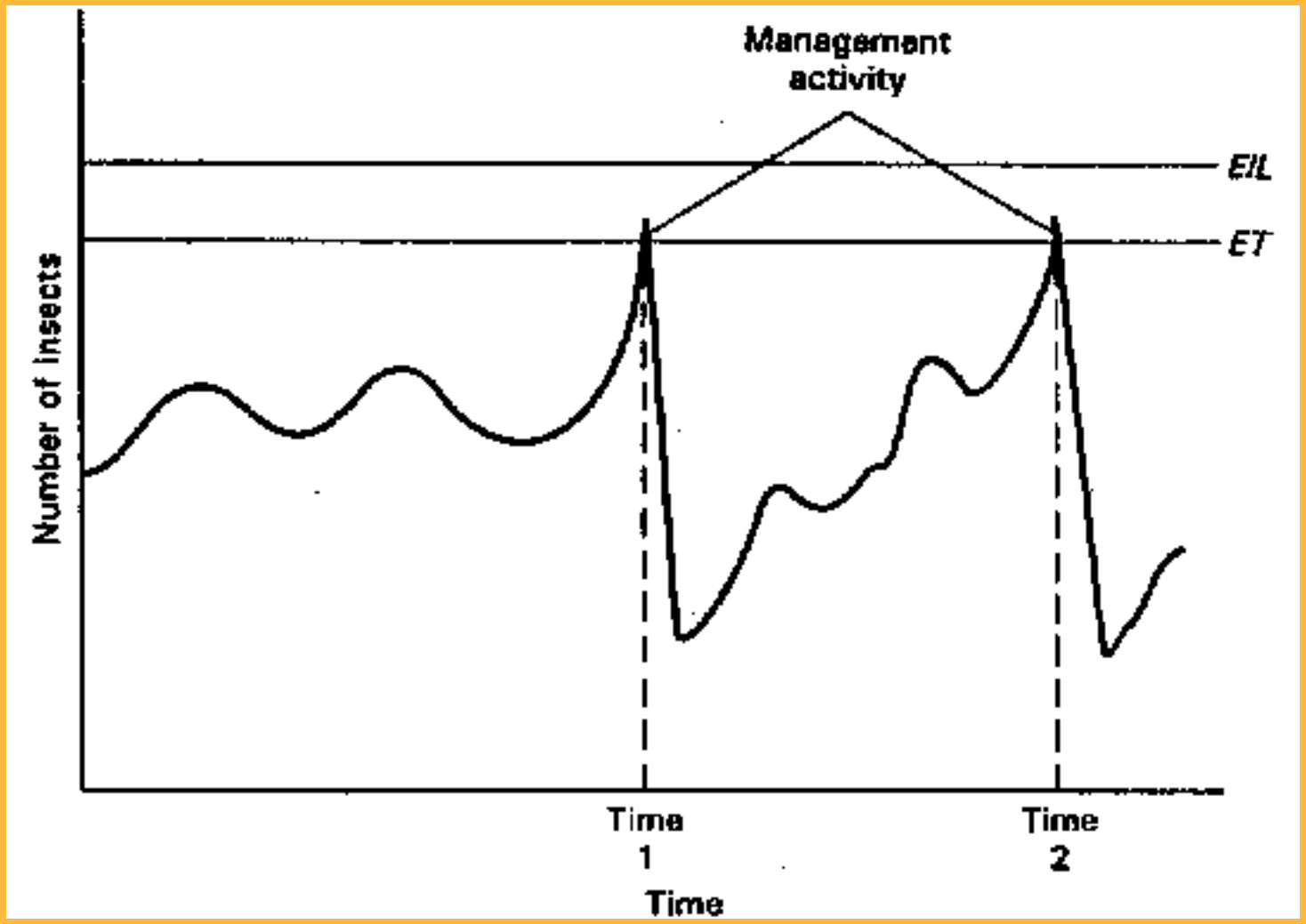
# Economic Injury Level

## Economic Injury Level

**Another of the basic elements, the economic injury level, is the lowest population density that will cause economic damage. The EIL is the most basic of the decision rules; it is a theoretical value that, if actually attained by a pest population, will result in economic damage.**

**Therefore, the EIL is a measure against which we evaluate the destructive status and potential of a pest population.**

# Economic Injury Level



# Economic threshold

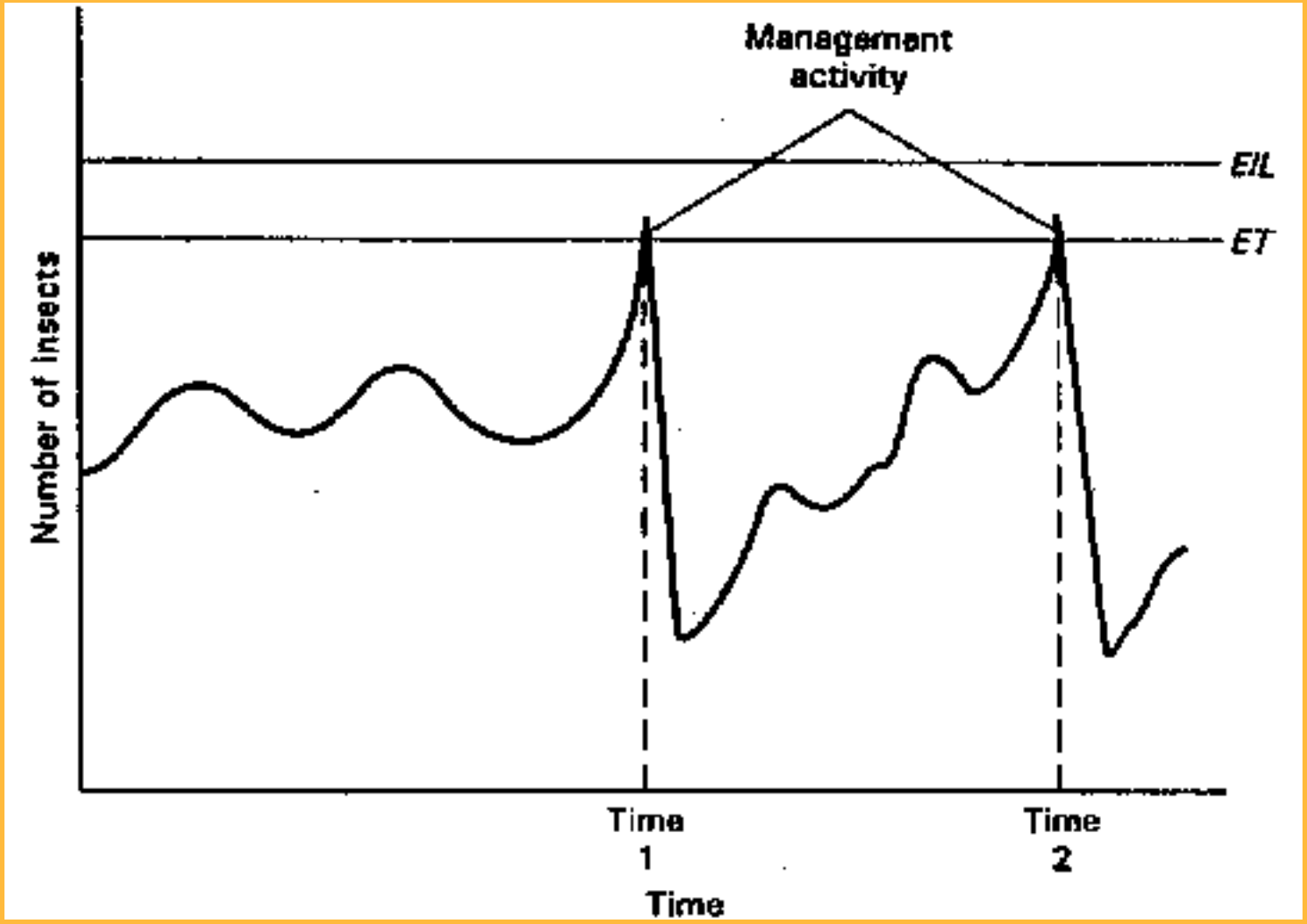
## Economic threshold

**The economic threshold (ET) differs from the EIL in that it is a practical or operational rule, rather than a theoretical one. It is the population density at which control action should be determined (initiated) to prevent an increasing pest population (injury) from reaching the economic injury level.**

**Although measured in insect density, the ET is actually a time to take action, i.e., numbers are simply an index of that time.**

**ET is the action threshold.**

# Economic threshold



# Lower Pesticide Farm Pioneers Win World Food Prize

**Ray Smith, and Perry Adkisson devoted three decades of work to development and adoption of IPM, which uses biological, cultural and crop management techniques as well as chemicals to protect crops from insect damage.**

**IPM is used worldwide and was credited by the prize committee with vastly reducing farmer reliance on synthetic pesticides. The World food Prize is awarded annually in recognition of work that aided the world through greater availability, quality and quantity of food.**