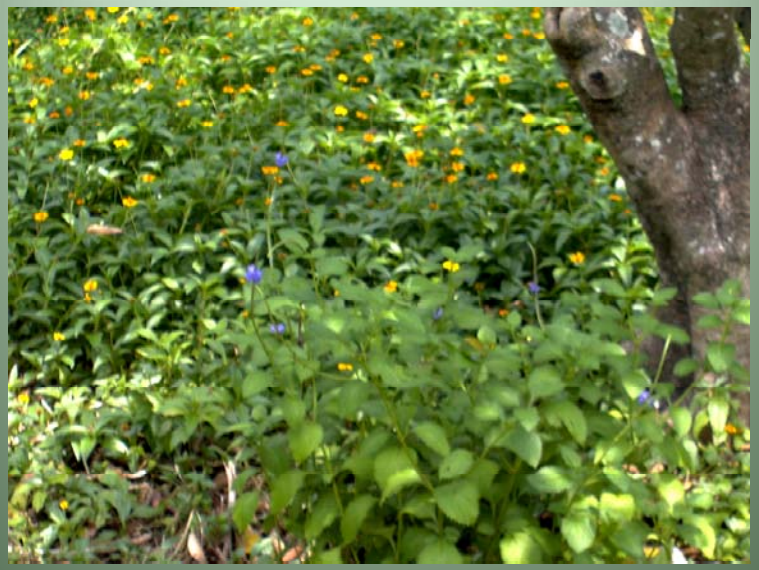
Insectaries

· Small flowering plants are encouraged to grow throughout the fields

· Nectar and pollen are essential to the adult stage of many beneficial predators

·Research has shown that they breed thousands of beneficial organisms

·Tall flowering plant host more species than short mowed or bare areas



Different Insectary Models

Perimeter planting
acts as barrier for pests
an windbreak

Host crops fop beneficial species planted as strips within the crop as part of the rotation cycle

Insectaries

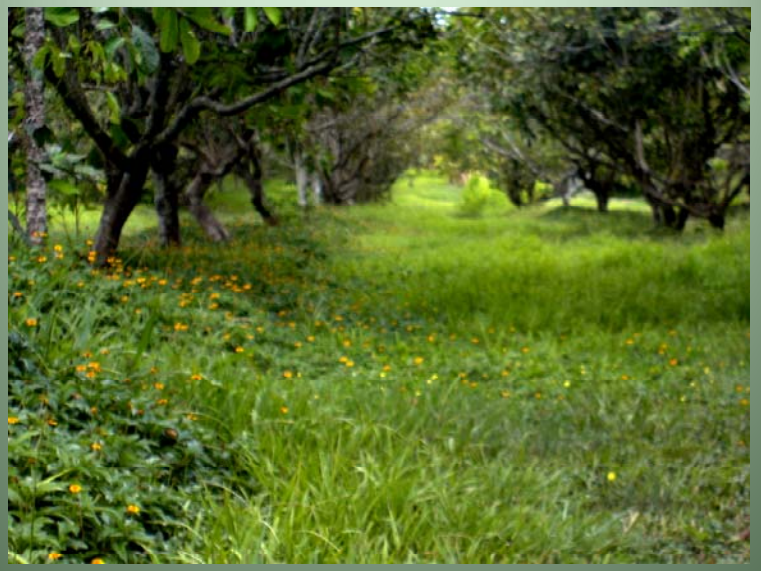
·Strip mowing used to leave pockets and strips as refuges for beneficials

·The remaining areas are mowed at a later stage leaving other areas as refuges

·The forest allowed to regenerate in marginal areas on the farm

·Watercourses planted to provide habitat for the beneficial bird species

·Marginal areas host a variety of beneficial insect species



Strip Mowing

Leaving rows of long grass - insectary plants increases the number of beneficial insect species

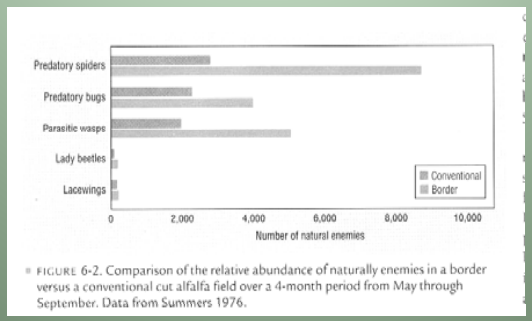


FIGURE 6-2. Comparison of the relative abundance of naturally enemies in a border versus a conventional cut alfalfa field over a 4-month period from May through September. Data from Summers 1976.

Three Good rules of thumb for designing insectaries.

1. Any flowering plant that attracts bees is suitable as an insectary plant. Beneficial insects prefer species that are rich in pollen and nectar.

2. Smaller flowers are best for parasitic wasps.

3. The greater the diversity of species the more effective the insectary system.

Insectary Calendar

It is possible to plan to have insectary plants in flower all year

	Moisture*	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Willow species	W	■	■	■	■								
Ceanothus spp.	D												
Redbud	D-I		■	■	■								
Mule fat	I-W												
Yarrow species	D-I				■	■	■	■					
Coffeeberry	D-I												
Hollyleaf cherry	I				■	■							
Soapbark tree	I												
Buckwheat species	D					■	■	■	■	■	■	■	■
Elderberry species	I-W												
Tyon	D					■	■						
Creeping boobyalla	I												
Bottlebrush	I							■	■	■			
Narrowleaf milkweed	D-I												
Coyote brush	D-I										■	■	

*Moisture requirements:
dry (D) dry to intermediate (D-I) intermediate (I) intermediate to wet (I-W) wet (W)

Trap Crops

Trap Crops are a variation of insectaries and are used to trap pest species. There are a range of methods and types of crops that are used.

a. Continuous Preferred Hosts

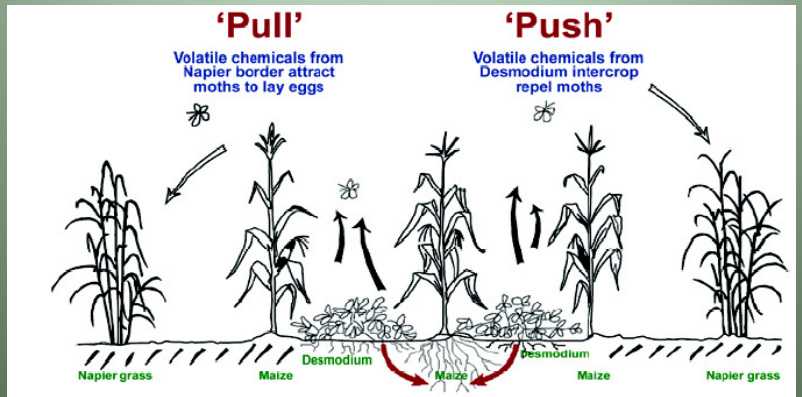
These work by drawing the pest species away from the crop because they prefer the trap crop to the cash crop.

Continuous Repellant Plants

These work by repelling the pest species out from the crop because they do not like the compounds emitted by the plants

High Yields

"Push – Pull" for Stemborer and Striga Control



Chemicals (isoflavones) secreted by desmodium roots inhibit attachment of striga to maize roots and cause suicidal germination of striga seed in soil

The System's Approach: Eco-intensification

Using natural systems to regulate pest outbreaks

(example of push-pull greater farm productivity vs higher yields 2 to 10X)

Eco Function Intensification

The Napier grass is progressively cut and fed to a cow. The excess fresh milk is sold everyday as a cash income

Eco Function Intensification

The desmodium, suppresses weeds, adds nitrogen, conserves the soil, repels pests and provides high protein stock feed

Trap Crops

b. Timed Alternate Hosts

These work by planting crops that attract the pest species before or after the season. The pests are then destroyed to break the breeding cycles and reduce the pest population.

c. Lures

Insectaries can be used as trap crops by placing/spraying lures and baits to attract the pest species out of the cash crop and into the predator rich insectary. Lights at night work very well

Eco-intensification Agroecology

Insectaries

Borders of flowers create refuges for beneficial insects

Other effective cultural PEST control methods

- **Planting non pest host species and pest resistant varieties**
- **Clean planting material**
- **Crop Rotations**
- **Purchasing beneficial Arthropods**
- **Baits, lures, traps and Pheromones disrupters**

Crop Rotation is very effective in controlling pests and diseases by breaking the reproductive cycles

3. Allowable Organic Sprays and Spray Technology

Spraying pesticides and fungicides should be regarded as the tools of last resort.

Ideally a good organic farmer tries to avoid pests by having healthy fertile soil and good biodiversity on farm.

However there are certain pests that can periodically cause economic damage if they are not controlled at critical times.

Constant monitoring and timely action can control these before they increase into a significant problem.

Monitoring and only spraying hot spots.
Many organic sprays are broad spectrum, killing both pest and beneficial species.

Monitor the crop and establish the areas that have the highest numbers of the pest. These areas are the 'Hot Spots'.

Only spray the hot spots.

Use pest specific techniques
Biological pesticides such as Bacillus thuringiensis and Metarhizium are usually pest specific and do not harm beneficials – or people.

Examples of effective sprays

Biologicals
Many people have failures with biologicals, due to not realizing that they are dealing with living organisms rather than a chemical.

Biologicals need to live in suitable conditions to be effective.

It is important to understand these requirements

Non Toxic Sprays
Emulsified vegetable oils
Natural Soap Sprays
Clays, Flour and water.

Examples of effective sprays

Toxic Sprays
Natural pyrethrum
Spinosad
Eucalyptus Oil

Repellents
Garlic, chili, tea tree oil, lavender oil, citronella, cypress pine oil.

Vertebrate Pests

Birds, Fruit Bats and other mammals can cause major production losses

Throw over nets and scaring are used to control them

These methods are only partially effective

- •The pests chew through the nets,
- •Crawl under nets
- •Crawl through any small holes

Permanent netting is not economic

- •Prohibitive cost
- •Acts as a barrier to the many beneficial species

Retractable netting systems will be used in the future

More research needed to designed efficient cost effective systems

Throw Over Netting

It is only partially effective as pests can chew through it

4. List of Organic Insecticides, Fungicides and other controls

- **Botanical and simple natural chemicals**
- **Biological controls**
- **Beneficial Insects and Arthropods.**
- **Natural Biological Controls**
- **Fungicides**

Botanical and simple natural chemicals

Natural pyrethrum
Rotenone
quassia
ryania
propolis
Emulsified vegetable oils
Mineral oils – white oils, DC Tron etc
Essential oils - tea tree, eucalyptus, citronella, lavender, cypress pine etc.
Potassium soap
Plain soap
Sodium silicate (waterglass)
Neem
Envirospray
Copper sulphate
Lime
Sulphur
Potassium permanganate
Borax

Botanical and simple natural chemicals

Baking Soda
Diatomaceous earth
Stone meal
Sea salts
Kaolin
Flour and water
Chili sprays,
Garlic
Vinegar
Tobacco – not pure nicotine
Bluish Dogbane
Pheromones
Baits such as vegemite and water

Synthetic chemical lures and baits are allowed if they are enclosed so that they do not leach into the environment.

Biological controls

Biopesticides

Bacillus thuringiensis - var kurstaki for caterpillars
Bacillus thuringiensis - var enebrionis for beetles
Bacillus thuringiensis - var israeliensis form mosquitoes and some flies
Metarhizium species or grasshoppers, beetles, white flies and a range of insects
Trichoderma species for controlling diseases
Cliocladiun virens for controlling diseases
Bacillus subtillus for controlling diseases
Gemstar for caterpillars
Verticilium lecanii for scale insects, aphids and white flies
Beauveria basiana for a wide range of insects.
Nematophagous fungi for controlling nematodes.

A fresh good quality compost should have high levels of actinomycetes, protozoa and beneficial fungi that will control a wide range of pests and diseases.

Biological controls

Beneficial Insects and Arthropods.
The most effective way to introduce these creatures to a farm is to provide insectaries.

Predatory nematodes
Predatory mites
Trichogramma, Telenomus and other parasitic wasps
Lacewings
Hover flies
Lady Beetles
Assassin Bugs
Spiders
Green ants
Praying Mantis
Dragon Flies

Vertebrates
Birds, Bats, Frogs, Lizards

Disease Controls

Natural Biological Controls
•Use rotations to break disease cycles
•Do not plant the same crop into a field where the previous crop had a disease
•The longer the break – the less the disease
•Add high levels of compost into the soil
•High calcium soils balanced using the Albrecht system
•Ensure good mineral balance – no deficiencies
•Use clean, uninfected pleating material
•Strict Quarantine controls to prevent disease entering

Disease Controls

Fungicides

Bordeaux mixture,
Burgundy mixture
Copper Sulphate
Copper carbonate
Micronised copper
Sulphur
Sodium bicarbonate
Vinegar and wood vinegar
Potassium permanganate
Tea Tree oil, Lavender oil, Eucalytus and other essential oils
Yogurt and other natural lactic acid fermented milk products
Milk, Whey and milk solids
Compost/Compost teas/Decaying wood
Trichoderma species, Cliocladiun virens
Bacillus subtillus
VAM fungi

5. Pest Management Plans

The most efficient method dealing with pests and diseases is to be proactive and have a pest management plan.

Generally the best results are obtained by developing a plan that uses a range of strategies taking a whole of farm approach.

Pest Management Plan

1. Identify all the pests that cause problems for each specific crop.

2. Make lists of all the control agents that can be used.

3. Divide these strategies into short term and long term controls.

4. Write down how, where and when to apply these control methods.

5. Keep good records.

6: Constantly Monitor and Review the plan every season.

6. Records Templates

Worksheet 2.1

Spray Record

Date	Product	Amount	Carrier nutrient	Crop	Pest	Section

Thankyou