



Chemical *versus* Biological Control of Sugarcane

By

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Sugarcane

- It is an important cash crop, Pakistan is the fifth largest cane producing country.
- However, its yield per acre here is lower than in most of the sugar cane producing countries.
- Among many reasons behind this low production such as poor management practices, weeds, water shortage etc, insect pests also play a negative role in decreasing the yield.



Pest

A pest is any organism that injures or spreads disease to humans, domestic animals and desirable plants.



Pesticide

Any chemical used to repel or kill a pest organism.



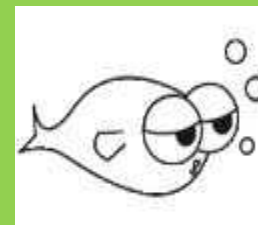
Advantages of Pesticides

- **Effectiveness:** Pesticides are quick way of controlling pests. They require low labor inputs and allow large areas to be treated quickly and effectively.
- **Flexibility:** A suitable pesticide is available for almost all pest problems with variation in type, activity and persistence.



Disadvantages of Pesticides

- **Reduction of beneficial species:** Animals which interact with the targeted pest can also be affected by the chemical application. The reduction in these other organisms can result in changes in the biodiversity of an area and affect natural biological balances.
- **Drift of sprays and vapors:** Pesticides can affect other areas during application and can cause severe problems in different crops, livestock, waterways and the general environment. Wildlife and fish are the most affected.



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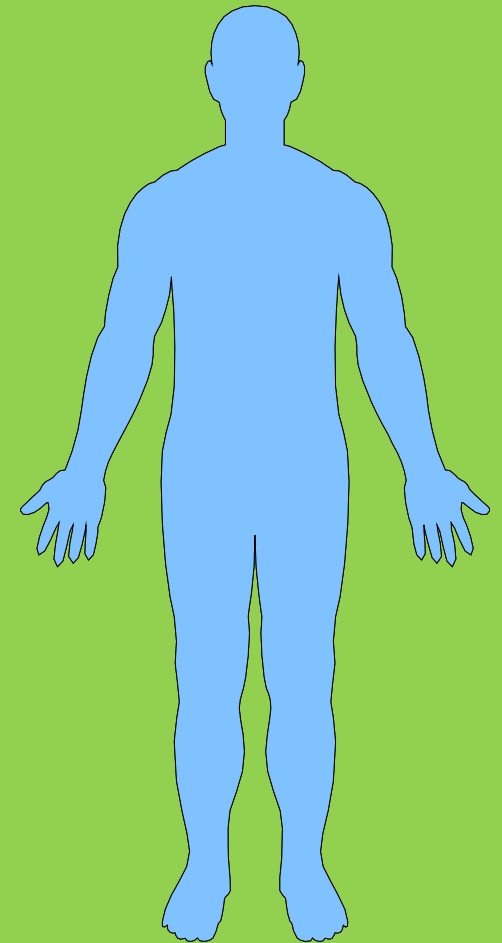
- **Residues in food:** There is the possibility of pesticides in human food, either by direct application onto the food, or by bio-magnification along the food line. Not all levels are undesirable but unnecessary and dangerous levels must be avoided through good agricultural practices.
- **Ground water contamination:** Chemicals can reach underground aquifers if there is persistent product use in agricultural areas.



Pesticide Toxicity

Routes of Exposure

- Eye
- Dermal – skin
- Oral - by mouth, ingestion
- Inhalation-breathe in



Effects of Pesticides on Human Health

- Cancer
- Asthma
- Birth Defects
- Neurological Effects
- Endometriosis
- Hormone Disruption
- Reduced sperm counts
- Fertility Problems



Skin damaged by pesticides



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Acute contact dermatitis due to pesticide spray



Breast Cancer in Lactating women (related to cotton pickers)



Biological Control of Insect Pest

- Biological control is the use of a pest's natural enemies to control its population and spread.
- Biological control is one method of preventing pests from causing economic or environmental damage.



Advantages of Biological Control

- Biological control agents are pest-specific and greatly prefer to feed on the target organism, leaving non-pest organisms undisturbed.
- Once a biological control program is underway, the field aspects of the program are inexpensive compared to other control methods and require little human efforts



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- Biological control agents can sustain themselves and spread on their own.
- Beneficial animals and plants as well as people in an area where biological control is being used are by and large unaffected by this method of control.

Disadvantages of Biological Control

- Biological control agents usually only affect their target organism, but there is a chance that the biological control agent may feed on a beneficial organism and may even prefer it over the pest, rendering the program ineffective.
- Also, not all pests can be controlled by biological agents, or a pest may be so similar to a native or beneficial insect that the risk of introducing the control agent outweighs any benefits.



Insect Pest

According to rough estimates, insect pests cause almost 15 to 30 per cent reduction in yield of the crop resulting in huge losses to the growers.



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Here we discuss only on insect pest of sugarcane because we remained successful in biological control of sugarcane insect pests in surroundings of Matiari Suger Mills Ltd.

Sugarcane borers

- Amongst sugar cane pests, borers cause more damage to the crop.
- Moths of sugarcane stem borers lay their eggs underside the leaves. Within 36 to 48 hours larvae come out of the eggs and start feeding on tender parts of the plant.



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After some time, the larvae find their way into the stem. They keep feeding inside the cane and render it unfit for consumption and milling. Weight of cane and sucrose percentage is drastically reduced. In case of root borer attack, the central whorl of leaves dry up and form dead hearts.

Top Borer



Stem Borer



Root Borer



Borer Infestation



Chemical Control of Borers

- Corbofuran (Granular)
- Chloropyriphos (Liquid)

Biological Control of Borers

There are many parasites and predators to control insect pest of sugarcane but we are rearing some of them, in laboratory.

Biological Control of Borers

Trichogramma



Cotesia



Chrysoperla Carnea



Sugarcane Leaf Hopper

Another harmful pest of sugarcane is the leaf hopper (pyrilla), which causes serious damage to the crop. Its attack is reported to have been increasing for the last few years in Sindh. Pyrilla is an insect pest which sucks juice from the leaves as a result they dry up.



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In addition, it also emits a sweet substance (honey dew) which serves as a medium for a fungus namely sooty mould, which turns the leaves black and photosynthetic activity of plants is badly affected. Plants get weakened and sucrose percentage also drops.

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Both the adults and nymphs suck the sap from leaves. The leaf hopper is very agile and jumps around in large numbers, making a faint noise when a person walks through a heavily infested field. This pest breeds through out the year and migrates from one crop to another in search of fresh food.

Sugarcane Leaf hopper



Leaf hopper Infestation



Chemical Control of Leaf hopper

- Acetamiprid+Imidachloprid
- Spirotatamet

Biological Control of Leaf hopper

Epipyrops (parasite)



Chrysoperla (predators)



Sugarcane whitefly

- Macro plant symptoms and other conditions and characters that indicate presence.
- The nymphs are responsible for most of the damage to plants.
- The sap suck by nymphs result in the leaf gradually turning yellow and pinkish and ultimately the leaf dries up.



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The nymphs excrete large quantities of honey dew which accumulates on the affected leaves and the leaves appear black due to development of sooty mould, interfering with photosynthesis. High infestation causes stunted crop growth and reduces juice quality. Severe whitefly infestation may result in reduction in cane yield up to 65%.

Sugarcane whitefly



White fly Infestation



Chemical Control of White fly

- Acetamiprid+Imidachloprid
- Spirotatamet
- Chloropyriphos

Biological Control of White fly

Chrysoperla Carnea



Ladybird Beetle



Is Biological Control Expensive?

Price of 1 card	= Rs. 13
Price of 1 appl: of 30 cards/acre	= 13 X 30
	= Rs. 390
Price of 7 applications	= 7 X 390
	= Rs. 2730

Comparison/acre:

Biological Control:	Rs. 2730
Pesticide (approx:)	: Rs. 8000 – 10000



Matiari Agriculture Services (MAS)

MAS is a sister running company of Matiari Sugar Mills, it consists of four Units i.e

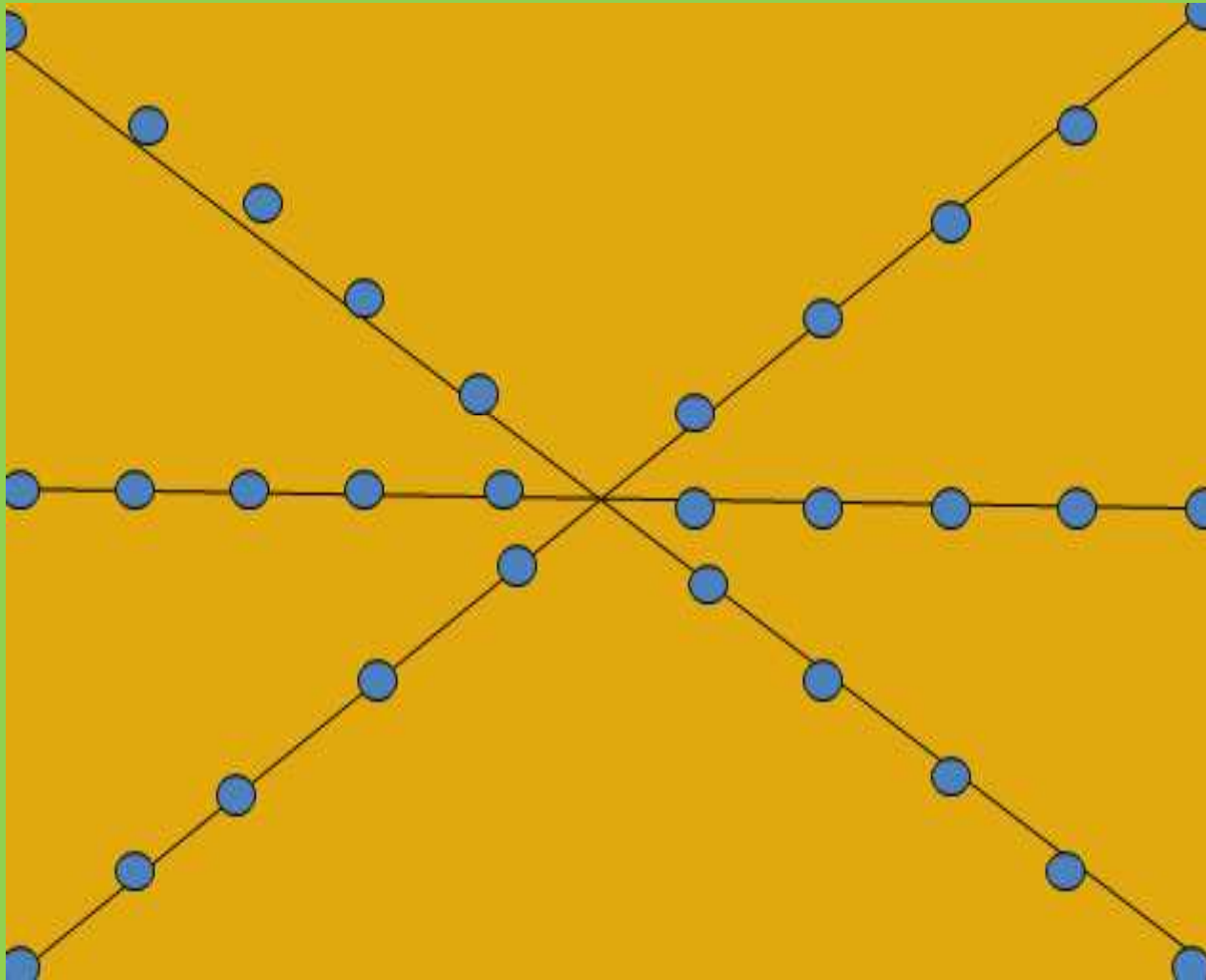
- Biological Control Laboratory
- Tissue Culture Laboratory
- Bio-compost Project
- Research Farm (multiplication of Improved sugarcane varieties)



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- In 2000 we introduced biological pest control Laboratory and we had trails in different areas of sugarcane.
- Our aim is to provide information and awareness to the growers about the Sugarcane pests and how to control these pests through biological control.

Procedure of cards application in the field



BIOLOGICAL PEST CONTROL LABORATORY OF MAS

The highly skilled and experienced staff is working on rearing of beneficial insect against the pests of different crops like Sugarcane, Banana, Cotton etc.



Biological Control Laboratory of MAS

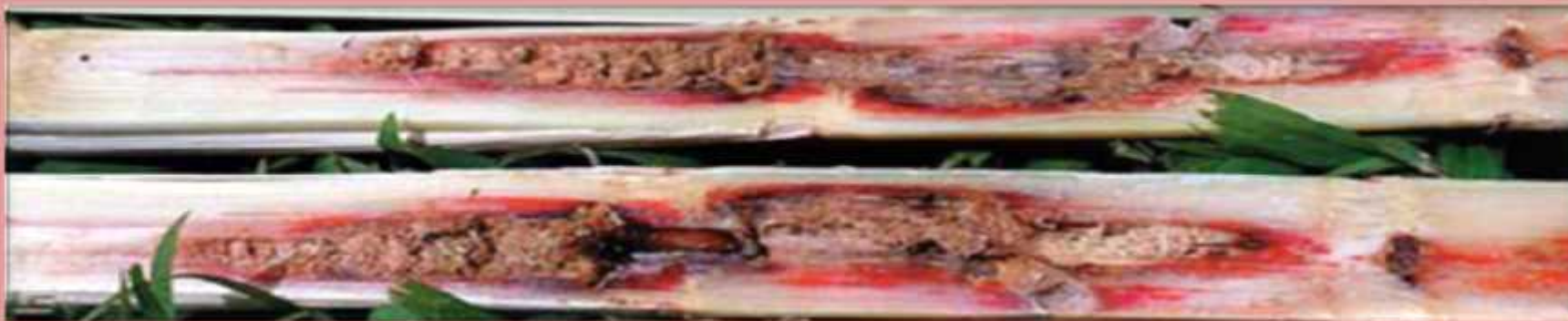


Beneficiaries of Surroundings of Matiari Sugar Mills Ltd.

S.No.	Season	Area Under Cane in acres	No of acres Treated with bio- cards	Bio cards used /year	Remarks
01	2007-2008	35089	1260.28	63014	This resulted in mark reduction in the use of chemicals and consequently mark improvement in environment in the area
02	2008-2009	31462	3165.7	158435	
03	2009-2010	23746	4359.9	217995	
04	2010-2011	26542	6033.62	301681	
05	2011-2012	27364	5134.1	256705 (To date)	

Dissection of Year wise Infested cane samples

S.No	Season	No. of Samples	No. of Sticks	Internodes		
				Total Numbers	Infested Numbers	Infestation Percentage
1	2007-2008	910	25610	271575	12886	4.74
2	2008-2009	425	12641	126855	4597	3.62
3	2009-2010	350	9440	86298	2612	3.02
4	2010-2011	590	17261	157393	4115	2.61
5	2011-2012	230	6361	60120	1502	2.49



Conclusion

- Biological Control agents are environmentally safe, non-toxic and non polluting.
- Repeated application of chemical control evokes genetic resistance in the pests and it becomes harder and harder to suppress the pests through repeated chemical spray.
- Chemicals are highly toxic to human health they create many diseases.



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- In Matiari area there is a mark improvement in awareness among the growers for adopting Biological control of pests.
- In the said area, application of cards in 2011-2012 remained remarkable (No. of cards, 2,567,05) it is still going on.

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Cane samples taken from cane carrier during the season and infestation rate of borers was gradually decreased through Biological control agents

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Hence proved that Biological control is cheaper (Rs. 2,730/acre) than chemical control (Rs. 8,000 – 10,000) and it has no toxic effects on human health.

THANK YOU VERY MUCH

