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# WEED MANAGEMENT IN VEGETBLE CROPS

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## INTRODUCTION

Weeds are harmful and are unwanted plants that grows in places where they aren't desired or the plants growing out of the place that interferes with crop species for water, nutrients solar radiation, and space, that in turn reduces yield, quality and the marketability of produce as well increases the cultivation cost. Weeds are found everywhere from the crop land to the wastelands. Mostly, found harmful to the crop species. As they posses some medicinal values, few are useful to mankind too. Some are useful in raising crops for sod culture in perennial crops like fruit and plantation crops that are wide spaced.

However, for successful vegetable production, management of weed is most essential. In fact, it is found that none of the vegetable crops is to be free from the weeds and weed intensity differs with soil, climate, management practices etc. In production of vegetable weed alone accounts for about 30 to 45 percent crop loss and much damage is observed by weeds found during early crop growth, later the weeds are suppressed when the crop canopy develops. Extent of suppression depends upon the crop spreaders. Weed control in right way and at right time, increases the production potential of the vegetable crops (Mandeep *et al.,* 2019).

## HARMFUL EFFECTS OF WEEDS

Production of vegetables are adversely affected by the weeds in following ways:

- As weeds are fast growing, they compete with the crop for water, solar radiation, space and nutrient
- They decrease the yield potential, quality and the marketability of vegetables species.
- Secretes some harmful chemicals that might affect the crop plant
- Increases the cultivation cost.
- They impede water flow and block the drainage in the irrigation channels.
- Weeds act as the host plants for certain pathogens.

## VEGETABLE CROPS AND ASSOCIATED WEEDS

| Vegetable Crops | Associated weeds |
|---|---|
| **Tomato** | *Chenopodium album, Spergula arvensis, Carthamus oxycantha,Cirsium arvense, Cynodon dactylon, Cyprus rotundus, Vicia hirsnta, Echinochloa crusgalli, Orobanche cernua,* |
| **Brinjal** | *Cynodon dactylon, Blumea spp. Chenopodium album, Cyperus rotundus, Orobanche aefyptica* |

| Vegetable Crops | Associated weeds |
|---|---|
| **Chillies** | *Amnaranthus spinosus,Ageratum conyzoides, Argemon mexicana, Blumea spp., Chenopodium album, Trianthema monogyna, Cannabis sativa, Cirsium arvense, Cynodon dactylon, Convoluelus arvensis ,Cyperus rotundus, Leucas asperata, Euphorbia hurta, Orobanche cernua, Vicia hirsuta,* |
| **Beans** | *Anagalis arvensis, Carthamus oxycantha, Digera arvensis, Asphodelus tenuifolius, Chenopodium album, Cyperus rotundus, Blumea laura, Convalvulus arvensis, Cynodon dactylon, Fumaria parviflora, Polugonum bistorta, Viola spp.* |
| **Okra** | *Cyperns rotundus, Blumea sp, Chenopodium album* |
| **Elephant Foot Yam** | *Cynodon dactylon, Cyperus rotundus, Dactyloctenium aegyptium, Commelina benghalensise, Euphorbiahiirta and Digera arvensis.* |
| **Potato** | *Cyperus rotundus, Rumex dentatus, Medicago arabica,Anagallis arvensis Chenopodium album, Phalaris minor and Coronopus didymus* |
| **Cassava** | *Synedrella nodiflora, Andropogon spp. Mimosa invisa, Panicum maximum, Mollugo distica, Pennisetum spp., and Imperata cylindrical* |

**Method of weed control**:

The methods of weed control affects the environment, under the mechanical method the soil is subjected to rain and wind erosion resulting in loss of top soil. The adoption of the biological method, were the predators controls the target weed, but might pose danger for desired plant species. Herbicides application kills weed but leave residues that are toxic to the beneficial micro-organisms (Hussain *et al*., 2007).

The best method for controlling the weeds is by adopting integrated weed management (IWM) technology **(Fig 1)**

**Preventive methods**: Weed infestation could be prevented by following ways.

1. Select the seeds that are weed free for sowing.
2. Livestock movement must be checked.
3. Remove the weed plants from sides of irrigation and drainage channels.
4. Planting of the crop species must be done after cleaning the weed plants.

**Curative or control methods**: There are four types of control measures

.


**Fig 1: Integrated Weed Management Techniques**

***1. Cultural Methods:***

Vegetable crops that are fast growing could effectively suppress the weeds through shading. Vegetables like cucumber melons, squashes, pumpkin, beans, peas, and tomato could suppress weeds effectively. Mulches are used to check the weeds and ultimately reducing both the labour and time required for removing them. The mulches used are 2 types -- ***organic mulches,*** *that* are derived from plant material and they decompose naturally and ***inorganic mulches*** that do not decompose and so need to be removed after increasing the soil moisture retention, enhancing soil warming and for checking weeds (Coolong, 2012).

***2. Mechanical Methods:***

Weeds are removed mechanically through hand, weeds are hand pulled or removed using the hand tools. Various small hand tools such as hand hoe, wheel hoe are available that are effective on the small weeds and for working on garden plants.

**3.Biological weed control**:

Controlling weeds though biological method is successful. Example: Mexican beetle on parthianum.

**4. Chemical Methods:**

The use of herbicides are another method to weed control that aids some gardeners employ. The gardeners must be aware that a *no single herbicide will do the entire job* of controlling the weeds in all vegetable crops. There is a problem of applying relatively small amounts of herbicide evenly to garden surface. Miscalculation of rates or the miscalibration of application equipment could cause some garden areas to get too much or too little of herbicide. Under-application will result in the poor weed control while over-application will result in damaging the plant. Various weedicides like 2,4-D, Treflan, Paraquat, Stomp, MCPB etc. could control weeds effectively.

### Chemical Weed Control in Vegetable Crops

| Vegetable Crops | Recommended weedicide | Dose (kg/ha) | Time of Spray |
|---|---|---|---|
| **Tomato, brinjal, chilli** | Pendimethalin/ Fluchloralin | 1.00 1.00 | Pre-emergence |
| **Okra** | Oxyflourfen/ Fluchloralin/ | 0.15 1.00 | Pre-emergence |
| **French bean** | Alachlor | 3.00 | After sowing |
| **Cow pea** | Alachlor | 3.00 | After sowing |
| **Cluster bean** | Alachlor | 3.00 | After sowing |
| **Dolichos bean** | Fluchloralin | 3.00 | After sowing |

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# SUCCESS STORIES OF NEERAJ KUMAR PRAJAPATI – THE BICYCLE MAN OF INDIAN AGRICULTURE

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## Introduction

Neeraj Kumar Prajapati is "The Bicycle Man of Indian Agriculture". He was born in Gohana district of Sonipat, Haryana. He is on a mission to spread awareness on Organic farming which is named as **"111111 Km Mission Organic Bicycle"**. He is a member of International Federation of Organic Agriculture Movements (IFOAM), Germany, International Society of Organic Agriculture Research (ISOFAR), Germany and Agricultural and Processed Food Products Export Development Authority (APEDA), India.

## 11111 Km Mission Organic Bicycle

He is a dynamic youngster who feels that his purpose of life is to serve our Mother India by helping farmers who are the backbone of Indian Economy. He dropped out his B – Tech degree. But this change turned out to be fruitful. He bought a bicycle from all his savings and started the selfless legendary journey 111111 Km Mission Organic Bicycle for the welfare of farmers. He travels on the bicycle because he does not want to pollute the environment.

He aims to train farmers and helps them to carry out organic farming and Good Agricultural Practices (GAPs) in India through his cycle tours across different regions of the country. He educates farmers on the negative implications of using pesticides for their crops. He personally visits the farmer fields and helps them by teaching the control measures for pests, diseases and nutrient deficiencies. He seeks these advices on crop protection practices from Agricultural scientists at different KVKs and ICAR Institutes and Universities and Agricultural Officers all over India.

He teaches techniques of organic farming and has devised marketing channels and selling points for farmers produce. Today, all these farmers are earning and producing more with limited resources. As of now he has travelled 26000 Kilometers and trained more than 70,000 farmers. He is helping them to produce 1,000 kilograms of food every month. At 2018, he successfully tied up with International agriculture institutes and housing societies to sell the harvest.

He visits research institutes, KVKs and ICAR Institutes and Universities, Agricultural colleges to learn about the strategies to combat the problems encountered in Agriculture from Agricultural Experts, Scientists and Professors in these places. His young talent is being supported by many states in northern parts of India. The main aim of this article is to create awareness among farmers in southern parts of India about his tireless good efforts done for the farmers and this article also carries one of his success stories about Cucumber which was practically carried out and can be adapted by farmers in South India when they encounter the same problem.

### Success story of Neeraj on Cucumber fields of Haryana

- ✓ Farmer Name: Vikas Malik
- ✓ Place: Gohana, Sonipat, Haryana
- ✓ Cropping pattern: Cucumber intercropped with Sugarcane
- ✓ Variety: $F_1$ HY Manish
- ✓ Quantity of Vermicompost used: 200 Kg for half acre (applied only around the roots of plant)
- ✓ Frequency: Applied once throughout the cropping period
- ✓ Duration: 4 months
- ✓ Date of Sowing: 18 February
- ✓ Harvest: 30 May
- ✓ Problem: Bitter taste and drying up of the fruit
- ✓ Benefits after application of Vermicompost: Bitter taste and drying up of fruit got rectified


**Yellowing, Drying and bitter tasting fruit**

**The fruit turned out to be normal**

## Conclusion

This experience is a standing example indicating the success of organic farming. Application of Vermicompost is beneficial to soil dwelling micro – organisms as well as improves soil health. Hence, application of insecticides can be avoided and farmers can "Go Organic" to maintain soil health and avoid the hazardous effects of insecticide application.

## Acknowledgement

The authour is thankful to "The Bicycle Man of Indian Agriculture**"** for his enormous support and being kind enough to share his practical experience which helped in bringing out this article for the benefit of farmers.

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# MUTATION BREEDING IN VEGETBLE CROPS

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## INTRODUCTION

Mutation refers to the sudden heritable changes in the organism. The mutation might be due to change in chromosome, gene, or plasmagene. Mutation that is produced by the change in base sequence of the gene is known as gene mutation or point mutation.The chromosomal mutation is change in structure of chromosome. The structural change in the structure are due to large deletion, duplication, inversion, translocation and chromosome number changes. Mostly the mutations are lethal to organisms. Only few mutations are said to beneficial for organisms. In addition to, by mutation inducing agents, breeder could induce some preferred changes in genetic constitution of the vegetables and could improve the cultivated vegetable variety. The use of induced mutations for the improvement in crop is termed as mutation breeding. Freisleben and Lein in 1944, coined the term mutation breeding to refer the deliberate induction and mutant lines development for the purpose of crop improvement (Jankowicz-Cieslak *et al.,* 2017& Oladosu *et al.,* 2016).

## SPONTANEOUS AND INDUCED MUTATIONS:

**(1) Spontaneous mutation:** These are the mutation that occurs naturally. It occurs in organism without any treatment at a very low rate. Frequency of spontaneous mutation is about $10^{-6}$.

**(2) Induced mutation:** These are the mutations induced through treatment with physical or with chemical mutagen. Agents that are used for inducing mutation are referred as mutagens.

## CHARACTERISTICS OF MUTATION:

- ✓ Mutations are recessive; the dominant mutations occur naturally.
- ✓ Some of the mutations are recurrent, occurring again and again
- ✓ Mutations are mostly harmful to organism; only a small percentage of it is said to be beneficial.
- ✓ The induced mutations usually exhibits pleotropy.
- ✓ Occurs randomly in chromosome, but might occur in any of the gene.
- ✓ Some of the genes exhibit higher mutation than others.

### Mutagens:

Agents that induces mutation in organism are referred as the mutagens. There are several classes of the mutagens that are based on their physical or chemical nature. These mutagens induce the mutations in genome through chemical or structural modification in DNA (Chaudhary *et al.,* 2019).

**MUTAGEN**

**Physical mutagen**

**Chemical mutagen (EMS, MMS, etc.)**

## MUTATION BREEDING

The use of induced mutation for the crop improvement is known as mutation breeding. In this, the desirable mutations are induced in the crop plants with mutagens. Variability by induced mutations are either released as a new variety or used as parent for further breeding programmes. Treating the biological materials with mutagenic agents for inducing mutation is know as mutagenesis (Kharkwal *et al.,* 2004). The following are the steps involved in mutation breeding **(Fig 1)**:


**Fig 1: STEPS IN MUTATION BREEDING**

## MUTANT VARIETY IN VEGETABLE CROPS

The following are some of the vegetable variety that are developed through mutation

| Crop | Mutant varieties |
|---|---|
| Tomato | PKM 1, CO 3, Pusa Lal Meeruti |
| Brinjal | PKM 1 |
| Chilli | MDU 1 |
| Snake Gourd | PKM 1 |
| Okra | EMS 8 |
| French bean | Pusa Parvati |
| Palak | Jobner Green |

## ADVANTAGES OF INDUCED MUTATIONS FOR CROP IMPROVEMENTS:

- Mutation breeding are used for both polygenic and oligogenic traits.
- $F_1$ hybrids that are obtained from the inter varietal cross are treated with the mutagenic agent to enhance variability.
- Improves physiological and morphological traits.
- Induced mutations induces needed mutant alleles in the plants.
- Quantitative traits characteristics of the plants such as yield could be improved through induced mutations
- Improve specific characters of the well-adapted and the high yielding variety.
- Improve disease resistance in plants.

## DISADVANTAGES OF THE MUTATION BREEDING

- Frequency of the desirable mutation would be too low.
- Breeders has to screen huge population for selecting desirable mutation.
- The desirable mutations are mostly associated with the undesirable side effects.
- Mutations commonly produce the pleiotropic effects.
- History of parent variety is difficult to be traced out.
- Numerous problems in mutant variety registration.
- Many mutations are found to be recessive and their effects are not expressed.

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# OPTIMISTIC IMPACT OF COVID-19 LOCKDOWN ON ENVIRONS

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## Introduction

The inquiry concerning COVID-19 pandemic being a gift from heaven for individuals or not cannot be replied, yet it would appear to be one for the climate. Following the flare-up of the Covid, numerous nations had embraced lockdown methods that prevented individuals from moving out and for shops and different foundations to shut down Pridmore., (2020). Before the beginning of the COVID-19 pandemic, the air around us had been considered exceptionally poisonous to take in because of the measure of ozone depleting substances that had been transmitted throughout the long term (Bera *et al*., 2020). The Earth confronted rising temperatures, which thusly prompted the dissolving of icy masses and ascending of ocean levels. Ecological corruption was occurring quick because of the consumption of assets like air, water and soil Hickey., (2020). In any case, after the Covid lockdown initiated, there have been slight changes in the climate.

## Impact of COVID-19 Lockdown on Environment

### Air Quality:

After the lockdown was set up in numerous nations, there was lesser voyaging done by individuals, regardless of whether it be by their own vehicles, or via prepares and flights. Indeed, even businesses were shut down and not permitted to work (Holland *et al.,* 2020). This thus prompted the contamination noticeable all around dropping essentially, as there was a stamped decrease in nitrous oxide discharge (Zuo *et al*., 2020).

### Water Quality:

Since there were no boats, regardless of whether they be fishing or joy ones, employing on the streams and streams, the water has cleared up. In regions like Venice, the water turned out to be obvious to the point that the fish could be seen and there was better water stream. Almost certainly, in view of the lesser human footfall even the seas are recuperating and marine life is flourishing Baker., (2020).

### Impact on Wildlife:

Again where fish is concerned, the lockdown has seen a decrease in fishing, which implies that the fish biomass will increment after over-fishing nearly drained it. Aside from that, creatures have been spotted moving about uninhibitedly where once they would not challenge to go. Indeed, even ocean turtles have been spotted getting back to regions they once stayed away from to lay their eggs, all because of the need human obstruction, Singh, S. and Ranjith, M. (2021).

## Effect on Vegetation:

Plants are growing better because there is cleaner air and water, and because yet again there is no human interference. With everything at a standstill, plants are allowed to thrive and grow and produce more coverage and oxygen. Less litter also means lesser clogging of river systems, which is good in the long run for the environment, Singh, S. and Ranjith, M. (2021).

## Conclusion

In conclusion, though there has been a positive impact on the environment due to the lockdown, there is fear that once people start travelling again or go back to doing what they have been doing, all the positive impact will also disappear.

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# BIOLOGICAL CONTROL AS A TOOL OF PLANT DISEASE MANAGEMENT IN ORGANIC FARMING

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## Introduction

Organic agriculture has increased in importance worldwide over the past 20 years, with growth rates of more than 10% per year in many countries. By 2014, approximately 2 million certified organic producers farmed more than 43 million hectares of certified organic agricultural land. Organic crop production is partially characterized by the absence of synthetic pesticides and fertilizers, but practices that promote ecosystem health are even more important. The emphasis is mainly on the application of naturally occurring antimicrobial organic substances also application of antagonistic microorganism as tools for sustainable productivity and management of pests, diseases, and weeds.

## What is Biological control:

Biological control is a mechanism in which the natural enemies to diminish the number of destructive organism, which could be in any form, small bacterium to large animals. This mechanism includes the use of predators, competitors, pathogens and compounds of biological origin.

According to Garret (1965), "Biological control of plant disease may be precisely defined as any condition or practice whereby survival or activity of a pathogen is reduced through the agency of any living organism (except man himself) with the result that there is reduction in incidence of the disease caused by the pathogen."

## Why Biological control:

Biological control is eco-friendly, and the diversified microbial world provides endless resources for biologically active molecules which can stably inhabit the environment as non dominant species but maintain their effectiveness in suppression of plant pathogens.

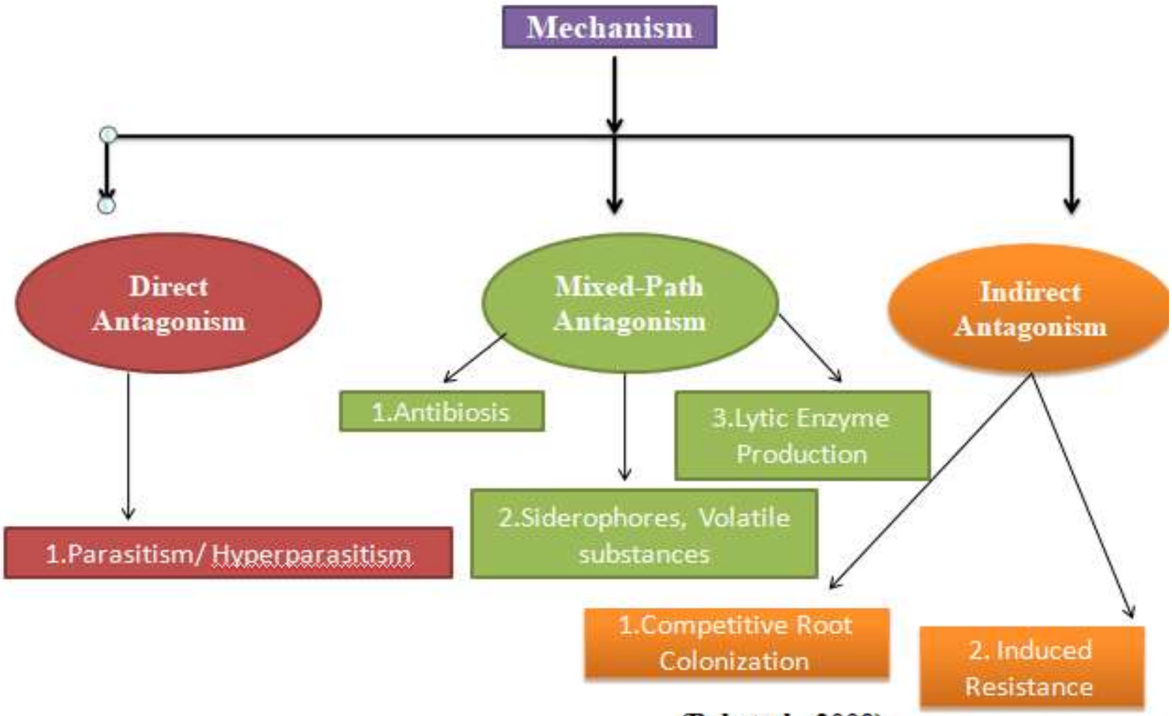
## Advantages of biological control:

- It is comparatively easier to manufacture biocontrol agents.
- It can eliminate the specific pathogens effectively from the site of infection and can be used in combination with biofertilizers.
- Biocontrol agents are very effective for a large number of soil-borne pathogens.
- Biocontrol agents do not cause any toxicity to the plants.
- Biocontrol agents avoid problems of resistance.
- Biological control is self-regulating and helps to preserve the ecosystem.

### Disadvantages of biological control:

- Biocontrol agents work slowly.
- No Broad spectrum activity.
- The antagonists and shelf life of biocontrol agents are short. For example, the shelf life of *Pseudomonas fluorescens* is 3 months and of *Trichoderma viri*de is 4 months only.
- Skilled persons are also required for multiplying and supplying the biocontrol agents without contamination

### Mechanisms of Biological Control:




(Pal et al., 2009)

### Hyper parasitism:

Hyperparasites are the agents that are parasites of harmful plant pathogens. They reduces the disease producing capacity of the pathogens by involving direct physical contact with the pathogen and causes hyphal lysis. Sclerotia or may parasite growing hyphae by coiling around them. The mycoparasites penetrates resting structure. A classic example is the Hypovirus, a hyperparasitic virus on *Cryphonectria parasitica*, a fungus causing chestnut blight.

### Antibiosis:

Antibiosis came from the term Antibiotics which refers to organic substances produced by microorganisms that affect the metabolic activity of other microbes and growth. Many organisms especially soil fungi and actinomycetes produce antibiotic substances. The result of antibiosis is often death of microbial cells by endolysis and breakdown of the cell cytoplasm. *Agrobacterium radiobacter* K-84, produced commercially as Agricon 84, was first recognized as a valuable control agent of crown gall since 1973.

### Siderophores:

Siderophores are ligands with low molecular weight having high affinity to sequester iron from the micro-environment. It has the ability to sequester ferric ion and competitively acquire iron from iron-limiting environment thereby preventing growth of other microorganisms. Two major classes of siderophores, classified on the basis of their functional group, are catechols and hydroxamate. A mix of carboxylate-hydroxamate group of siderophores is also reported. Numerous strains of *Streptomyces spp*. have been reported as siderophore producers, namely, *S. pilosus* . *Pseudomonas fluorescence* produces Ferribactin, pyoverdine, pseudobactin which have high affinity towards ferric ion.

### Volatile substances:

Apart from the production of antibiotics, some biocontrol agents are also known to produce volatile compounds as tools for pathogen inhibition. Common volatile compounds are hydrocyanic acid (HCN), certain acids, alcohols, ketones, aldehydes and sulphides. HCN production is reported to play a role in disease suppression, for instance. HCN production by strains of *P. fluorescens* that helped in the suppression of black root rot of tobacco.

### Lytic Enzyme:

Many microorganisms secrete and excrete lytic enzymes that can hydrolyse a wide range of polymeric compounds, including hemicellulose, cellulose, chitin, DNA and proteins. *Serraia marcescens* ,*Streptomyces scabies* was found to be inhibitory against *Sclerotium rolfsii, Fusarium spp.*

### Competitive Root Colonization:

From the microbial perspective, living plant surfaces and soils are often nutrient restricted environments. Nutrient limitation is an important mode of action of some biological control agents. Carbon plays an important role for competition of root colonization for nutrients such as *Trichoderma spp*. Carbon competition between pathogenic and non-pathogenic strains of *F. oxysporum* is one of the main mechanisms in the suppression of *Fusarium* wilt. Ability of bio control agents to colonize specific substrates or sites provides protection to infection site from pathogen attack.

### Plant Growth Promotion Through SAR and ISR:

Chemical stimuli are produced by some biocontrol agents, i.e. non-pathogenic plant growth-promoting rhizobacteria (PGPR) and fungi (PGPF), or by soil- and plant associated microbes. Such stimuli can either induce a sustained change in the plants which increase the capacity of tolerance to infection by pathogens or induce the local and/or systemic host defences of the whole plant against broad-spectrum pathogens. This phenomenon is known as induced resistance. Two types of induced resistance are distinguished in plants, systemic acquired resistance (SAR) and induced systemic resistance (ISR). The first of the two pathways is mediated by salicylic acid (SA) which is frequently produced after pathogen infection and induces the expression of pathogenesis-related (PR) proteins that include a variety of enzymes. The second method is mainly Jasmonic acid (JA) and/or ethylene mediated following the applications of some nonpathogenic rhizobacteria.

**Table 1**

| Mechanism | Biocontrol agent | Target pathogen |
|---|---|---|
| 1.Hyperparasitism | *Phlebiopsis gigantea* | *Heterobasidion annosum* |
| | *Ampelomyces quisqualis* | *Powdery mildew fungi* |
| | *Trichoderma is* | *Rhizoctonia, Sclerotium* |
| 2. Siderophore | *Pseudomonas fluorescence 3551* | *Pythium ultimum* |
| | *Pseudomonas putida WCS 358* | *Fusarium oxysporum f. sp. raphani* |
| 3.Volatile substances | *Pseudomonas putida N1R* | *P. ultimum* |
| 4.Competitive Root Colonization | *E. herbicola* | *Erwinia amylovora* |
| | *Pseudomonas spp* | *Botrytis cineria* |
| | *Trichoderma spp* | *Rhizoctonia solani* |

**Table 2**

| Mechanism | Antibiotic | Biocontrol agent | Target pathogen |
|---|---|---|---|
| 5. Antibiosis | Agrocin 84 | *Agrobacterium radiobacter* | *Agrobacterium tumefaciens* |
| | Gliotoxin | *Trichoderma virens* | *Rhizoctonia solani* |
| 6.Lytic enzyme | Chitinases | *Arthrobacter sp* | *Fusarium sp.* |
| | Glucanases | *Streptomyces sp.* | *Phytophthora fragariae* |

## Conclusion and Future Prospects:

The last century witnessed the rise of chemical pesticides and fertilizers, but only recently the hazardous effects of the injudicious use of these toxic pesticides and fertilizers have been observed. Thus it almost became a necessity to explore either the stress-tolerant stains of biocontrol agents or to produce them through biotechnological interventions. Sequencing of both agriculturally important and harmful genes of Biocontrol agents is advocated for strain improvement. The Biocontrol agent plant molecular interaction should be provoked, which will lead to functional understanding of underlying molecular mechanisms of biocontrol. Currently, biggest hindrance in commercialization of BCAs is their poor shelf life. Thus, it would be of utmost importance to develop formulations with improved shelf life.

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# STRUCTURE – ACTIVITY RELATIONSHIP OF ORGANOPHOSPHATES AND ROTENONE

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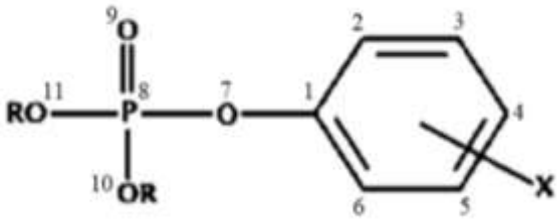
## SAR

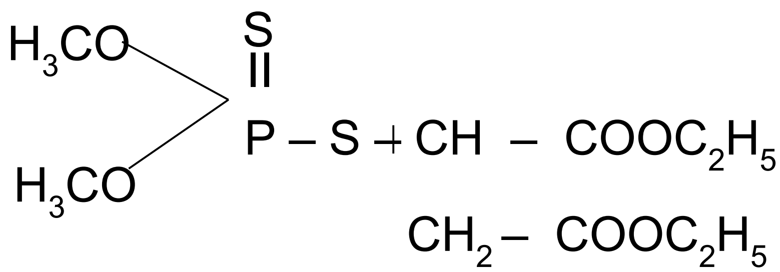
The SAR is the relationship between the chemical or 3D structure of a molecule and its biological activity. The analysis of SAR enables the determination of the chemical groups responsible for evoking a target biological effect in the organism. This allows modification of the effect or the potency of a bioactive compound by changing its chemical structure.

**Structure of OP derivatives**

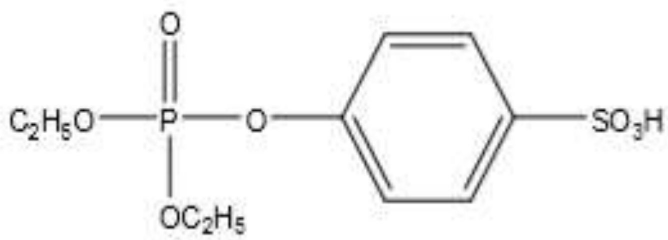


## Example for SAR

In Malathion because the presence of carboxyl groups, they are subjected to mammalian hydrolysis. This makes the insecticide less harmful to mammals and humans. $LD_{50}$ 1375 – 2800 mg/kg.



**Chemical structure of Benzene sulfonic acid**



### Placement of molecules in R and X position decides the SAR

| Compound | R | X | -Log $LD_{50}$ |
|---|---|---|---|
| 1 | $CH_3$ | H | 2.75 |
| 2 | $CH_3$ | 3-$CH_3$ | 2.00 |
| 3 | $CH_3$ | 4-$CH_3$ | 1.99 |
| 4 | $CH_3$ | 4-$OCH_3$ | 2.00 |
| 5 | $CH_3$ | 3-Cl | 2.10 |
| 6 | $CH_3$ | 4-Cl | 2.60 |
| 7 | $CH_3$ | 3-Br | 4.00 |
| 8 | $CH_3$ | 4-Br | 3.53 |
| 9 | $CH_3$ | 3-CN | 4.99 |
| 10 | $CH_3$ | 4-CN | 4.84 |
| 11 | $CH_3$ | 3-$NO_2$ | 4.90 |
| 12 | $CH_3$ | 4-$NO_2$ | 5.10 |
| 13 | $C_2H_5$ | H | 3.20 |
| 14 | $C_2H_5$ | 4-$CH_3$ | 3.00 |
| 15 | $C_2H_5$ | 3-Cl | 3.80 |
| 16 | $C_2H_5$ | 4-Cl | 3.72 |
| 17 | $C_2H_5$ | 3-Br | 4.11 |
| 18 | $C_2H_5$ | 4-Br | 4.06 |
| 19 | $C_2H_5$ | 3-CN | 5.00 |
| 20 | $C_2H_5$ | 4-CN | 5.10 |
| 21 | $C_2H_5$ | 3-$NO_2$ | 5.10 |
| 22 | $C_2H_5$ | 4-$NO_2$ | 5.20 |
| 23 | $C_2H_5$ | 2,4-Cl | 4.30 |
| 24 | $C_2H_5$ | 2,5-Cl | 4.10 |
| 25 | $C_4H_9$ | H | 2.50 |
| 26 | $C_4H_9$ | 3-$CH_3$ | 2.00 |
| 27 | $C_4H_9$ | 4-$CH_3$ | 2.10 |
| 28 | $C_4H_9$ | 4-$OCH_3$ | 2.10 |
| 29 | $C_4H_9$ | 3-Cl | 2.80 |
| 30 | $C_4H_9$ | 4-Cl | 2.50 |
| 31 | $C_4H_9$ | 4-Br | 2.95 |
| 32 | $C_4H_9$ | 3-CN | 4.00 |
| 33 | $C_4H_9$ | 4-CN | 4.01 |
| 34 | $C_4H_9$ | 3-$NO_2$ | 4.21 |
| 35 | $C_4H_9$ | 4-$NO_2$ | 4.38 |

### Rotenone

Rotenone was isolated from the roots of *Derris elliptica.* It got its name 'rotenone' as it showed the characters of 'Ketone'. Correct molecular structure ($C_{23}H_{22}O_6$) was proposed by Takei and Koide (1929). It is very toxic to fish and hence used as fish poison. It is respiratory poison. Oral $LD_{50}$ in rats is 132 mg / kg.

### Cube resins

The active ingredient in the root extract is Cube resin. It is present in decreasing order in Rotenone

(1) < Deguelin

(2) - the 6a, 12a - dehydro derivatives of rotenone

(3) < Deguelin

(4) < 13-homo-13-oxa-6a,12a- Dehydro analogues Oxadehydrorotenone

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(5) < Deguelin

(6) cis-13-homo-13-oxarotenone and

(7) trans-isomer

### Comparison of potency

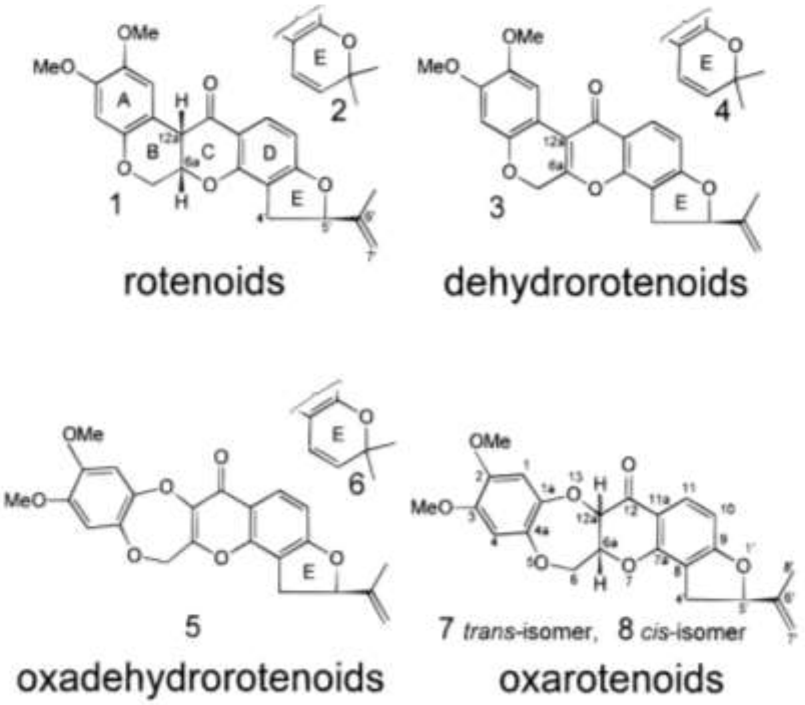
1 was 7 – 15 fold more active than 2 in the cytotoxicity assays.

### Maximum and minimum potency

The observed potency increase on conversion of dehydrorotenone to either rotenone or oxadehydrorotenone suggests that combining both structural changes to form cis-13-homo-13-oxarotenone might result in maximal activity. 5 was reduced with diisobutylaluminum hydride to the trans-isomer 7 and then epimerized with aqueous pyridine to the cis-isomer 8 of the same configuration as 1.

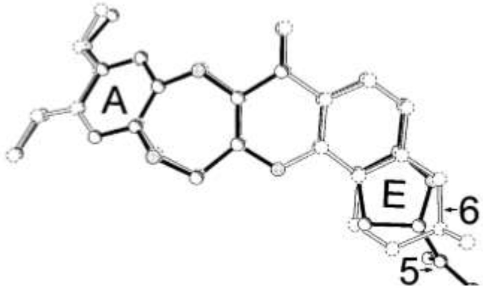
### Toxicity order

8 was much less active than 1. This is rationalized on the basis of conformational changes in the B/C ring system and decreasing dihedral angle (determined by X-ray crystallography and/or molecular modelling) between the A and D rings that follow the potency order. Rotenoids 1 and 2 > oxadehydrorotenoids 5 and 6 > trans and cis-oxarotenoids 7 and 8 > dehydrorotenoids 3 and 4.




### SAR of rotenone

Comparison of the conformations of rotenoids 5 and 6 with different E rings based on X-ray crystal structures. This is the first crystal structure reported for a rotenoid with a gem dimethylpyran moiety.




## Mode of action

It is a respiratory inhibitor enzyme resulting in failure of respiratory functions. It hinders the energy production by preventing the phosphorylation of Adenosine diphosphate (ADP) to Adenosine triphospate (ATP). This interference blocks oxidative phosphorylation by acting between $NAD^+$ and coenzyme Q. It is oxidized to non – insecticidal compound in the presence of light and air

## Toxicity symptoms

Acts as contact and stomach poisons in insects. Kills insects slowly but stops feeding immediately. Activity is lost in 1-3 days if exposed to sun. Some cases mouthparts become paralyzed, stop feeding and die of saturation. Poisoning symptoms are inactivity, locomotive instability, knockdown, paralysis and slow death. Death is mostly because of respiratory failure.

## Toxicity symptoms in mammals

Rotenone poison in man include conjunctivitis, dermatitis, pharyngitis and rhinitis. On ingestion it produces gastro intestinal irritation, nausea and vomiting. Inhalation of dust is more hazardous and it can cause respiratory stimulation followed by respiratory depression, in-coordination, convulsions, muscle tremors and death from respiratory failure.

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# MANAGEMENT OF AVIAN PESTS IN CROP PLANTS

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## Introduction:

Indian agriculture is facing various production constraints by abiotic and biotic factors. Among them the pests are one of the serious problems associated with both annual and perennial crops. Though pests like insects, pathogens and weed plants are forms the major pest status, of late the vertebrate pests like birds, animals and other miscellaneous groups are gaining importance. Recently damage to agricultural crops by avians/birds is increasing year by year due to the facts that the reduction in forest land and green cover and migration to agricultural fields from forest areas for food and survival. India has worldwide identification for its heritage, rich biodiversity and that leads to attention of conservation of some of the group of animals and bird. This become complicate the management tactics where the policy makers have to be careful in formulating the management strategies

## Avian as pests of crops:

Birds cause considerable damage to growing field crops, fruit trees, orchards, and threshing yards and in houses. Bird activities results the damage of crops and grains in grain stores and rice-shelling yards which vary state to state and area to area. In India most of such activities of birds are either advantageous or disadvantageous to the formers. Birds create negative impact on most of agricultural activities. The food of the birds is of mostly three types which depend on grains, seeds, fruits, green vegetation of the crop plants and grasses, insects, other arthropods rodent, etc. found in soil, crops and other plants. Birds plays dual role in Indian agro-ecosystem as pests as well as natural predators as feeding on small insects. Some of the bird species which act as pests to agricultural crops are described hereunder:

### House sparrow - *Passer domesticus*

They are omnivorous birds, eats grain, insects, fruit buds, flower nectar and kitchen scraps. It causes severe damage to sorghum, smaller millet, wheat, rice and small succulent fruits both under field conditions and in storage. It usually lives and build its nest in a hole in ceiling niche in wall, inverted lamp shade and every conceivable site within or without an occupied building.

### Parrot - *Psittacula krameri, P. cyanocephale*

Parrot is one of the most familiar of Indian birds. They often band into large flocks. It is highly destructive at all times to crop and orchard fruit, gnawing and wasting far more that it actually eats and cause heavy damage to agricultural and horticultural crops specially to sunflower, maize, sorghum, smaller millets, wheat, gram, pea, guava, jamun, mango, papaya and other fruits.

**Crow - *Corvus splendens***

It is the most familiar bird of Indian towns and villages. Live in close association of man and obtain its livelihood from his works. They have been reported to cause heavy damage to maturing or ripe crops of agricultural and horticultural importance especially to sorghum, groundnut, wheat, chillies, smaller millets, papaya, mango, guava, etc.  Besides they are also menace to poultry farming as they take away young chicken and eggs and to the livestock breeder as they peck the eyes out of newly born lambs. It is also a useful scavenger.

**Pigeon - *Columba livia***

It is a grey coloured bird with its neck and upper breast of a greenish, purple and mangenta sheen. Two dark bars on the wings and a band across the tail are prominent. The pigeons can be commonly seen on old buildings, churches, temples, railway stations, warehouses, etc. They are well adapted to noisy places. They fly to threshing floors, grain fields, and pickup grains. Since they fly in large numbers, the losses are high.

**Bulbul - *Pycnonotus cafer***

Bulbul are found throughout India. They are common in gardens and light scrub jungles, both near and away from human habitations. Large numbers collect to feed on grain crops, newly sprouting vegetables and fruits and termite swarms.

**Extent of damage by avians:**

The percentage of birds feeding at the field site decreased non-linearly with increase in distance from the vegetation cover, nearly 76 per cent of the birds were concentrated within 5 m from the cover. Whenever birds fed more than 30 m away from cover, they significantly preferred to feed on taller rice plants. Tall varieties with open (wide) plant-spread, erect ear heads, more horizontal flag leaf and flag leaf not projecting above the earhead (type I variety) were preferred by birds as opposed to dwarf plant stature, compact plant spread, drooping earhead, and erect flag leaf that projected above the earhead (Subramanya, 1994).

Many crops are damaged by birds, with a little knowledge available of actual economic loss is done by House Sparrows, House Crow, Common Myna, Asian Koel, Greater Coucal, Red–vented Bulbul and Red Wattled lapwing Graze on the crop and most of the time uprooting them in search of wireworm and other soil invertebrates. The great damage to the crop is noticed when they are in mature stage by the Baya and Munias during the observations carried in Hyderabad, India and these birds with house crow can reduce the crop yield by more than 55 per cent. In addition to above list of birds, the rose ringed parakeet, *Psittacula Krameri* is the most common and the destructive birds of India which inflicts huge damage to grain of standing crops, orchard fruits and vegetable crops. A single Parakeet consume about 15.0 gm of sunflower seed per day. These birds can cause 10 to 40 per cent damage and may cause 90 per cent in isolated area in the field of sunflower where sunflower is an important edible oil seed crop in India. Continues research in Karnataka, India is going on evaluation of high yielding sunflower varies with less prone to bird depredation (Prakas *et al*, 2008). Birds like common Myna, Jungle Myna, Brahminy Myana, Jungle Crow and White Cheeked Bulbul damage the crops of grapes in a great extent of grapes in Himachal Pradesh, India. These damages can result not only limited to yield loss but also affects on grapes which decrease the quality of the wine. Thus bird pests constitute a significance limitation of productivity. Almost 90 per cent of the agricultural land is facilitated with sound irrigation system with adequate tube well and cannel arrangement and it produces 22 per cent of country's wheat, 9 per cent of rice and 6 per cent of cotton. According to estimation of damage potential it is found that loss due to bird is considerably large. These birds are also responsible for the activities like spoiling the site area, damaging the gunny bags and contaminated grains with their droppings in the grain stores. Such research indicates that the need of research in damage estimation in Maharashtra, which is also most important state in the field of agriculture and to develop the concerned measure. Indian Peafowl was assessed by Sathyanaryana (2004) in Tamil Nadu, and conclude that Peafowl consumed 0.99 gm/m2 area/day and total damage is estimated 1.9 per cent paddy tiller/m2 per day and he also suggests mitigation measure which is reflective ribbons as a bird scaring device which can save paddy, ground nut, onion and ladies finger. The damage to sorghum and pearl millet (bajra crop) is a major concern by birds like sparrows (different spp.), parrot, pigeon, etc. The sunflower is being mostly damaged by parrot, crows, and pigeon. The extent of damage varies as per location and area available for damage. In general 20-22 % damage is being noted on sorghum and bajra crop. However the sunflower damage extends to 25 to 65 % depending on the location of cropped area (Kale *et al*., 2012).

**Management of bird pests:**

Killing most of the birds are illegal in India in spite of that it is strong belief among the farmers that Killing the birds is considered as a surest way to free from the problem of birds and they use techniques which consist of shooting, trapping, fumigation, poison baiting, egg and nest destruction, killing with the help of gun and catching them in trap. All these will produce the damage to threaten and migratory birds and also produce damage to the conservation of biodiversity. Killing the birds is not a proper solution of the problem and such an attempt is disapproved on the international background such as mass killing of *Quelea* in Africa and *Sturnus vulgaries* in Europe. Importance of discussion about bird life in ecosystem is often neglected in the consideration of economic losses and present bird management programs are not implemented in the ecofriendly way because this nature of the damage, both spatially and temporally, is due to sporadic feeding behaviour and mobility of birds. India is known for its rich biodiversity and agriculture. The present bird management methods have been found to have far reaching consequences on the agro- ecosystem. They are disadvantageous to both bio-diversity and agriculture as they are neither scientific nor eco-friendly and result in endangering bird species while not making much of a difference to avoid agricultural loss. It is also found that the techniques like drum sticking, models of scares (statues like man), reflecting ribbons, crackers and catapult *(Kavan)* are not efficient enough to manage the problem permanently. After several observations it is concluded that bird repellent like neem powder and reflective ribbons are not effective for repelling the birds, though these techniques are ecofriendly. There is a need of interdisciplinary research in the development of ecofriendly bird repelling techniques. It is also concluded that visual estimation for the crops, fruits and grains damage is not accurate damage assessment process and there is future scope for research in the development of some scientific method for the assessment of these losses in India.

### The following are some of the methods can be used

- Repellents
- reflecting ribbons
- acetylene exploder
- gas exploder
- Bio- acoustic methods (distress call of birds)
- Different types of bird scarers
- Bird netting –standard bird net ¾" mesh size
- Hydroblast scarecrow – electronic repeller and motion activated scarecrow sprinkler systems scares away birds
- Stainless steel bird spikes – keep birds off
- Avishock – give mild electronic shock and ride off birds, use battery or low electric power
- Bird repellent liquids – available in liquids and gelly forms, spread around borders and corners, stick on the legs which bird will not enter the vicinity of the field

Some of the eco-friendly management strategies suggested by All India Co-ordinated Research Improvement Project (AICRIP) on Ornithology:

- Wrapping method on maize crop
- Reflective ribbons for bird scaring
- Bioacoustics
- Botanical Repellents
- botanical formulation like Bio-bird Repellent (BBR) and Fortune Aza (Neem formulation)
- Tobacco leaf decoction (10%) spray on sorghum at milk stage reduced bird damage

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## Birds species - Acts as pests to crops

**House sparrow**

**Parrot**

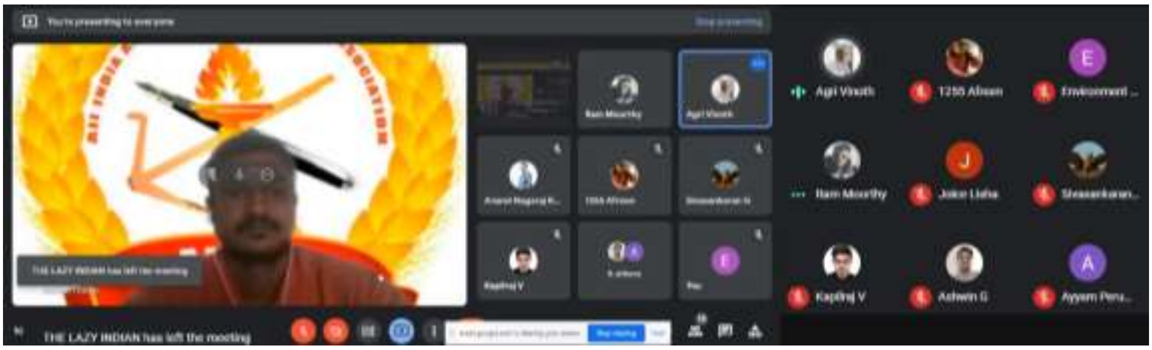
**Pigeon**

**Bulbul**

**Crow**

**On the eve of World Environment Day 5th June,2021 All India Agricultural Students Association, Tamil Nadu Organizes Special Lecture & National Level Quiz Programme & Launch of Environmental Cell in TNAIASA.** On the occasion of **World Food Safety Day, 7th June,2021 and World Ocean Day, 8th June,2021** All India Agricultural Students Association, Tamil Nadu Organizes **Video release on Corona Awareness.** As for the impact, efforts and hard work from the cabinet members of AIASA-Tamil Nadu. These events gain more outreach all over the country and sets a milestone to improve the next event in a betterway for the improvement of the Association in India.



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