# PERSISTENCE AND BIORMEDIATION OF ENDOSULFAN IN AGRICULTURE SOIL

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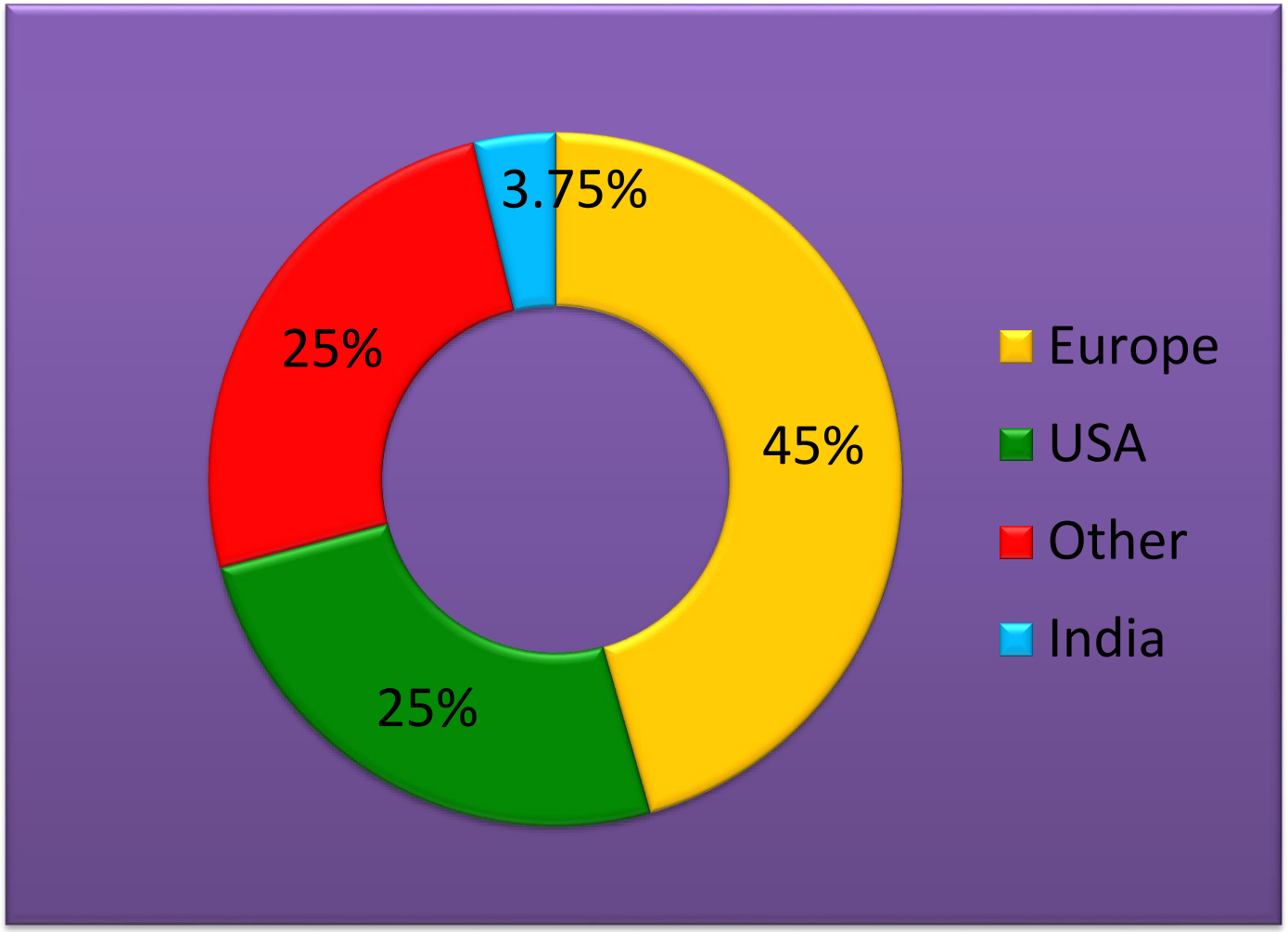
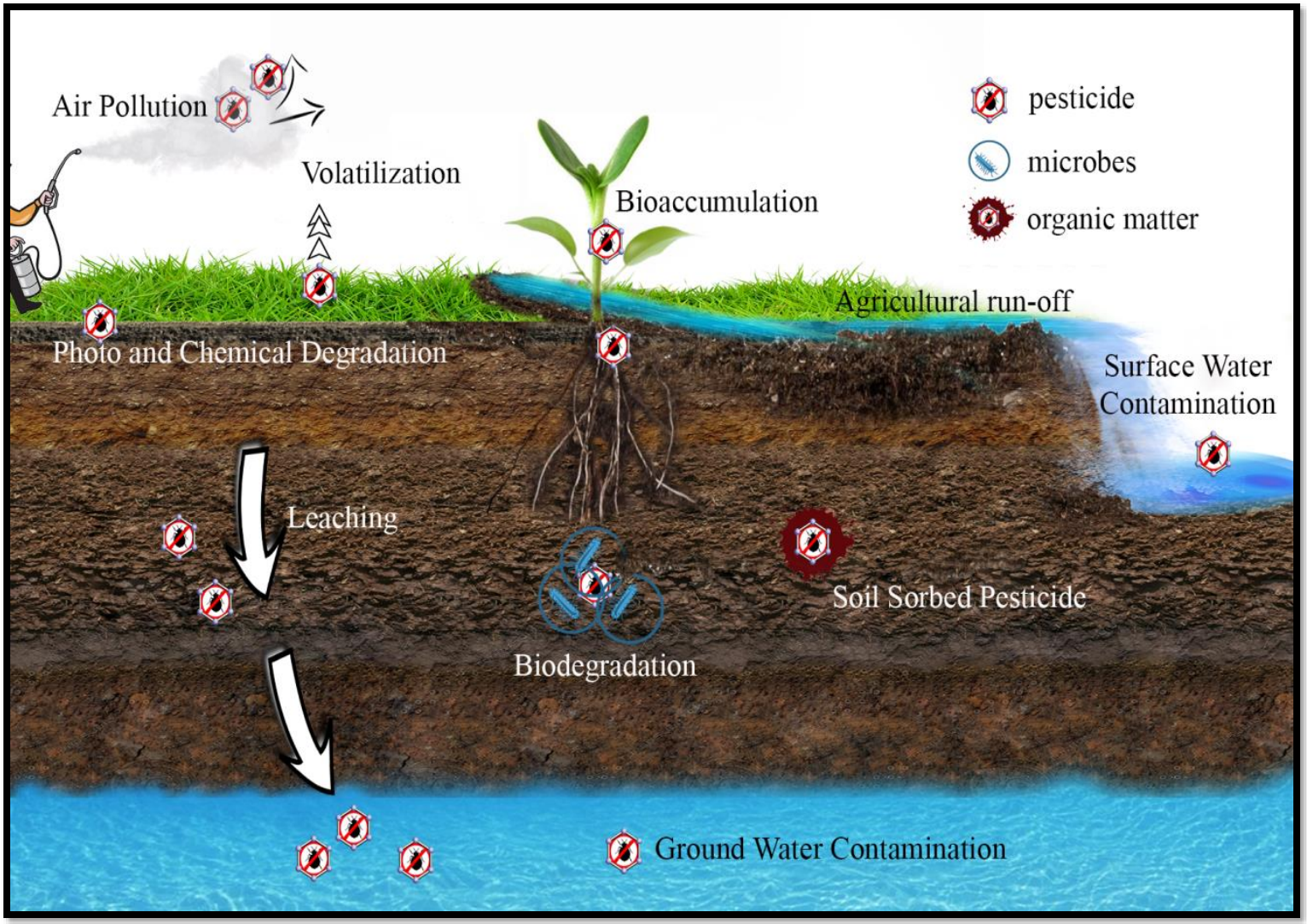
# PESTICIDE CONSUMPTION



# ENDOSULFAN – STATUS IN INDIA

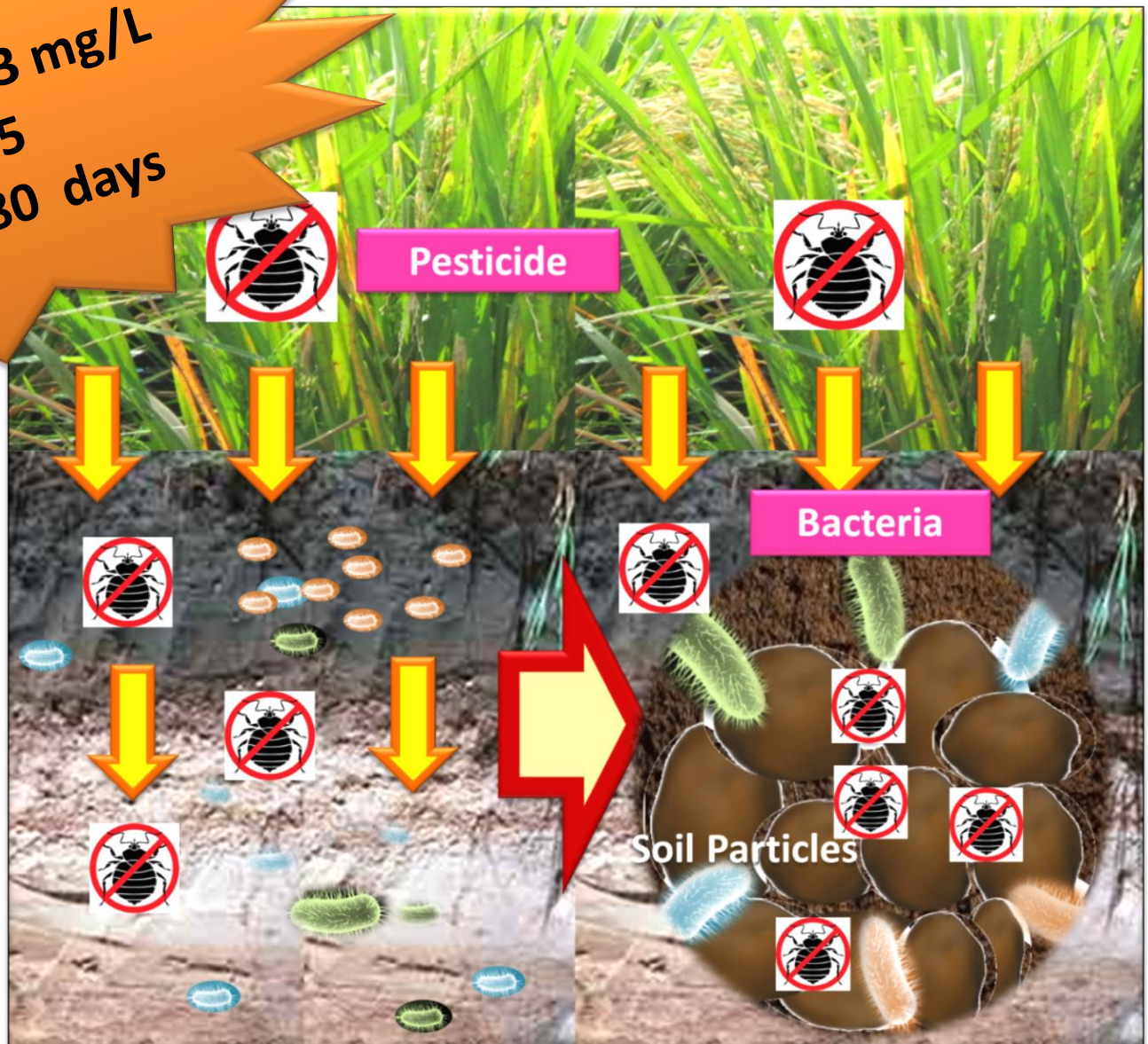
- The world's largest user of endosulfan, and a major producer
- 4500 tonne annually for domestic use and 4,000 tonnes for export.
- 2001- major suspect of endosulfan began owing to abnormalities noted in local children of Kasargod District of Kerala after aerial spraying of endosulfan on Cashew Plantation.
- Protest from Kerala & different regions of India resulted in the present ban on endosulfan production and usage under Stockholm Convention 2011.

# FATE OF PESTICIDES IN THE ENVIRONMENT

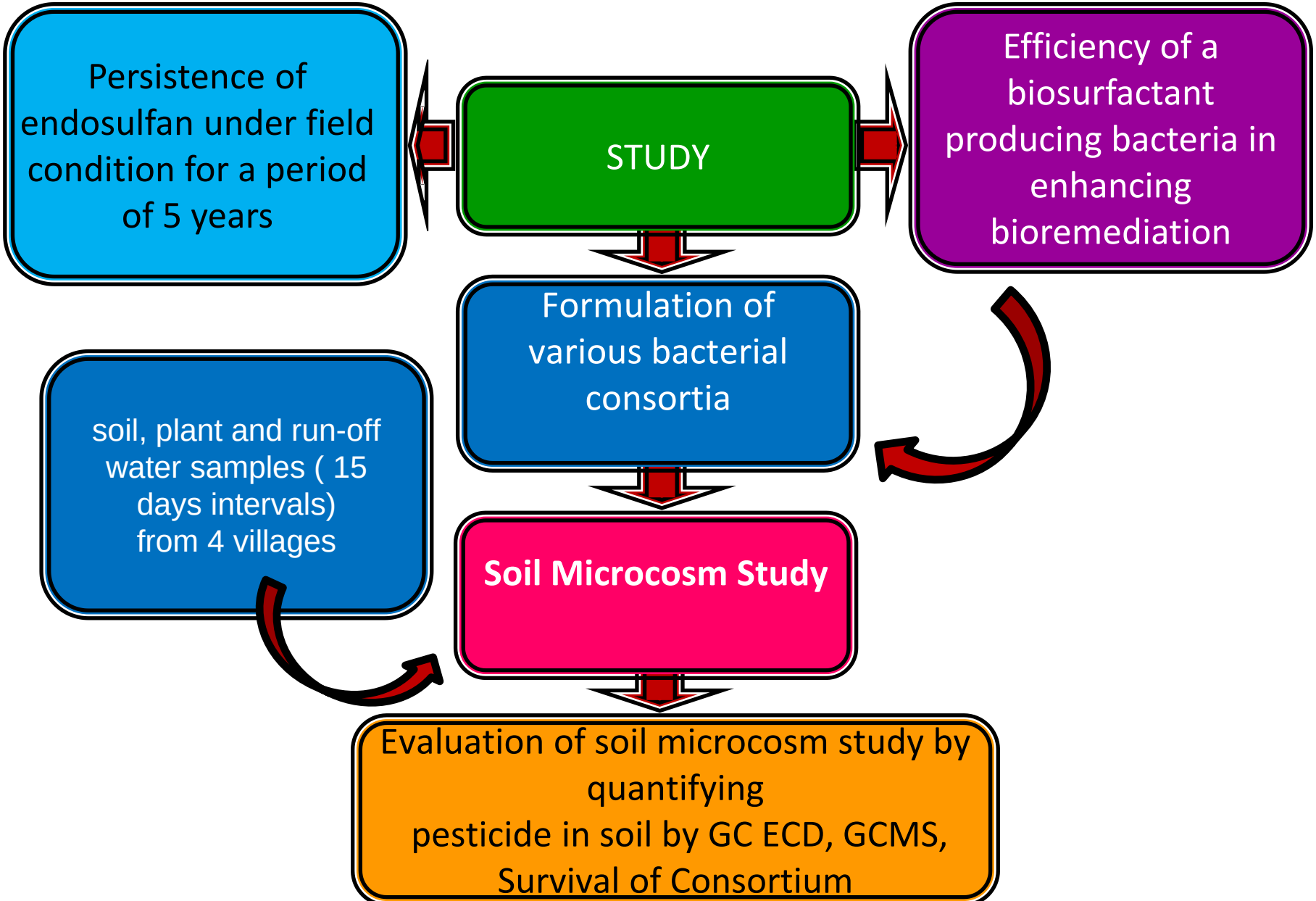


# PERSISTENCE-BIOAVAILABILITY

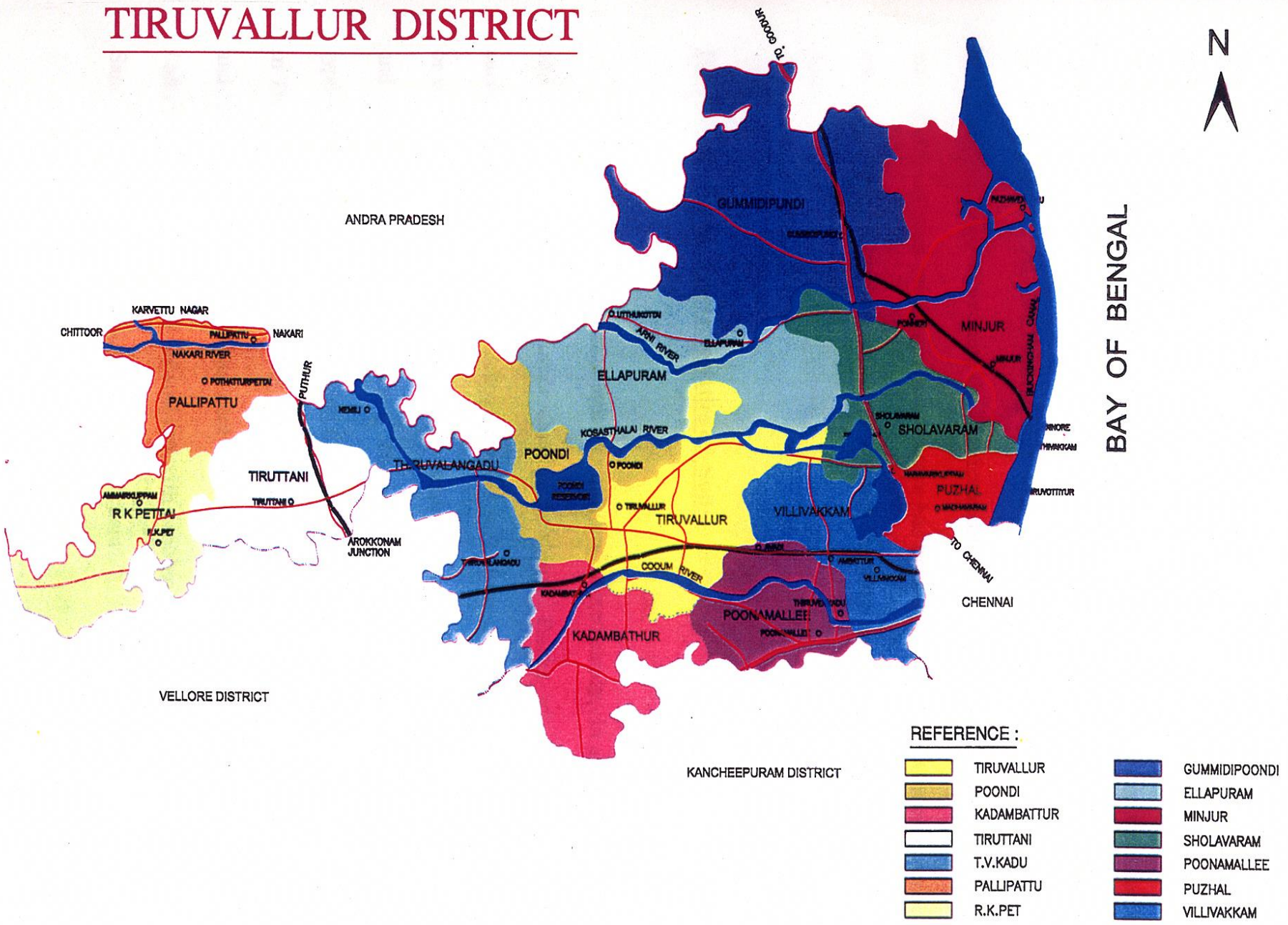
solubility-0.33 mg/L
koc-3.5
$t_{1/2}$ - 60-180 days



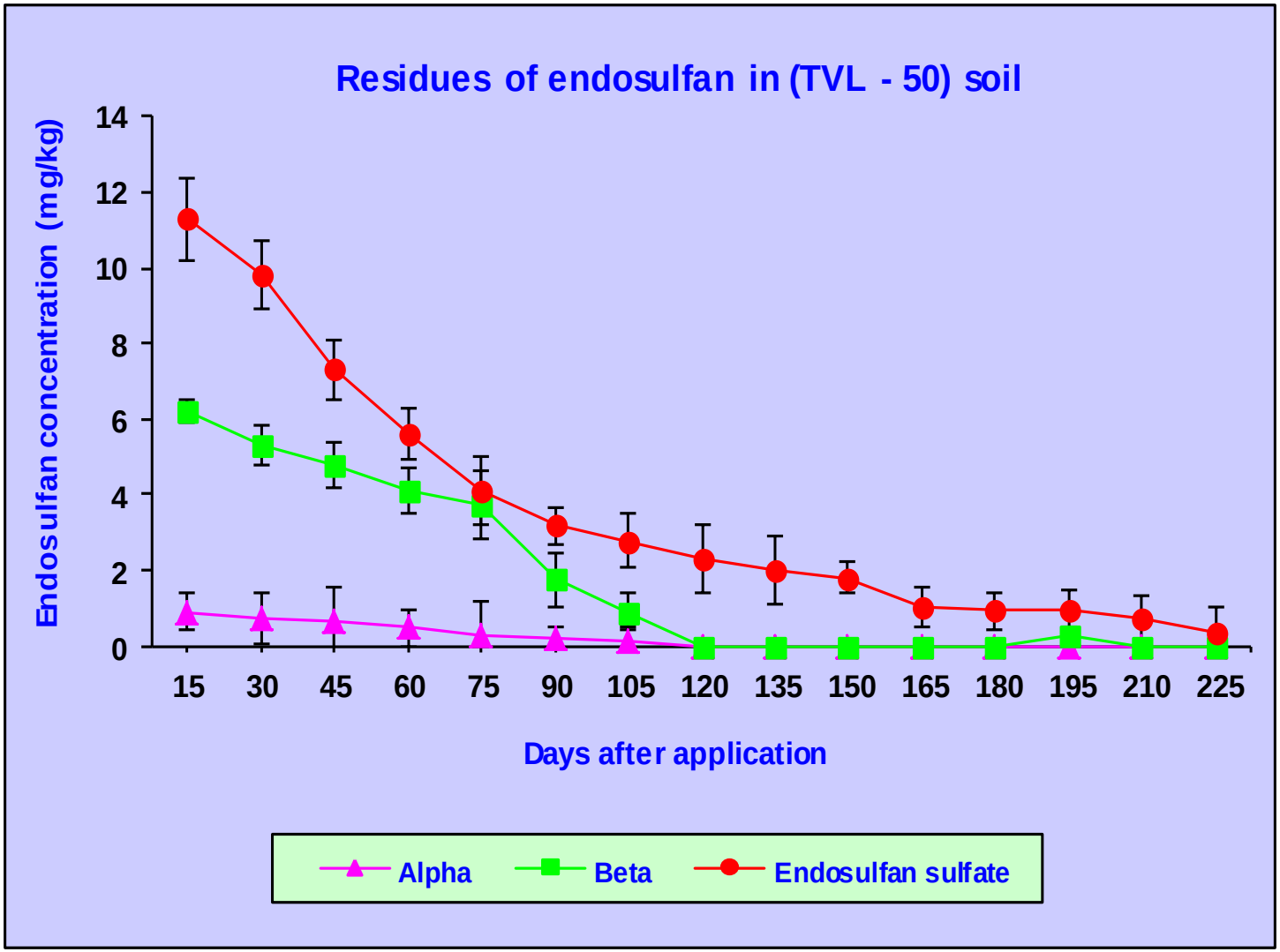
# STUDY OVERVIEW



# Map of Thiruvallur district



# PERSISTENCE OF ENDOSULFAN



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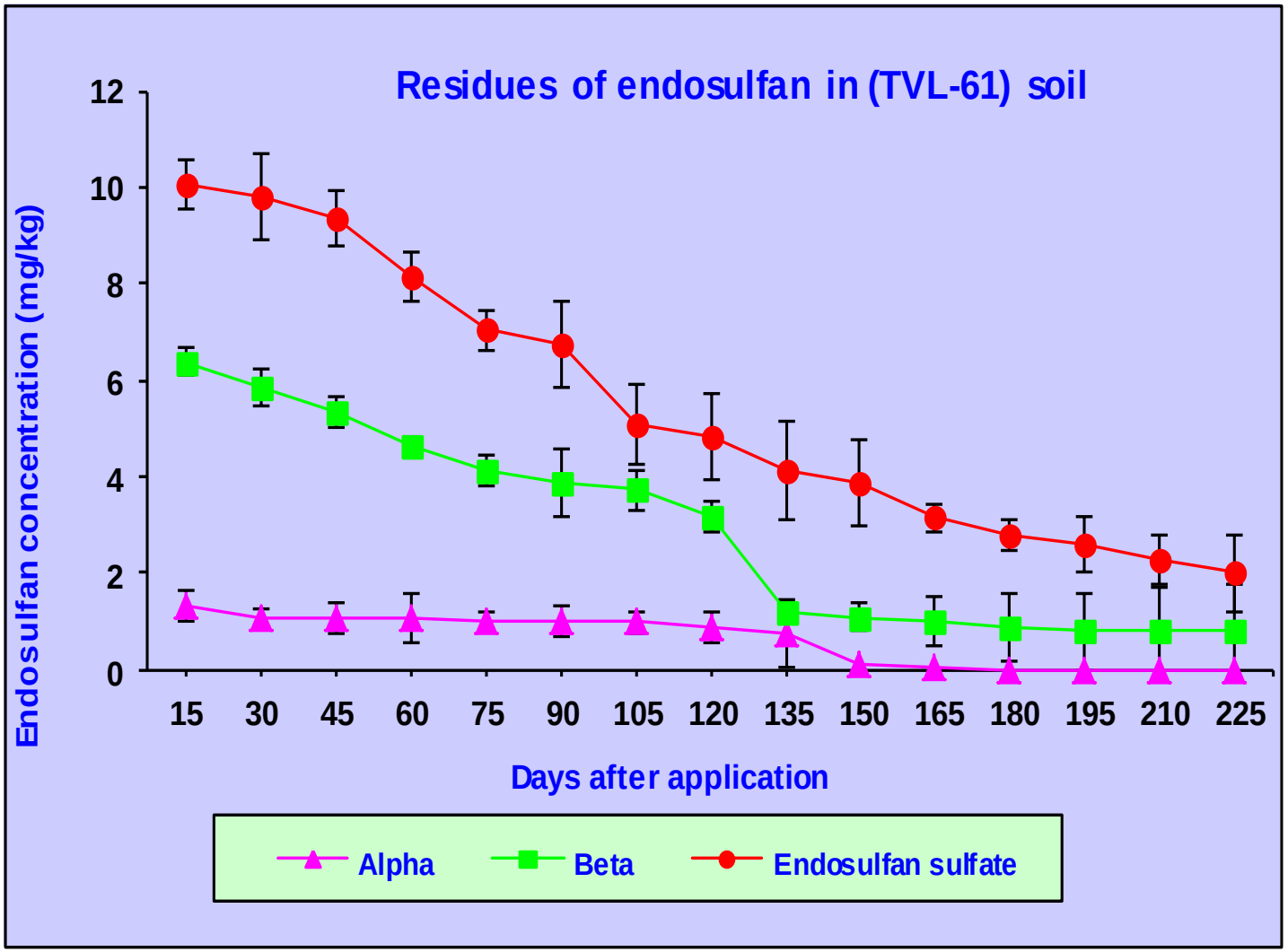
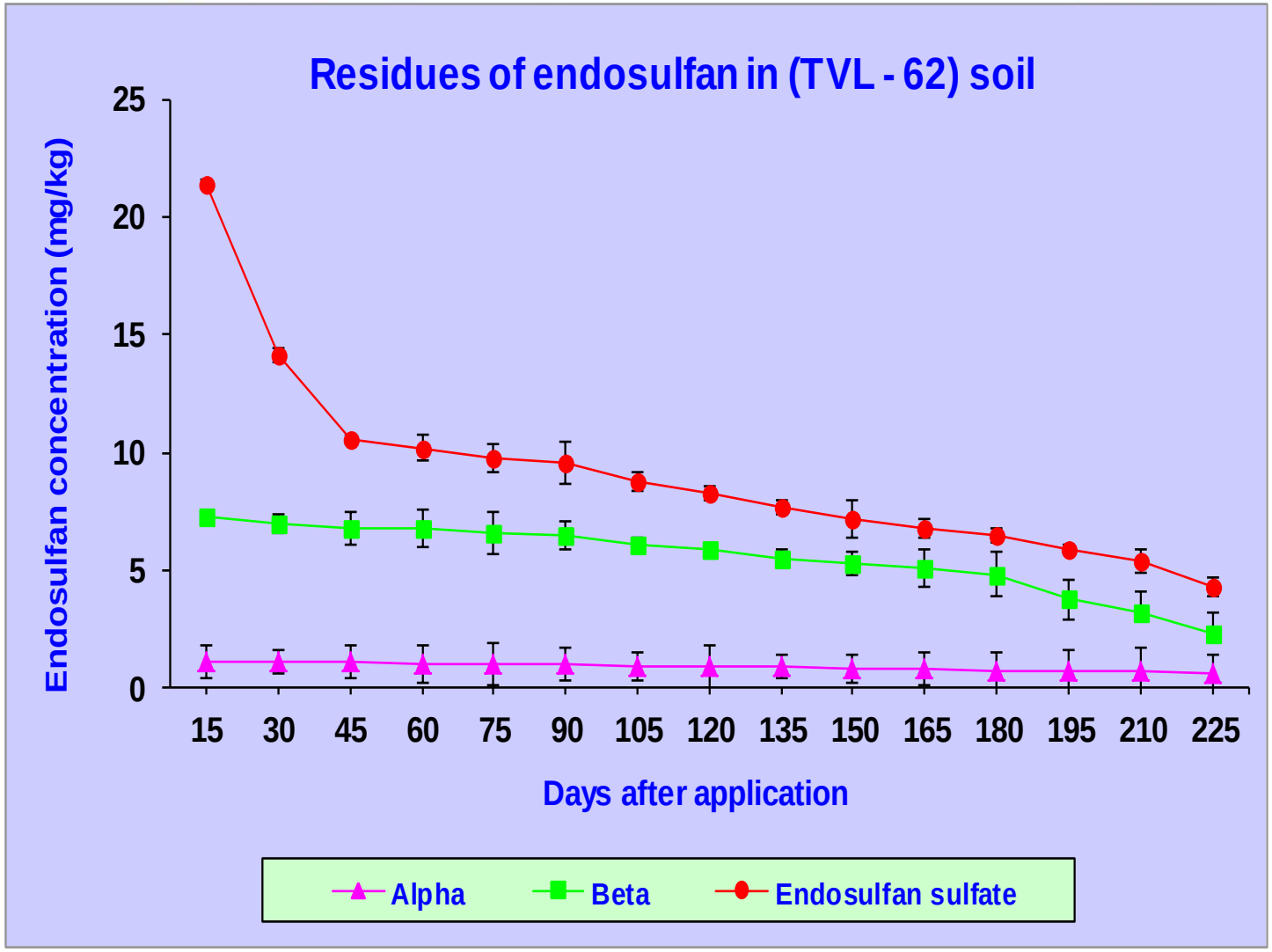


# Persistence of Endosulfan



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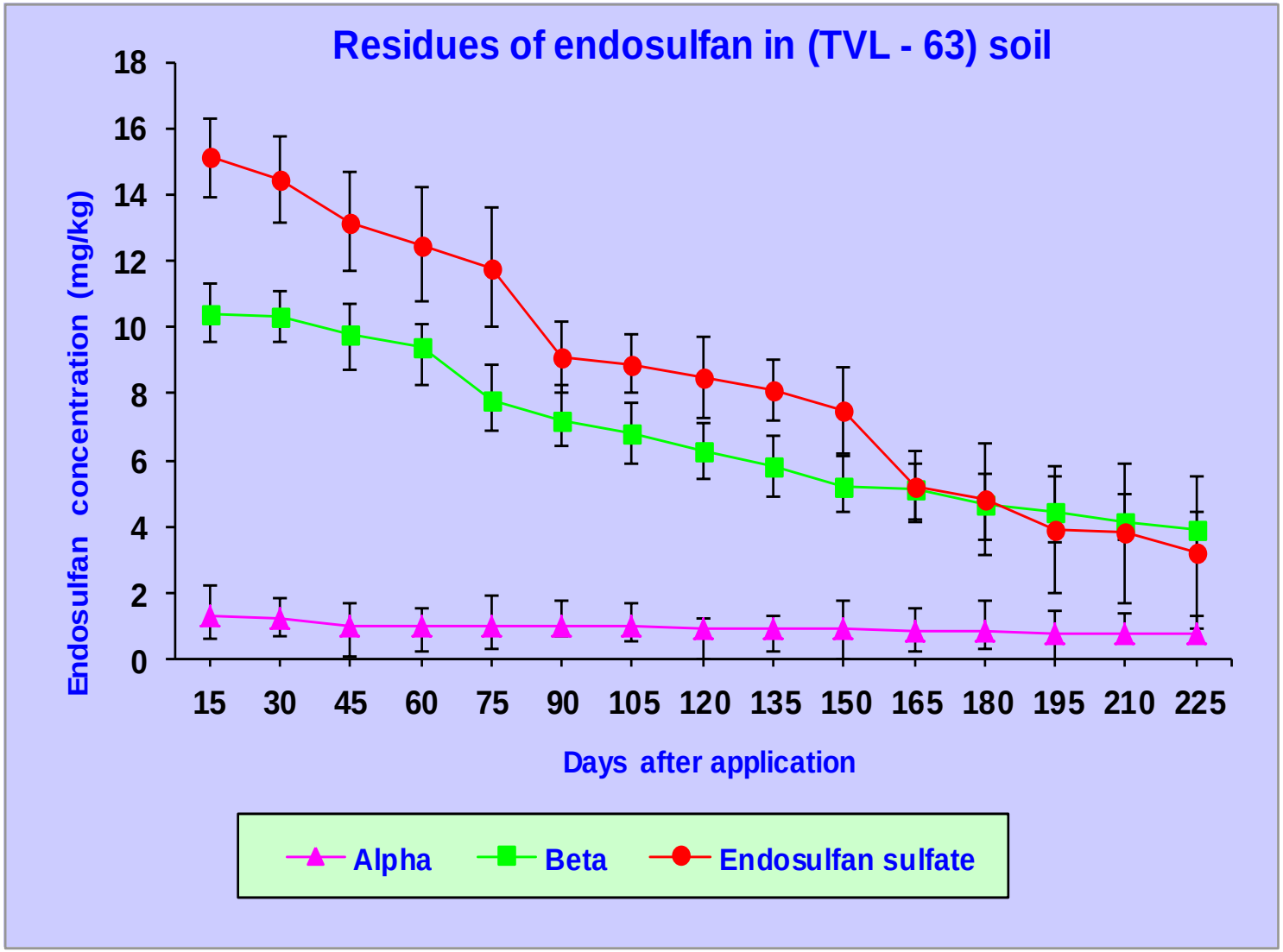

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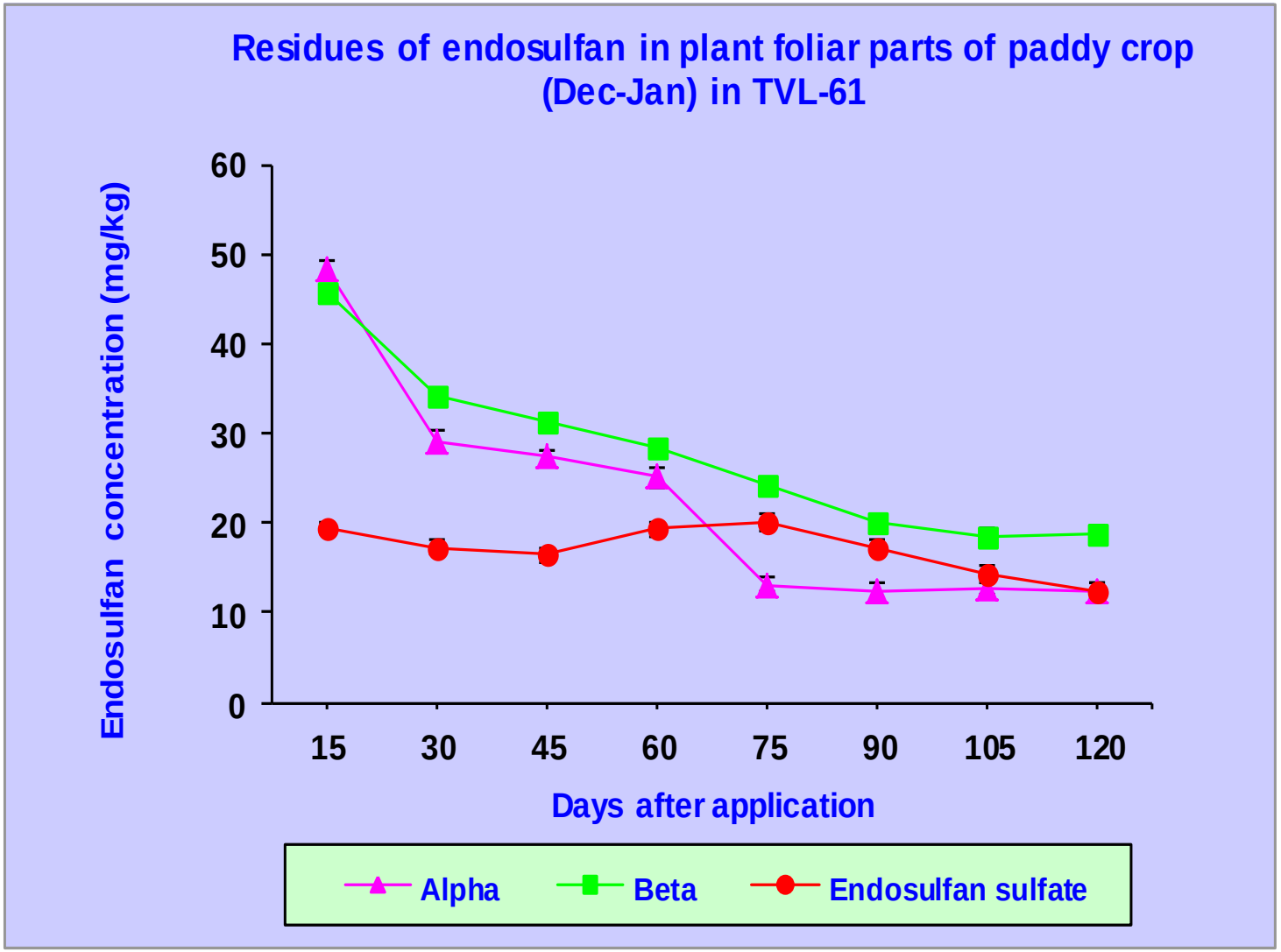

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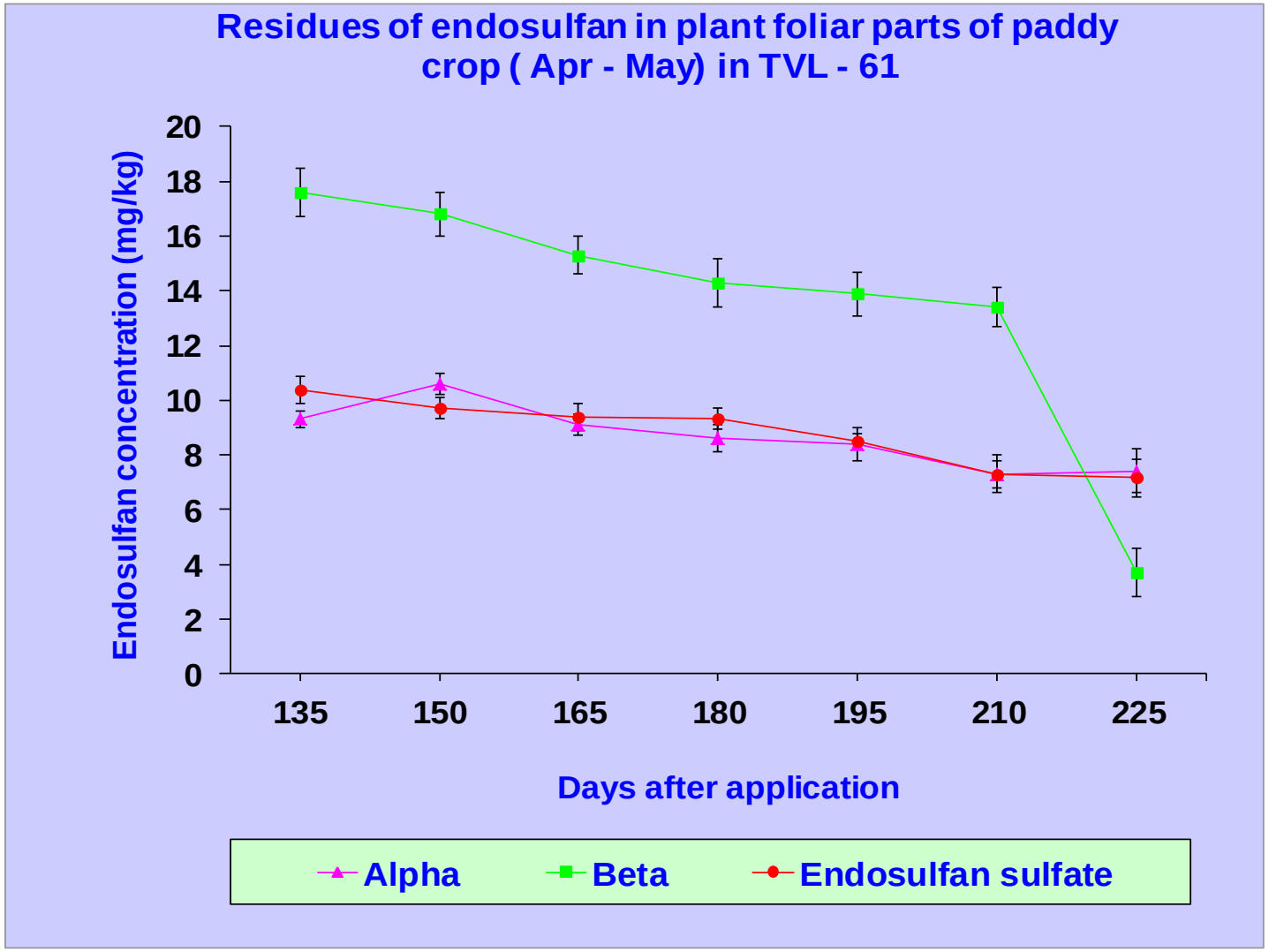
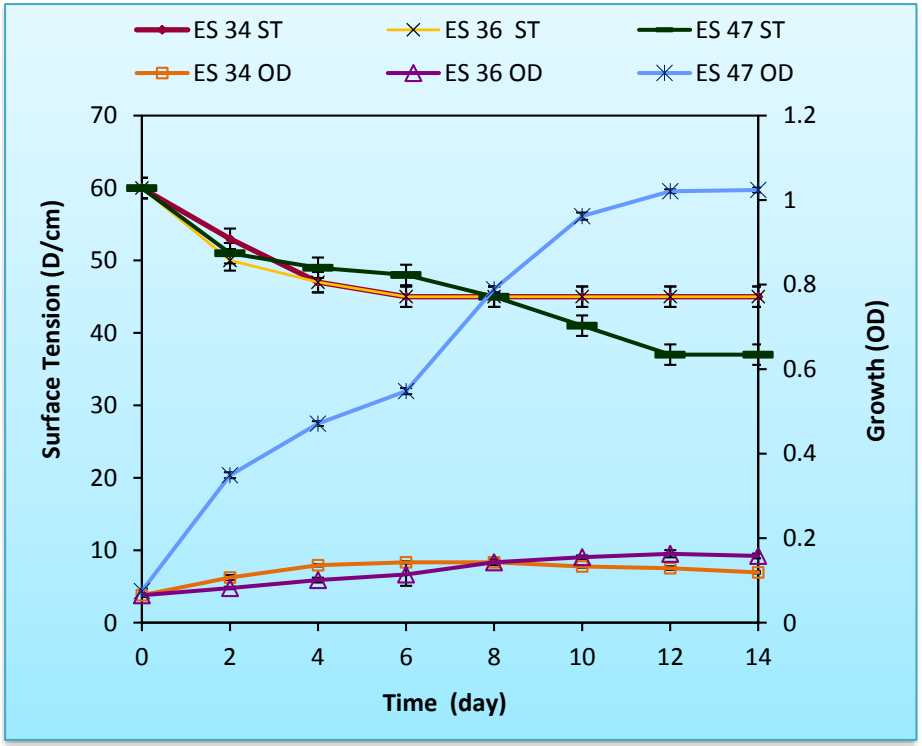


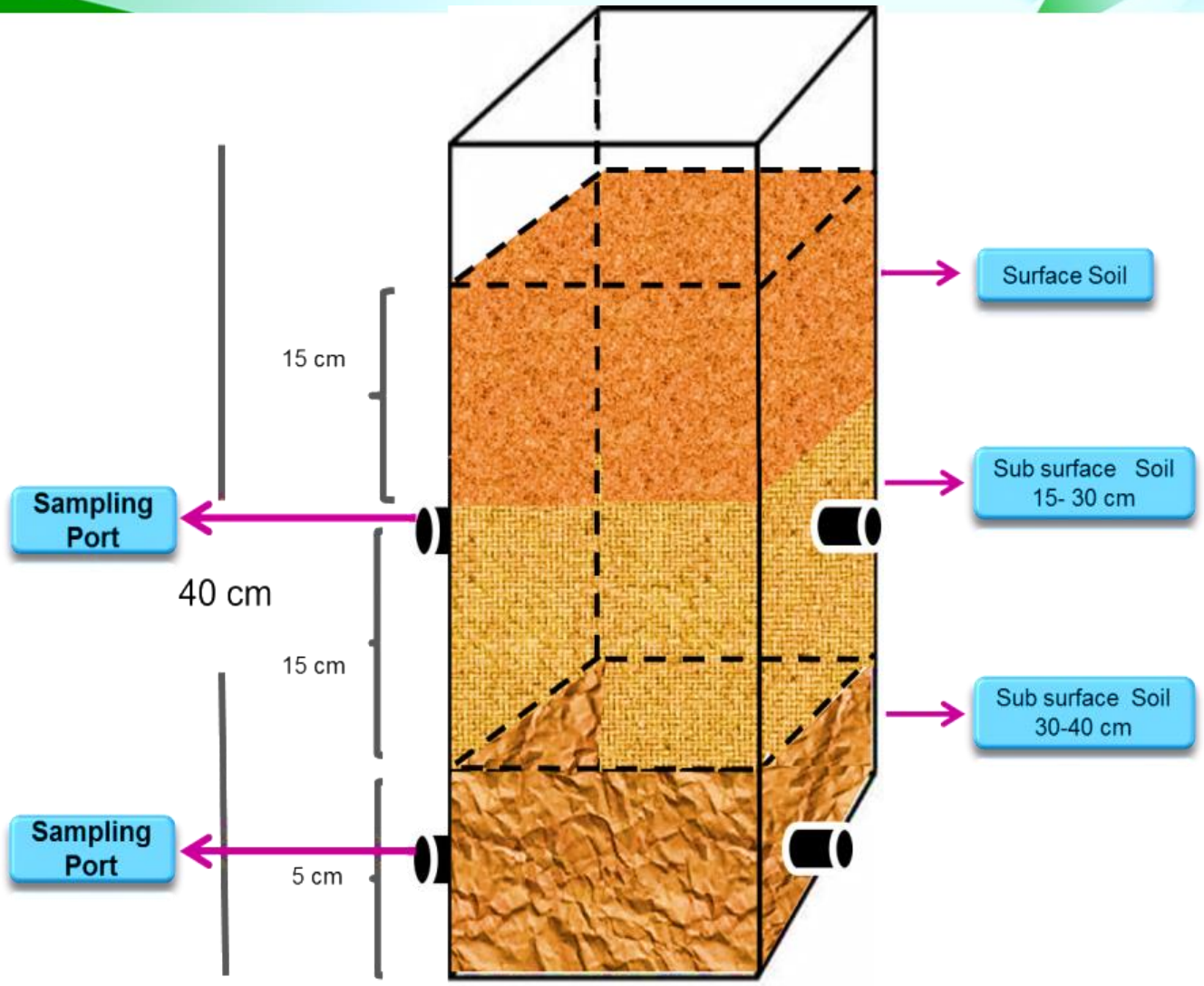
# BIOSURFACTANT PRODUCTION




**ES-47 -37 D/cm, where as the other two strains showed a reduction upto 44 D/cm.**

ES-47 Achromobacter xylosoxidans
ES-34 Bordetella petri GVI
ES-36 Bordetella petri GVII

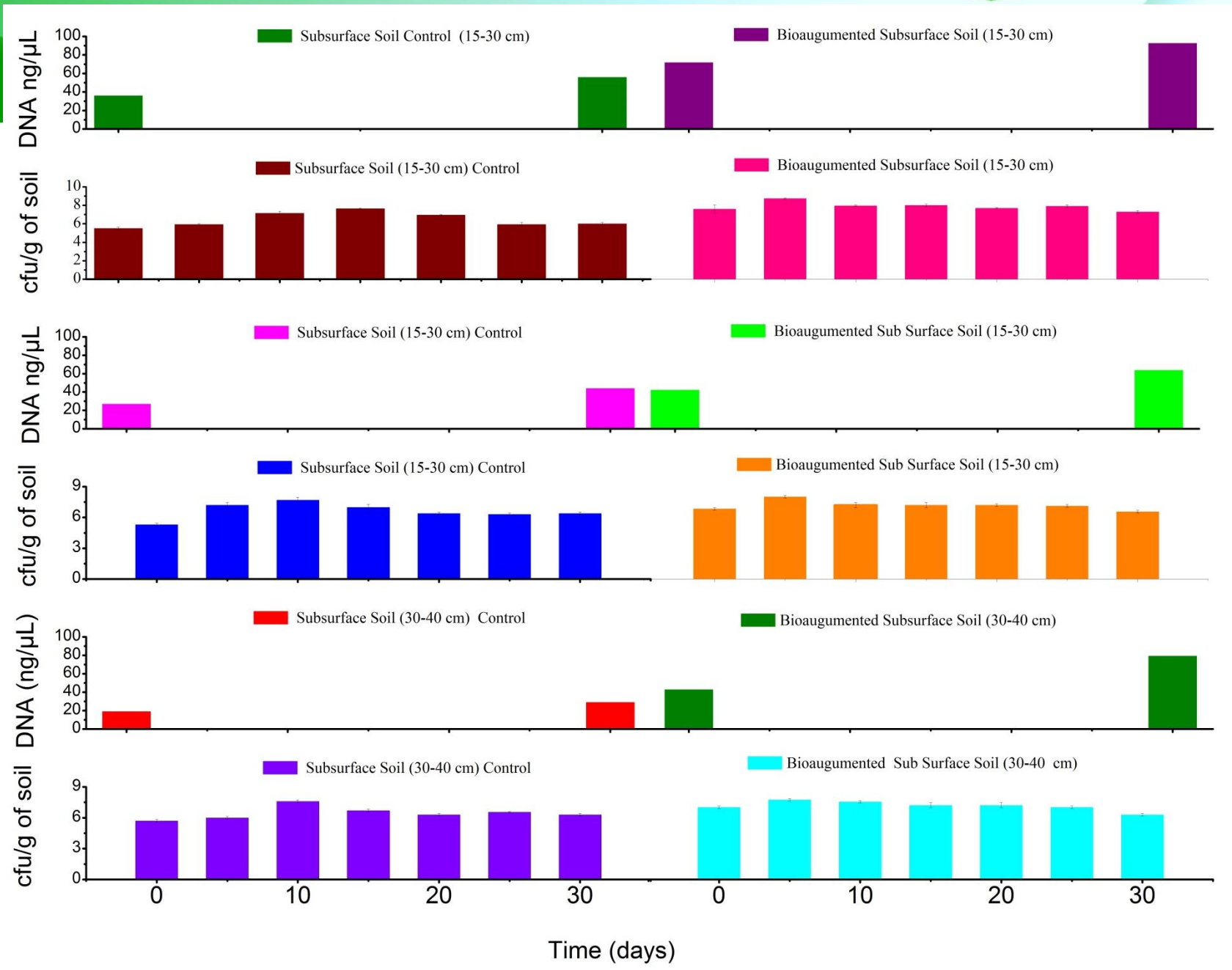
# EXPERIMENTAL DESIGN



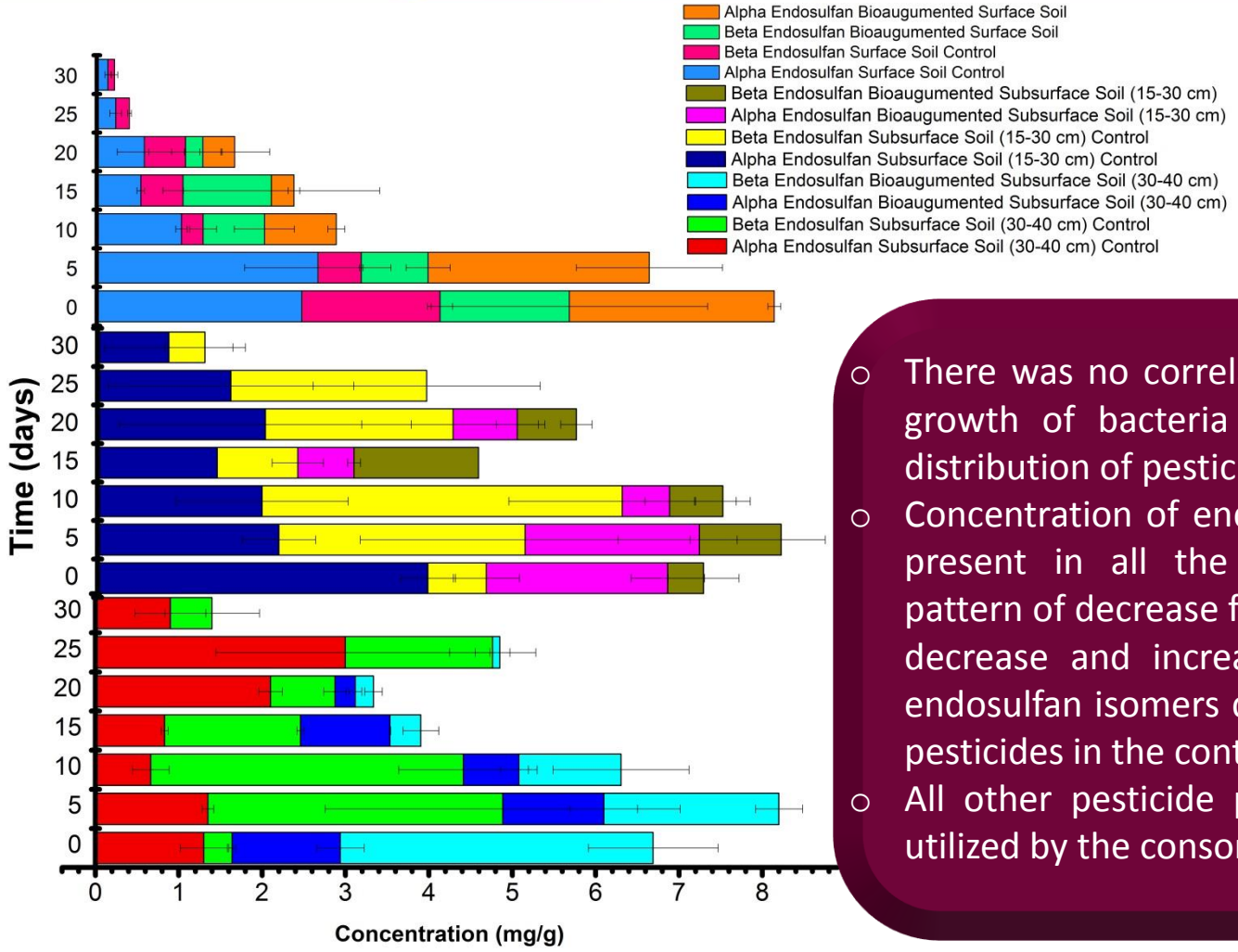
# PESTICIDE RESIDUES IN AGRICULTURAL SOIL OF PAKKAM VILLAGE

| Pesticide | Concentration of pesticide in soil (mg/g) | | |
|---|---|---|---|
| | Surface (0-15cm) | Subsurface (15-30 cm) | Subsurface (30-40cm) |
| α Endosulfan | 4.6±0.14 | 1.4±0.28 | 1.3±0.28 |
| β Endosulfan | 3.1±0.08 | 0.63±0.25 | 0.34±0.04 |
| Endosulfate | 11.74±0.04 | ND | ND |
| α BHC | 0.39±0.06 | 0.23±0.18 | ND |
| Γ BHC | 0.3±0.44 | Nil | Nil |
| Beta Cyfluthrin | ND | ND | 6.64±0.09 |
| op- DDE | 0.002±0.15 | Nil | 0.004±0.21 |
| Chlordane isomers | ND | Nil | 0.0006±0.34 |

# BACTERIAL GROWTH IN THE SOIL

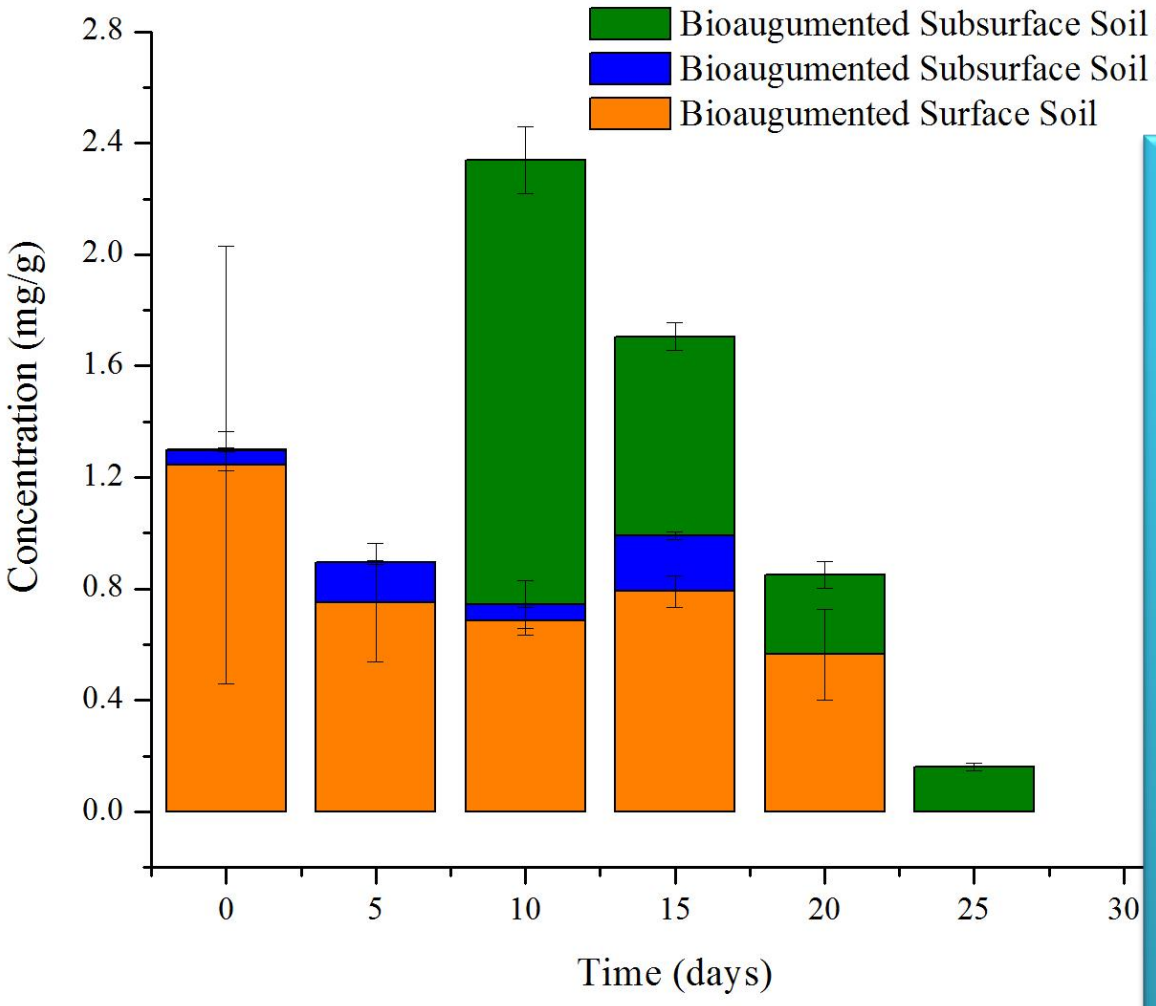


# BIODEGRADATION OF ENDOSULFAN AT DIFFERENT DEPTH OF SOIL



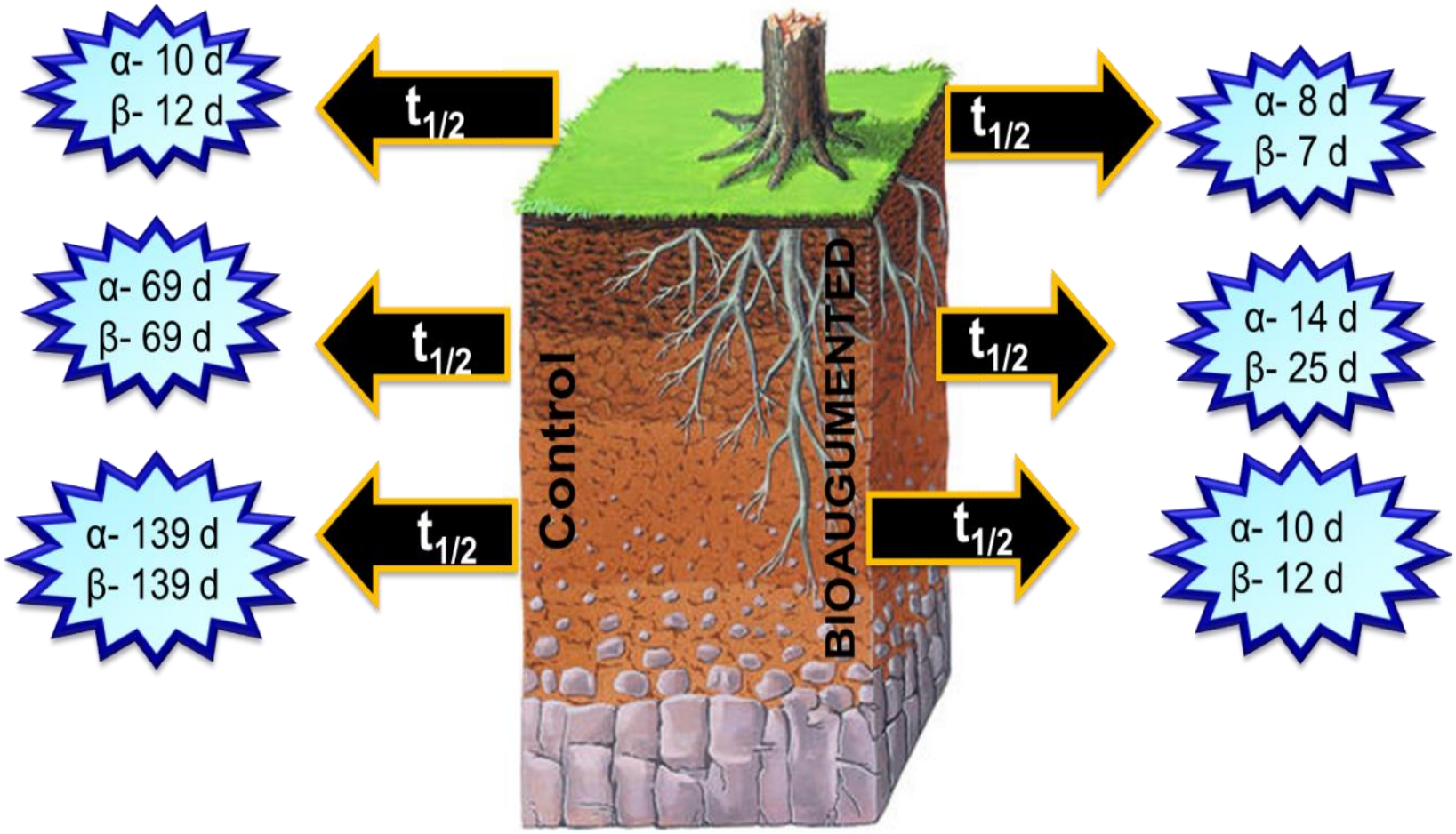

- There was no correlation in the degradation and growth of bacteria due to variation in spatial distribution of pesticide in the soil matrix.
- Concentration of endosulfan, the major pesticide present in all the layers showed an uneven pattern of decrease from $0^{th}$ day to $30^{th}$ day with a decrease and increase in the concentration of endosulfan isomers due to uneven distribution of pesticides in the contaminated soil ($p>0.05$).
- All other pesticide present in the soil was also utilized by the consortium.

# BIODEGRADATION OF ENDOSULFATE

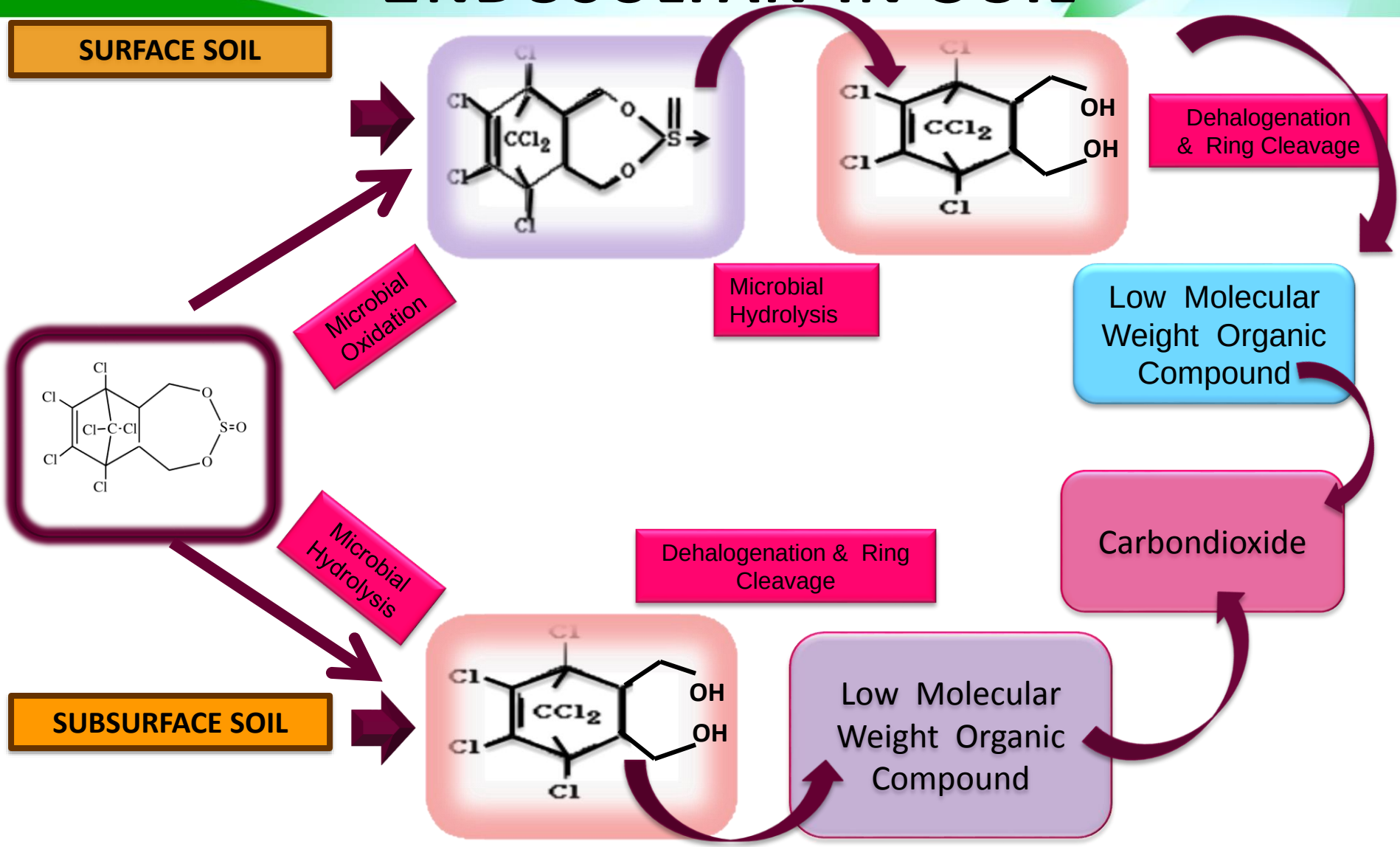



- Endosulfate concentration was high in the surface soil.
- Endosulfate - 1.2 mg/g in the surface soil, whereas in the subsurface soil it was present in lesser concentration.
- Decrease in endosulfate concentration was observed in the surface soil and its complete removal in the surface soil was observed on the 25th day.
- In both the subsurface soil (15-30 cm) and subsurface soil (30-40 cm) the distribution of endosulfate was uneven, but after 25 days endosulfate was not detected

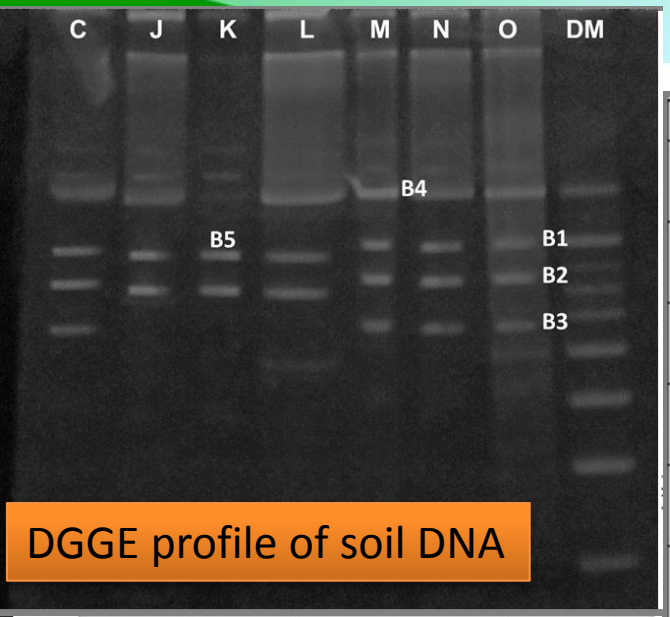
# HALF- LIFE OF DEGRADATION OF ENDOSULFAN IN SOIL



# Biodegradation Pathway of Endosulfan in Soil

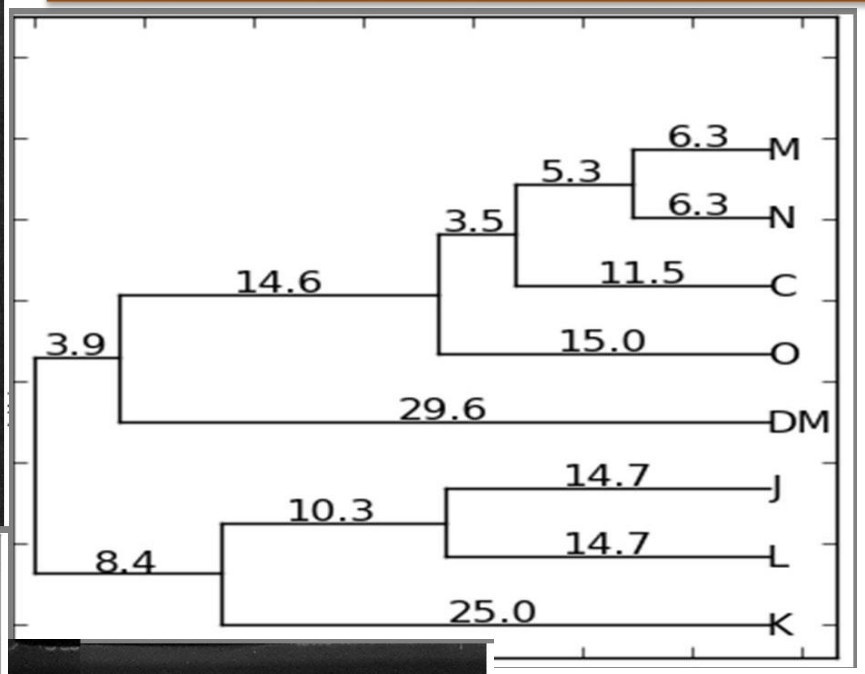


# SURVIVAL OF BACTERIAL CONSORTIUM

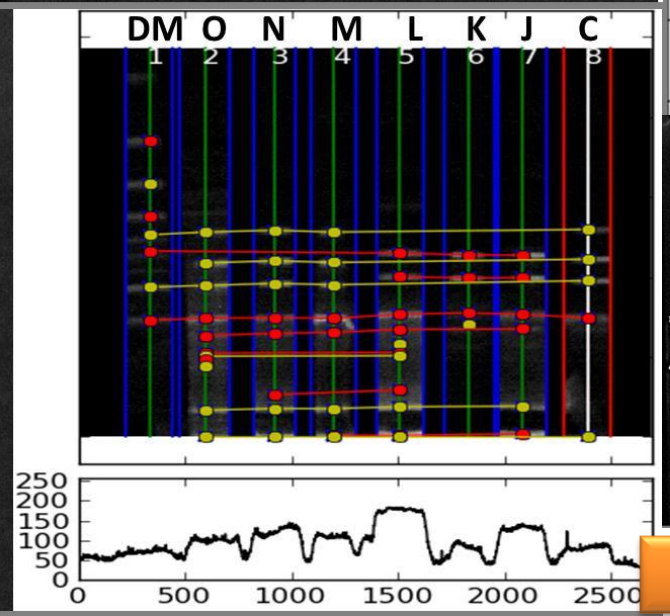


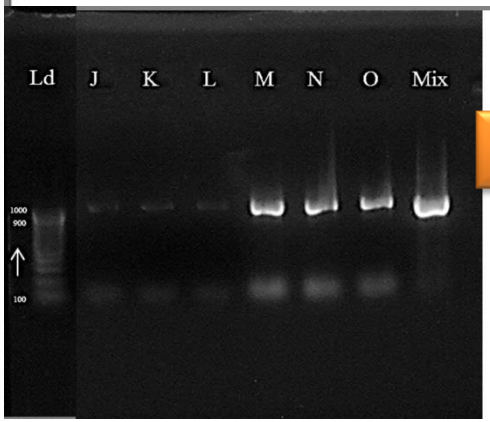

DGGE profile of soil DNA

Dendogram of DGGE profile of bacterial community in soil




l DM: Marker; C: Consortium; J: Surface Soil Control; K: Subsurface Soil (15e30 cm) Control; L: Subsurface Soil (15e30 cm) Control; M: Bioaugumented Surface Soil; N: Bioaugumented Subsurface Soil (15e30 cm); O: Bioaugumented Subsurface Soil (30e40 cm); B1, B2, B3, B4, B5prominent DNA bands




specific primer-amplified soil DNA

Band Match using PyElph software at distance 2%

# CONCLUSION

- Persistence of endosulfan in soil of Thiruvallur, even in subsurface environment.
- Less water soluble pesticides get adsorbed to soil which makes them less bioavailable there decelerating their biodegradation in soil.
- Bioaugumentation enhance the bioavailability of pesticides in soil with simultaneous biodegradation.
- bioaugumentation of contaminated soil with biosurfactant producing bacterial strains capable of surviving in subsurface soil environment can enhance the bioremediation process.
- Bacterial strains*Bordetella petrii* I GV 34, B*Bordetella petrii* II GV 36 and *Achromobacter xyloxidans* GV 47 can be an efficient microbial catalyst for enhancing the bioavailability of soil sorbed hydrpophobic pesticides.

# THANK YOU

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