

**Name: Dr. Rachana Shalini**

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## **Role of Bacteria in Agriculture:**

Role of Bacteria in agriculture and nature can be described under following sub-heads:

### **1. Nature's Scavengers:**

Bacteria decompose organic matter, by decay and putrefaction, to keep our earth clean. Decay is the aerobic decomposition of organic matter without the release of foul smell, while putrefaction is the anaerobic decomposition of organic compounds with the release of foul smell ( $\text{NH}_3$ ,  $\text{H}_2\text{S}$ , and  $\text{CH}_4$ ).

### **2. Control of Pollution:**

Acetobacter aerogens is known to decompose DDT. Pseudomonas decomposes petroleum wastes and other man-made pollutants. Recently in bioremediation technology, naturally or genetically modified bacteria are released to remove pollutants like heavy metals, dyes, pesticides, petroleum wastes, coal wastes etc. from environment. The purity of Ganga water is due to *Bellerophon* bacteriovorous.

### **3. Disposal of Sewage and Agro-wastes:**

Sewage is the household and industrial waste water discharges. Bacteria decompose organic wastes of waste and agriculture into humus which can improve soil fertility.

#### **4. Symbiosis:**

Symbiotic bacteria present in the rumen (1st chamber of stomach) of herbivore help in cellulose digestion. In human colon *E. coli* synthesizes vitamins B and K.

#### **5. Material Cycling:**

Many bacteria and saprophytic fungi decompose dead organisms- so that complex organic matter is converted into simpler organic matter and subsequently into inorganic components which can be reused to make the living matter. Therefore, bacteria regulate biogeochemical cycles for C, H, S, P etc.

#### **6. Biogas (biogas):**

In a biogas plant bacteria can be used for production of methane (fuel gas) by anaerobic breakdown or fermentation on cow dung, animal wastes etc.

**7. Silage:** It is a preserved cattle feed or fodder prepared by bacterial activity.

#### **8. Soil Fertility:**

Some bacteria increase the soil fertility and act as Nature's farmers. These bacteria are involved in the decomposition and transformation of nitrogenous organic compounds to maintain soil fertility. There are three types- ammonifying bacteria, nitrifying bacteria, nitrogen fixing bacteria.

##### **(a) Ammonifying bacteria:**

These bacteria release ammonia from protein, e.g. *Bacillus vulgaris*, *B. ramosus* etc. Soil ammonia is trapped in form of ammonium salts, and available for plant absorption.

##### **(b) Nitrifying bacteria:**

The soils contain two types of nitrifying bacteria: Nitrite bacteria which convert ammonium nitrogen into nitrites (e.g., *Nitrosomonas*, *Nitrosococcus*), and

Nitrate bacteria which convert nitrites into nitrates (e.g., Nitrocystis) the most readily utilized of all nitrogen compounds by green plants.

**(c) Nitrogen fixing bacteria:**

Nitrogen fixation is the conversion of free atmospheric dinitrogen (N<sub>2</sub>) into compounds of nitrogen. Bacteria and Cyanobacteria carry out 60% of total nitrogen fixation in natural ecosystems. For example, Azotobacter chroococcum, Beijerinckia and Clostridium pasteurianum occur as saprophyte in soil. Rhizobium leguminosarum (syn. Bacillus radicola) and related species live inside the root nodules of leguminous plants as symbionts and fix atmospheric nitrogen.

**9. Biopesticides:**

Biopesticides are derived from such natural materials as bacteria, animals, plants, their genes or metabolites and certain minerals that are used to protect vegetation against damaging pests. Bacillus subtilis (strain QST 713) controls the growth of certain harmful bacteria and fungi that cause scab, powdery mildew, sour rot, downy mildew, and early leaf spot, early blight, late blight, bacterial spot, and walnut blight diseases through competition. Bacillus sphaericus (strain 2362) acts as an endotoxin to mosquito larvae of Culex, Psorophora and Anopheles species, when the larvae consume the live bacteria. Bacillus thuringiensis (Bt) is an aerobic spore forming bacterium.

Different varieties of this bacterium contain plasmids for synthesis of several Insecticide Crystal Protein (ICP) toxins viz.,  $\alpha$  –  $\beta$  & endotoxins. Now transgenic plants produced through introduction of endotoxin genes of Bt. Agrobacterium radiobacter (strain K84) occurs in soil and near plant roots. When used as a pesticide active ingredient, it releases a protein that inhibits the growth of A. tumefaciens that causes crown gall disease in plants, by competing directly with A. tumefaciens for food and space.

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