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Course: Deg.-I (Hons.)
Paper: I
Topic: Role of Bacteria in Agriculture and Industries
Lecture no.- 27
Date: 29/04/2021

Role of Bacteria in Agriculture (contd.):

8. Soil Fertility:

Some bacteria increase the soil fertility and acts as a Nature's farmers. These bacteria involved in the decomposition and transformation of nitrogenous organic compounds maintenance of soil fertility. These are of 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 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_2) 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 radicum*) 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., α – β & 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.