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B.Sc. PART- I
PAPER- I, GROUP- [C]

**(i) ROLES OF BACTERIA
IN AGRICULTURE.**

Roles of Bacteria in Agriculture

Of all the living organisms found in soils, bacteria are among the most active. They are especially abundant in the surface layers of soils, decreasing in numbers with depth of soils. These bacteria play a dominant role in soil fertility. In general, they succeed in converting insoluble or unobtainable materials into forms that can be used by higher plants. Of the essential elements secured by the green plants from the soil, nitrogen is next to hydrogen and oxygen, the one which is needed in the large quantities. Large quantities of nitrogen from the soil which has been built into plant proteins of crop plants are removed from the field in the grain or other useful parts.

The element nitrogen passes repeatedly through a cycle which is known as nitrogen cycle, in which it is first converted from simple to complex compounds and then returned to the simple form in a cyclic order by the activity of bacteria in collaboration with higher plants and animals. Most plants absorb nitrogen from the soil principally in the form of nitrate ions, although they

they can also absorb ammonium ions. (2)
Since nitrate ions are continually being removed from the soil by the green plants certain groups of bacteria are involved in the decomposition of nitrogenous organic compounds of both plants and animals and the nitrogenous waste excreted by animals and nitrogen transformation in the soil and thereby play an important role in maintenance of soil fertility. They are called nitrifying bacteria and nitrogen fixing bacteria. The bacterial decomposition of nitrogenous organic compounds in the absence of abundant oxygen usually results in the formation of material of offensive odour chiefly sulphur compounds. Such anaerobic decomposition is termed as 'putrefaction'. The decomposition of organic compounds in the presence of oxygen and without the development of odorous substance is called 'decay'.

The ammonifying bacteria transform various proteinaceous substances into ammonia in the soil. The process is known as 'ammonification'. Ammonium ions can be absorbed directly by most of the plants and used as a source of nitrogen. The ammonia of the ammonium salts is oxidized to stable nitrate by the nitrifying bacteria and the process is known as 'nitrification'.

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Nitrogen fixing bacteria assimilate atmospheric nitrogen (which green plants cannot utilize) by converting into organic nitrogen compounds, which are subsequently decomposed by other bacteria and transformed through a series of steps into nitrates. The process by which they assimilate free nitrogen is called nitrogen-fixation. There are two types of nitrogen fixing bacteria.

(i) Non-symbiotic → These nitrogen fixing bacteria live independently in the soil. Two prominent genera of this group are 'Azotobacter' and 'Clostridium'. These free-living bacteria fix independently atmospheric nitrogen in their body and convert to organic nitrogen compounds. When they die, the organic nitrogen compounds of their body are made available to higher plants through the activities of other bacteria.

(ii) Symbiotic → These nitrogen fixing bacteria consisting of species of 'Rhizobium leguminosarum', live symbiotically in root nodules on the roots of various seed plants, chiefly leguminous plants. These bacteria fix atmospheric nitrogen to synthesize organic nitrogen compounds. When the leguminous plants are harvested,

the roots with nodules containing (4)
bacteria are left in the soil. When
they decay, the organic nitrogen com-
pounds made by bacteria become
available as nitrates through the process
of nitrification. A leguminous crop in
a rotation thus possesses an advantage
besides that of crop itself, it increases
the amount of nitrogen in the soil.

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