**IMPORTANT FACTS**

**Food security and boosting human health & wealth**

Pulses are a source of plant-based proteins, amino acids and other nutrients in human diets.

Pulses cover 57.3 million hectares, one-tenth of the area dedicated to cereal crops. Global production is 40 million tonnes, with an average yield of 0.86 tonnes per hectare compared to 3.5 tonnes per hectare for cereals.

**Ecological and soil health**

Pulses boost soil fertility and reduce the need for industrial nitrogen fertilizers because they fix nitrogen (N) from the atmosphere and provide organic matter to soils.

When included as a rotation crop with cereals, they could save up to 120 kilograms of nitrogen per hectare.

Pulse-cereal rotation helps to control weeds and reduce disease and pest infections.

Pulses extract water and nutrients from deep soil through their deep (tap) roots that minimise the impact of water stress.

Pulses produce lower carbon and water footprints compared to cereals: The water footprint to produce a kilogram of pulses is 18, 11 and 5 times lower than the water footprint to produce similar amount of pork, chicken and soybean, respectively.

When grown as cover crops, pulses are effective in controlling soil erosion. Pulses reduce nitrous oxide emission because of minimal N inputs via chemical and organic fertilizers.

Pulses support a large and diverse population of soil organisms (including microbial populations) and therefore promote/enhance biodiversity in soil.

Despite their important role in improving the sustainability of agricultural cropping systems and mitigation of the effects of climate change, pulses have not received the same attention and production resources at the farm level compared to cereal crops.

**What are pulses?**

Pulses are an annual leguminous crop harvested solely for their seeds. They include Bambara beans, chickpeas, cowpeas, dry beans, dry peas, Faba beans, lentils, lupins, pigeon peas and vetches, but exclude soybean and groundnuts which are considered as oil crops.

Pulses fix nitrogen in the soil and reduce the need for industrial nitrogen fertilizers and therefore boost soil fertility.

**Why does nuclear technology matters?**

The stable isotope of nitrogen, $^{15}$N, can be used to identify pulses and legumes with high nitrogen fixing abilities and to quantify the amount of nitrogen fixed. This knowledge can help improve yield and enhance soil fertility for sustainable farming systems.

For the past thirty years, the Soil and Water Management and Crop Nutrition (SWMCN) Subprogramme of the Joint FAO/IAEA Division of Nuclear Techniques in Food and Agriculture has been assisting Member States in developing $^{15}$N isotopic methodology to identify pulses and legumes with high nitrogen fixing abilities to improve yield and enhance food security.
Pulses for soil fertility and sustainability of cropping systems

Nitrogen is the most essential plant nutrient, but its deficiency in soils is contributing to reduced crop yields throughout the world. Fortunately, pulses can fix up to 120 kilograms of nitrogen per hectare through biological fixation of atmospheric nitrogen, a process which not only reduces fossil fuel energy input costs, but also provides a more sustainable crop yield and agricultural production.

Pulses fix nitrogen through nodules formed on their roots. The bacteria (rhizobia) in these nodules convert atmospheric nitrogen into ammonia, which is then absorbed by the plant. The annual global input of atmospheric nitrogen fixed biologically amounts to 195 megatonnes of nitrogen per year.

The Joint FAO/IAEA Division’s work has shown that yield increases from 20% to 35% have occurred when spring wheat or barley is followed by a crop of peas. In India and Bangladesh, the inclusion of short duration pulses such as lentil, mung bean and peas into the rice-wheat cropping systems has helped to sustain yields of rice and wheat and reduce the application of nitrogen fertilizers.

Pulses for climate change mitigation

Soil can be both a source or sink of greenhouse gases such as carbon dioxide and nitrous oxide, depending on land uses and management practices. The SWMCN Subprogramme is currently developing protocols to measure carbon dioxide and nitrous oxide greenhouse gas emissions in legume-based cropping systems. Field studies using isotopic techniques in IAEA Member States show that less nitrous oxide is emitted when pulses are used as fertilizer as opposed to chemical fertilizers.

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