Agriculture and Agri-Food Canada (AAFC) soil fertility specialist Dr. Cindy Grant remembers what her professor used to say about the benefits that a pea crop in rotation can offer a producer. “It is not easy to quantify,” she says. “He called it ‘pea magic’.”

Peas, lentils, and other legumes are best known for their ability to fix nitrogen. To achieve the optimal nitrogen fixation benefit, a pulse crop in rotation must be inoculated with a high quality, species specific strain of *Rhizobium*, in order to convert nitrogen from the air in the soil around the roots to a nitrogen source available to the plants.

Within a month of germination, the plant’s roots will exhibit nodules, tiny bumps on the roots that contain *Rhizobia*. This is the sign that plants are fixing nitrogen.

While all legumes fix nitrogen, some are better at it than others. Of pulses, faba beans top the list of nitrogen fixers, deriving 90 per cent of their nitrogen from fixation. Peas and lentils follow close behind at 80 per cent, chickpeas at 70 per cent, and soybean and dry beans at 50 per cent.

### Measurable Benefits
When peas and other pulses are grown in rotation with other crops, producers can realize multiple benefits.

**1. Use less fertilizer**
In a pulse rotation year, fields will require fewer inputs. While pulses can fix their own nitrogen, they will use nitrogen in the soil or added fertilizer first. To maximize the nitrogen fixing capabilities of pulses, growers should avoid adding nitrogen if the soil levels are above 15-20 pounds per acre (lbs/ac).

**2. Gain residual nitrogen for next year’s crop**
As roots from a harvested pea or lentil crop decay, they release nitrogen into the soil. Next year’s crop will benefit from the nitrogen in the soil not only at seeding time, but also during the growing season.

Dr. Bob Blackshaw, a research scientist with AAFC in Lethbridge explains, “You have an extra 10-30 lbs/ac of nitrogen at seeding time, but there is probably that much again available later in the growing season, unlike a fertilizer application that is taken up immediately.”

**3. Better flax crops**
A pulse rotation can set the foundation for mycorrhiza-dependent crops such as flax. Planting flax following a pulse crop can ensure better soil microbe populations, leading to improved yields.

With canola featuring prominently in growers’ rotations, it is important to realize that canola is a mycorrhiza inhibitor. Research has shown that flax grown following canola has decreased yields. In a multi-year rotation, it may be advisable to select cereal-oilseed-pulse, so that the pulse can restock the soil’s microbial populations after a canola year.

### Non-measurable benefits: Improved soil diversity
Dr. Blackshaw identifies several long term advantages of soil improvement, backed by multi-year studies. “Soil microbes need nitrogen, and prefer it to be in a more stable form. Total soil microbial population and biodiversity improve when pulses are included in crop rotation.”

Good soil microbes present in high numbers can inhibit disease-causing microbes. “It is hard to measure what that means economically to the grower, but we know it is an indicator of overall soil health,” he says.

Related to soil health, soil scientists identify several other factors that point to soil health and long-term sustainability. Dr. Grant says, “Pulse rotation can create a disease break, improve soil workability, reduce penetration resistance or soil hardness, and increase moisture retention in drier conditions.”
years. While you cannot easily attribute the benefits directly, we know that there are economic benefits to diversification."

"From a crop sustainability and soil health standpoint, it is advisable to work a pulse crop into a three-five year rotation. We are lucky to have several types to choose from in our climate,” says Dr. Blackshaw.

**Better Yield = Better Nitrogen Supply**
The healthier your pulse crop, the more nitrogen it will put into the soil. Careful management of your pulse crop, through choosing ideal seeding dates, preparing the seedbed, proper inoculation (using the correct inoculant species for the pulse you are planting), and early weed control will all help to optimize your pulse crop.

Of course, a healthy pulse crop also means higher yields and economic gains. Dr. Grant says, “Research shows that benefits to the crop following a pulse rotation are directly related to the yield of the pulse crop.”

Faba beans may be the most efficient nitrogen fixers, Dr. Grant points out, but their yield potential can be highly variable.

**Put Your Peas to Work**
When planning your crop rotations, consider not only the inputs required and the potential yield of a pea or lentil crop in the year you plant it, but also factor in the savings you gain from reduced inputs that year and the benefits to your other crops the years following.

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**Benefits of Pulses in Rotation:**

1. Use less fertilizer
2. Gain residual nitrogen for next year’s crop
3. Better flax crops
4. Improved soil diversity
5. Better yield = better nitrogen supply

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