Are legumes logical?

Growing legumes in rotation with winter wheat has some benefits — but also some costs. Find out if it pays before you plant. ■ *By Merle F. Vigil and David C. Nielsen*

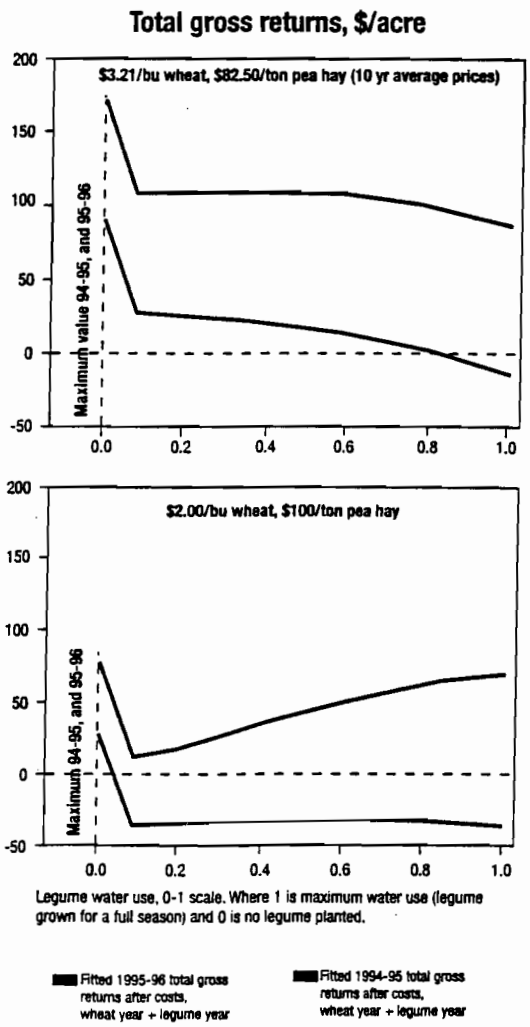
Legumes in rotation with winter wheat? You must be kidding!

Before we began studying this issue a few years ago, we questioned whether eastern Colorado dryland farms could grow a legume in rotation with winter wheat — and make it pay. Can we grow enough legume for either hay or seed to make a profit? What effect does the legume have on the winter wheat enterprise?

What we've found so far is that in most cases, it does not pay to plant a legume. The moisture used by legumes during the summer fallow phase reduces subsequent wheat yields. While legumes do add nitrogen to the soil, this legume fertilizer is too expensive to be considered a reasonable alternative to chemical fertilizer.

Winter wheat, summer fallow is still the dominant dryland cropping system in eastern Colorado, with wheat, corn, fallow an up-and-coming second choice. These systems require prudent nitrogen (N) fertilizer application. With typical N rates between 40 and 90 pounds per acre, fertilizer can be expensive. N fertilizer cost has increased about 60% since 1991 and further long-term increases are projected.

Legumes add beneficial nitrogen to the soil.



'FREE' FERTILIZER

Some farmers and researchers have considered including legumes on dryland to get the benefit of that "free" N. I've never been too trusting of a free lunch, but legumes do have some potential advantages. In addition to producing N, they also add another broadleaf crop to dryland agriculture, which is a grass-dominated system. Legumes can be either a forage or a grain crop. The Canadians are making it work, so why couldn't we?

We have measured as much as 116 pounds of above ground N in Austrian winter pea hay and about 30 pounds of additional N in the top two feet of the soil profile after a legume crop. In other studies, annual legumes have been reported to leave between 20 and 190 pounds of N per acre depending on the legume, season and management.

In the central Great Plains, with average annual precipitation between 12 and 22 inches, efficient use of water is critical. A legume grown during summer fallow will take water that would have been available for the subsequent wheat crop. To be cost-effective, a legume must produce a marketable yield to compensate for the loss in wheat yields.

Our research, which will continue one more year, includes plots with three legume species and traditional summer fallow plots. Those plots are divided into four subplots. The summer fallow plots are fertilized with 30, 60 or 90 pounds of N per acre (one plot is not fertilized) just prior to planting wheat in the fall. No N fertilizer is applied to the legume fallow plots.

In April, the legumes — Austrian winter pea, springfield pea and black lentil — are inoculated with the appropriate strains of *Rhizobium leguminosarum* bacteria and

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age during summer fallow. Fertilizer costs include 30 pounds of phosphate per acre at planting time for both legumes and wheat and 60 pounds of N for the wheat. Harvest costs are $26 per ton for legume hay and $13 per acre for winter wheat harvest, plus 13 cents per bushel for yields over 20 and 7 cents per bushel to haul to the elevator (see table). The N bonus includes the additional N from the legume, of which about 40% is available for crop uptake.

WATER USE

Favorable moisture and temperature conditions in 1995 nearly doubled legume biomass in early July, as compared with that measured in 1994. As much as 116 pounds of N per acre was found in the above ground portion of Austrian winter pea. This was produced using 16.5 inches of water. N fertilizer in our region costs about 19 cents per pound, so that water produced only $22.04 worth of legume N per acre.

That same amount of water can potentially help produce 64 bushels of wheat per acre, valued at $128. If the legume is harvested as a hay crop, this above-ground N does not benefit the subsequent crop. Only the below-ground portion of the plant, which is much less significant, is left.

We measured greater wheat yields both years in traditional summer fallow fertilized with 60 pounds of N per acre than in any of the legume plots. Wheat yields following legumes planted in 1994 and 1995 were 7.5 to 12 bushels per acre less than wheat fertilized with 30 pounds of N per acre in traditional summer fallow. All the legumes had about the same effect on wheat yields.

Surprisingly, the best economic scenario in all cases was to not plant a legume, even with $2 wheat and $100-per-ton hay (see chart on page 27). This held true even adding the value of the legume N as fertilizer (about $10 to 20) to the total net returns. Both 1995 and 1996 were good wheat years with maximum yields of 52 and 78 bushels per acre, while only the 1995 spring was a good legume year. Using the 10-year average prices, the legume becomes a good choice only if wheat yields are 20 bushels less than what we measured.

Why does this approach work in Canada? It could be they have less evaporative demand than we do during spring, enabling their pea crops to do better than ours. Soils in the north generally have greater organic matter, because their winters are so harsh that biological activity stops after October. Here, we have such open winters that our microbial populations are munching organic matter all winter.

Work on the issue continues. We are trying peas and some Roundup Ready soybeans in longer rotations: wheat, corn, peas versus wheat, corn, millet or wheat,corn, fallow and wheat, corn, millet, pea (soybeans). ◆

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