Optimizing Fertilizer Applications on Big Horn Basin Crops
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Components of reliable fertilizer recommendations
1. Analysis of representative soil samples at a reliable lab;
2. Realistic yield goals: 105 percent of 5-yr average;
3. Residual soil nutrients left over from previous crop;
4. Soil organic matter content (credited at 20 lbs N per percent SOM);
5. Irrigation water management: avoid irrigation wastes fertilizer;
6. Cropping history: legume credits;

Irrigation water management
- Irrigation enables precise nutrient management because dissolved fertilizers move where the water moves;
- Early on, shallow irrigation prevents losses through leaching: Most fertilizer used up before roots, and irrigation, extend deeper into soil;
- Recommend irrigation water management plan based on soil intake and water holding capacity:
  - Sprinklers provide most control over nutrient movement;
  - Surge irrigation, at least in early-season applications, much better than standard furrow.

Fertilizer placement
- Important for early access with limited lateral root development;
- Options include broadcast, knife banded, and point injected;
- Banding liquid provides better placement and can save an operation;
- Knife banding liquid UAN reduces losses and increases availability, but takes more horsepower;
- At PREC, point injection performed better than knife banding with less disturbance and fuel.

**SUGAR BEET** requirements for growth:
- Nitrogen: 9 lbs per ton;
- Phosphorus: 3 lbs per ton;
- Potassium: 9 lbs per ton;
- Recommendations use total required minus residual soil nitrogen (RSN), nutrients from decomposing organic matter, and other credits from legumes, manure applications, and nitrate in irrigation water.

Early results from N trials on sugar beet at Powell suggest soil test N rates are effective and there are no advantages to split applications or time-release formulations. Liquid UAN performed better than dry products, probably due to superior placement.

**DRY BEAN** requirements per cwt. yield goal:
- Nitrogen: 3.3 lbs
- Phosphorus: depends on soil texture and lime content;
  - 1.5 (coarse soils) to 3 lbs (fine or high lime soils) per cwt to compensate for P fixation;
  - Cut in half for banded application;
- Potassium: adequate in Wyoming soils;
- Micronutrients: High pH can cause problems with some micronutrients, especially Zn and Fe. Apply as per soil lab recommendation.

**Dry bean fertilizer recommendations**
- Based on representative soil sample to at least 12 inches;
- Recommendation = YG – RSN – other credits + straw adjustment.
- YG = Realistic, field-specific yield goals: long-term Wyoming average = 2300 lbs/ac;
- RSN = Residual soil nutrients determined from soil tests;
- Other credits: previous legumes and manure applications;
- Straw adjustment: decomposition of non-legume crop residue ties up N. Recommendation is increased by 15 lbs N per ton of straw: 30-50 lbs of straw per bushel of grain; 50-70 for wheat.

**Optimizing fertilizer on dry beans**
- Innoculate if beans haven’t been grown for 2-3 years or if previous crop wasn’t well nodulated;
- Banding 2 inches to the side and 2 inches below of P and up to 40 lbs N improves emergence on fine soils, but harms it on sandy soils;
- Split applications for high application rates (80 lbs/ac or more);
- Test for micronutrients: N and P are wasted if the crop is stunted from Zn or Fe deficiency;

**SMALL GRAINS**
- Wheat: 1.72 lbs N, 1.0 lb P₂O₅ per bu; Average yield in NW = ~75 bu;
- Oats: 1.15 lbs N, 0.5 lb P₂O₅ per bu; Average yield in NW = ~95 bu;
- Feed barley: 1.55 lbs N, 0.7 lb P₂O₅ per bu; Malting barley: 1.35 lbs N, 0.7 lb P₂O₅; Average all barley yield in NW = ~100 bu;
- Multiply by YG (105 % of 5y average) and subtract credits;
- K, S, and micronutrients usually sufficient, but test occasionally

**Optimizing fertilizer on irrigated small grains**
- Soil sample to two feet in 1-foot increments and as close as possible to planting time;
- N from manure and legumes in rotation is excellent source for wheat, oats, and feed barley;
- Manure should not be applied to malting barley;
- Malting barley shouldn’t follow legume;
- Increase OM through reduced tillage;
- Careful irrigation water management.

**CORN**
- About 1.6 lbs of N per bushel;
- About 6 lbs of P₂O₅ per bushel;
- About 1.2 lbs of K₂O per bushel.
- Grain yield: NW = ~130 bu;
- Silage yield: about 23 tons/ac.

**Optimizing fertilizer on irrigated corn**
- Soil sample to at least three feet;
- Test for and apply micronutrients if needed;
- Band fertilizers and split applications;
- Late spring soil test;
- Increase OM;
- Rotate with legumes.