

## Fertilizing Irrigated Soft White Spring Wheat

Soft white spring wheat responds well to fertilizer when grown on soils low in plant available nutrients. Nitrogen (N) fertilizer can dramatically increase yield, and under certain conditions, it will increase the protein content of the grain.

The ideal protein level of soft wheat should be less than 10.5 per cent, for optimum baking quality. For soft wheat growers, the challenge is to apply sufficient nitrogen fertilizer and irrigation water to achieve optimum yield and still maintain a protein content of less than 10.5 per cent.

Other nutrients such as phosphorus, potassium, sulphur and micronutrients will also have an effect on the growth of soft wheat.

### Soil testing

The optimum rate of fertilizer can best be determined by soil sampling and testing. Irrigated land should always be tested to a depth of 60 cm (24 inches), preferably in increments of: 0-15, 15-30, and 30-60 cm (0-6, 6-12 and 12-24 inches). Incremental depth sampling is very important to determine the amounts and location of mobile nutrients, such as nitrogen and sulphur, within the root zone.

### Target yield

A producer should select a target yield that is realistic and based on past average yields. A target yield is influenced greatly by a farmer's management ability in developing a good seed bed, timeliness of seeding, achieving an optimum plant population, good pest control (weeds, insects and disease) plus good irrigation management. Yield is also affected by soil type and variation in climatic conditions (rainfall and heat units) from year to year.

### Irrigation level

Two target yield levels are provided in Table 1 for two irrigation management levels.

**Optimum irrigation** occurs when total crop water use is between 450 and 500 mm (18-20 inches) per season, and soil moisture does not drop below 50 per cent of plant available moisture content during the growing season.

**Intermediate irrigation** occurs when total water use is in the range of 350 and 425 mm (14 and 17 inches) per season, and soil moisture will drop below 50 per cent plant available moisture content several times during the growing season, resulting in crop water stress and reduced yields.

## Fertilizer recommendations

### Nitrogen (N)

High rates of N fertilizer can be economical, but they should only be applied when soil test levels of nitrate-nitrogen are very low and irrigation water is not limiting. Table 1 gives the amount of soil nitrate-nitrogen ( $\text{NO}_3\text{-N}$ ) in the top 60 cm (2 feet) of soil plus fertilizer N that is needed to produce each target yield level. Table 1 is based on soil  $\text{NO}_3\text{-N}$  in soil samples taken in the fall (after October 1) or in early spring before seeding.

To determine the amount of nitrogen fertilizer needed, first select a realistic irrigation level and target yield goal from Table 1. Then, subtract the amount of soil  $\text{NO}_3\text{-N}$  (in lb/ac) determined by soil testing from the total N required from the target yield goal. This number is the approximate amount of N fertilizer needed to achieve optimum yield.

For example, as illustrated in Table 1, if your soil test shows that there is 60 lb/ac of  $\text{NO}_3\text{-N}$  in the top 60 cm (2 feet) of soil, and your target yield is 85 bu/ac under **intermediate irrigation** conditions, then the amount of nitrogen fertilizer required is 90 lb/ac. This is the difference between the 150 lb/ac of soil N + fertilizer N needed for a yield goal of 85 bu/ac (from Table 1, intermediate irrigation) and the 60 lb/ac of N in the soil.

**Table 1. Nitrogen fertilizer recommendations for soft wheat at two irrigation levels.**

Soil N plus Fertilizer N lb/ac	Yield Goal	
	Intermediate Irrigation	Optimum Irrigation
50	52	56
60	57	62
70	52	68
80	66	73
90	70	77
100	73	81
110	76	85
120	78	88
130	81	91
140	83	94
150	85*	96
160	87	98
170	88	100
180	89	102*
190	90	104
200	91	106

\* total nitrogen amounts above this level may result in grain protein level above 10.5 per cent.

### Phosphorus (P)

Soft wheat will respond to phosphate ( $P_2O_5$ ) fertilizer on soils low in plant available phosphorus. However, response to P is much less than with N fertilizer.

Over the past several decades, use of phosphate fertilizer has resulted in a build-up of residual P, most of which remains in plant available forms, but all these forms are not measured in a routine soil test for P. Phosphate fertilizer recommendations are provided in Table 2. These recommendations are based on the Kelowna soil test method and are for seed-placed phosphate. For the greatest efficiency, phosphate fertilizer should be either seed-placed or banded.

**Table 2. Phosphate fertilizer recommendations for soft wheat.**

Soil Test* P lb/ac	Recommended $P_2O_5$ lb/ac
0-10	45
10-20	40
20-30	35
30-40	30
40-50	25
50-60	20
60-70	15
70-80	15
80-90	0
>90	0

\* Based on the Kelowna soil test P method

### Potassium (K)

Most irrigated soils in southern Alberta have adequate levels of potassium. Soil test K is frequently over 500 lb/ac in the top 0-15 cm (0-6 inches) of soil. As a result, potassium (potash) fertilizer is generally not required for irrigated soft white spring wheat. Table 3 provides guidelines for rates of potash ( $K_2O$ ) at various soil test levels of potassium.

**Table 3. Potassium fertilizer recommendations for soft wheat.**

Soil test K lb/ac	Recommended $K_2O$ lb/ac
0-50	120
50-100	100
100-150	60
150-200	45
200-250	15
>250	0

### Sulphur (S)

Sulfur deficiencies are rarely observed on irrigated land in southern Alberta. Sulphate-sulphur ( $SO_4-S$ ) occurs naturally in irrigation water. Generally, about 25 to 30 lb/ac of  $SO_4-S$  is applied in 30 cm (12 inches) of irrigation water. Therefore, land that has been irrigated for a number of years usually has ample  $SO_4-S$  to meet crop requirements.

Sulphur deficiencies could potentially occur on very sandy soils if high amounts of rainfall have leached plant available sulphur below the active rooting depth of young plants early in the growing season.

### Micronutrients

Micronutrients include boron (B), copper (Cu), iron (Fe), manganese (Mn) and zinc (Zn). Most irrigated soils in southern Alberta are not deficient in micronutrients. No micronutrient responses have been documented in micronutrient fertilizers research trials with soft white spring wheat. So, micronutrient fertilizers should only be used in special circumstances in consultation with a crop specialist, soil agronomist and a soil testing lab.

For more detailed information on fertilizing irrigated crops, please refer to: **Agdex 100/541.1 - Fertilizing Irrigated Grain and Oilseed Crops** and **Agdex 531-1 - Micronutrient Requirements of Crops**.

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