

## SUNFLOWER FERTILITY

Ensuring the fertility needs of the crop are met is critical to maximize yield and profit. Fertilizer applications should be made based on a soil test, to prevent improper application causing crop damage and, or yield loss.

Germinating sunflower seed is very sensitive to seed-placed fertilizer, and fertilizer should therefore be placed away from the seed. No more than 6 to 10 lbs of N with potash should be placed with the seed. If sunflowers are planted utilizing row crop equipment, all phosphate and potassium should be side banded 2" beside and 2" below the seed during planting. Some or all of the nitrogen can also be side-banded, provided that the total amount of fertilizer material side-banded does not exceed 300 lb/ac. Nitrogen can also be side-dressed before the plants are 12 inches tall. To assess the amount of fertilizer effect on crop stand one may use the South Dakota State University Fertilizer Seed Decision Aid. Check out the following link <<http://www.sdstate.edu/ps/extension/soil-fert/index.cfm>> for the Decision Aid.

**Table 4.** Nutrient uptake and removal by sunflower in Manitoba studies.

Nutrient	Uptake	Removal	Uptake	Removal
	Lb nutrient for a 2000 lb crop		Lb nutrient per cwt	
Nitrogen (N)	74-122	48-66	3.7-6.1	2.4-3.3
Phosphorus (P <sub>2</sub> O <sub>5</sub> )	24-56	18-26	1.2 – 2.8	0.9 – 1.3
Potassium (K <sub>2</sub> O)	150-172	18-26	7.5 – 8.6	0.9-1.3
Sulphur (S)	8-12	3-4	0.39 – 0.58	0.17-0.22
Calcium (Ca)	54-94	3-4	2.7-4.7	0.15-0.23
Magnesium (Mg)	37-39	6-7	1.86-1.93	0.30-0.36

Uptake<sup>1</sup> = total nutrients taken up by the crop

Removal<sup>2</sup> = total nutrients removed up by the crop

From [http://www.umanitoba.ca/afs/agronomists\\_conf/Proceedings/2008/Heard%20sunflower%20nutrient%20uptake-poster.pdf](http://www.umanitoba.ca/afs/agronomists_conf/Proceedings/2008/Heard%20sunflower%20nutrient%20uptake-poster.pdf)

## NITROGEN

Nitrogen is the major nutrient required by sunflowers, and has the greatest impact on seed size, leaf size and number of leaves, test weight and yield. Insufficient N will limit crop yield, however, excess N applications can reduce oil content, and result in tall plants with large leaves more prone to lodging and disease. To help calculate the optimum quantity of nitrogen to apply, you need to develop a yield goal. It is important to be realistic when developing a yield goal and aim to be within 200 pounds of the fields' highest recorded yield. Sunflowers require approximately 5 lbs of nitrogen for every 100 lbs of production yield goal; however, it is important to not apply excessive amounts of nitrogen. Nitrogen applications can be made pre-plant, at seeding, post-seeding side-dress or a combination of these methods. Application should be timed so nitrogen is available for rapid plant growth and development. Often, logistically it is advantageous to apply nitrogen in the fall, however, the longer the time period between applications and plant use, the greater the possibility for N losses. Fall applications are not recommended in sandy soils since the opportunity for leaching is much greater. A side-dress application of N when the sunflower plants are about 12 inches high is often preferable.

## PHOSPHORUS

Phosphorus deficiency is considered the second (after N) deficiency to occur within sunflower crops. Phosphate and potash may be fall or spring applied before a tillage operation. These nutrients are not readily lost from the soil since they attach to the soil forming only slightly soluble compounds. Phosphorus can be applied pre-plant-broadcast, pre-plant banded, or banded at seeding. Band applied applications are most efficient, especially when small amounts are applied in fields low in available phosphorus.

## POTASSIUM

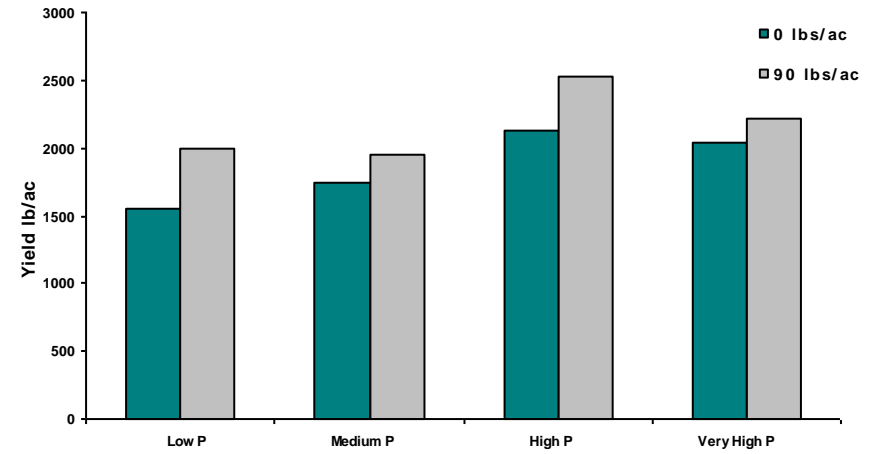
Potassium (K) is required by the crop for stalk and tissue strength. Sunflowers are a high user of potassium, with every 1t/ha yield, removing 30 kg K/ha. Potassium deficiencies normally only occur in sandy soils. Potassium that is band placed is about twice as efficient as broadcast applications.

## SPECIAL FERTILITY CONSIDERATIONS

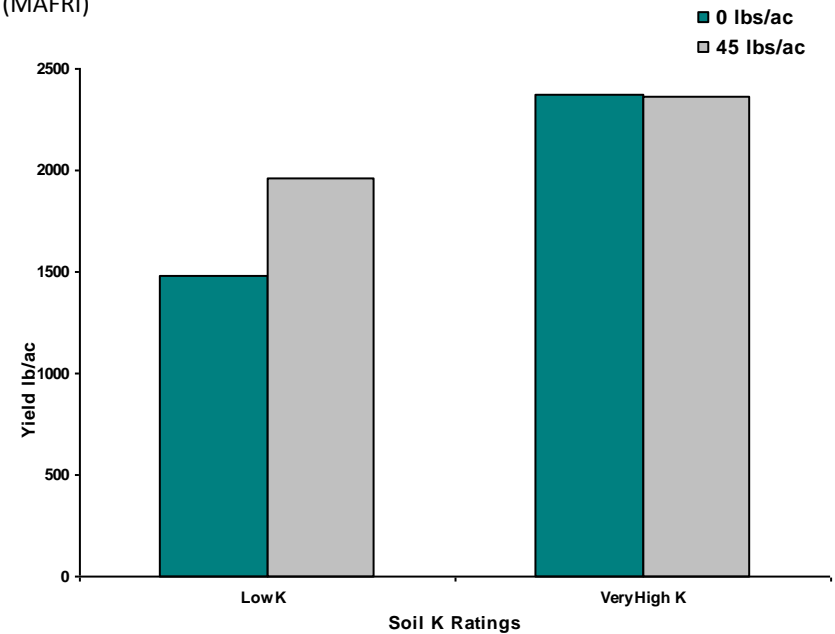
Sunflowers have deep tap roots that can obtain water and nutrients five to six feet (1.5 to 1.8 meters) deep in the soil. These reserves of water and nutrients are unavailable to most other annual crops, making sunflower a good rotational crop. Sunflowers have the ability to scavenge nitrogen that has leached below the rooting depth of other crops.

**Table 5.** Nitrogen recommendations for sunflower (based on spring band application). MAFRI.

		TARGET YIELD			
Fall Soil NO <sub>3</sub> -N		1,750	2,000	2,250	2,500
lb/ac in 0-24"	Rating	NITROGEN RECOMMENTATIONS (lb/ac)			
20	VL	40	85	125	170
30	L	20	60	105	145
40	M	0	35	80	120
50	M	0	10	55	100
60	H	0	0	30	75
70	H	0	0	5	50
80	VH	0	0	0	25
90	VH	0	0	0	0
100	VH <sup>+</sup>	0	0	0	0



**Figure 1.** Residual soil P and applications of potash on sunflower crop yield (MAFRI)



**Figure 3.** Residual soil K and applications of K fertilizer on sunflower crop yield (MAFRI)

**Table 6.** Phosphorus, potassium and sulfur recommendations for sunflower based on soil test levels and placement. MAFRI.

PHOSPHORUS					POTASSIUM					SULPHUR		
Soil Phosphorus (0-6")			Fertilizer Phosphate (P <sub>2</sub> O <sub>5</sub> ) Recommended (lb/ac)		Soil Potassium (0-6")			Fertilizer Potash (K <sub>2</sub> O) Recommended (lb/ac)		Soil Sulphate-Sulphur (0-24")		Fertilizer Sulphur (S) Recommended (lb/ac)
ppm	lb/ac	Rating	Sb <sup>2</sup>	PPI <sup>3</sup>	ppm	lb/ac	Rating	Sb <sup>2</sup>	PPI <sup>3</sup>	lb/ac	Rating	N/A <sup>3</sup>
0	0	VL	40	40	0	0	VL	30	60	0	VL	20
	5	VL	40	40	25	50	VL	30	60	5	VL	20
5	10	L	40	40	50	100	VL	15	30	10	VL	20
	15	L	35	35	75	150	L	15	30	15	L	20
10	20	M	30	30	100	200	L	0	0	20	L	20
	25	M	20	20	125	250	M	0	0	25	M	20
15	30	H	15	15	150	300	M	0	0	30	M	20
	35	H	10	10	175	350	H	0	0	35	H	0
20	40	VH	10	10	200	400	VH	0	0	40	VH	0
20 <sup>+</sup>	40 <sup>+</sup>	VH <sup>+</sup>	10	10	200 <sup>+</sup>	400 <sup>+</sup>	VH <sup>+</sup>	0	0	40 <sup>+</sup>	VH <sup>+</sup>	0

Sb<sup>2</sup> = Side Banded

PPI<sup>3</sup> = broadcast and pre-plant incorporated

N/A<sup>3</sup> = placement does not influence effectiveness of sulphate forms of sulphur fertilizer

## PLANT TISSUE ANALYSIS

Plant tissue analysis is an important tool in assessing nutrient status of the growing crop. Following are plant tissue analysis interpretive criteria used by the former Manitoba Agriculture Provincial Testing laboratory. These levels should be used for the top one to three most mature leaves collected at the bud stage. AgVise labs have a comprehensive tissue sampling guide <http://www.agviselabs.com/pdf/PlantSample.pdf>. If a deficiency is detected at this stage, yield potential has already been affected. This sampling is best used as an auditing tool to determine if your fertility program is sufficient for the yield potential. If nutrient deficiency is suspected earlier, sample plants and soil from the affected area and contrast results with plant and soil samples from an adjacent normal looking area. This is considered diagnostic sampling and could be used to correct some in-season deficiencies. Consult with your soil and plant tissue laboratory for guidelines when sampling at other growth stages. It is more efficient to assess soil sample results in the spring prior to planting and ensure the crop receives adequate fertilizer to last throughout the growing season.

**Table 7.** Sunflower tissue analysis interpretation

Nutrient	Content				
	Low	Marginal	Sufficient	High	Excess
Nitrogen % N	1.4	1.5-1.9	2.0-3.4	3.5-3.9	4.0
Phosphorus % P	0.14	0.15-0.24	0.25-0.49	0.5-0.79	0.8
Potassium % K	0.9	1.0-1.4	1.5-2.9	3.0-4.9	5.0
Sulphur % S	0.14	0.15-0.19	0.2-0.39	0.4-0.99	1.0
Calcium % Ca	0.19	0.2-0.29	0.3-1.9	2.0-2.4	2.5
Magnesium % Mg	0.09	0.1-0.19	0.2-1.4	1.5-1.9	2.0
Zinc ppm ZN	11	12-14	15-69	70-149	150
Copper ppm (Cu)	2	3-5	6-24	25-74	75
Iron ppm (FE)	14	15-19	20-249	250-499	500
Manganese ppm (Mn)	9	10-14	15-99	100-249	350
Boron	No provincial guidelines developed. Consult analytical companies				