Frost Impact on Sunflowers

Frost anytime before the sunflower crop reaches physiological maturity (R9) can cause damage. Once sunflowers reaches the R7 stage (ray petals have dropped, back of head starting to turn yellow), sunflower can withstand temperatures as low as -4° C, but temperature, duration and crop stage will influence the type and amount of damage.

A killing frost in sunflowers is considered to be -4 to -5° C for 6 or more hours, as this low temperature for the extended period is required to penetrate the thick layer in the back of the sunflower head and start the dry down process. The follow will attempt to describe what happens when a frost occurs prior to the R-9 growth stage.

R7 – Losses in yield, test weight, oil content and discolored seed coats. Some seeds will be low test weight and unmarketable

R-8 – Some reduction in yield, bushel weight, oil content and discolored seed coats. Most seeds will still be marketable

R9 – no damage will occur, at this stage a frost is needed to dry the plant for harvest

How Much Time is Needed to Reach R9?

Sunflower development is driven by temperature and accumulation of temperatures during the day/night. The formula to convert the daily max/min temperature to a sunflower GDD is $((T_{max} + T_{min})/2) - 6.7°$ C. If the T_{max} or T_{min} is at or below 6.7° C, then use the 6.7 temperature in the formula instead of the real number.

For example, with a 17° C max and a 4° C min temperate = ((17+6.74)/2 – 6.7) = 5 sunflower GDD.

From Table 1, the development model indicates it needs 79 'sunflower GDD' to reach R9 from R8 and 157 'sunflower GDD' from R7.

On average, throughout September most sunflower growing areas are accumulating on average 7 'sunflower GDD' per day, meaning:
R7 (start) to R9 = 22 days
R8 (start) to R9 = 11 days

Growth Stage	Accumulated GDD Needed (*C)
VE	97
R1	569
R2	647
R3	726
R4	805
R5.1	883
R6	1040
R7	1119
R8	1197
R9	1276

Table 1: Sunflower Growth and Development Model based on GDD from www.ag.ndsu.edu

Manitoba

CNSA