Irrigation management in sunflowers

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Cultivated sunflower (*Helianthus annuus* L.) is typically divided into two groups based on the intended use. Oilseed types, as the name implies, are grown for oil content and are further divided into linoleic and oleic hybrids. Oilseed sunflowers are usually black-seeded and contain from 38 to 50 percent oil. Often called confectionary or striped sunflowers, non-oilseed varieties are larger seeded and thicker hulled compared to oilseed types. In addition, they have a lower oil content and test weight.

The genus *Helianthus* comprises some 50 to 100 species, all native to North and South America. Seven of these species can be found in Wyoming, predominantly inhabiting disturbed areas such as roadside ditches and agricultural fields.

Due to its above-average rooting depth (more than eight feet in some cases), sunflowers can extract water in low rainfall areas more efficiently than many crops. As drought conditions continue throughout most of Wyoming and other western states, many producers face uncertainty as to the availability of irrigation water for the upcoming growing season. Historically, sunflowers have been grown under non-irrigated conditions in much of the High Plains. With limited irrigation supplies, there has been increased interest in growing irrigated sunflower as an alternative rotational crop. It is thought that sunflowers may be a viable alternative to sugar beets when grown under these limited water conditions. The question then arises "how can limited irrigation water best be utilized to maximize economic return in the sunflower crop?"

As with most crops, there seems to be a critical point during sunflower development when insufficient water can dramatically impact yield and quality. It is important to realize that, while sunflower can produce an economic crop with limited irrigation, proper timing of these irrigations can result in a substantial boost in productivity.

Table 1 illustrates the impact that well-timed irrigation of approximately one inch of water

Table 1. Oil content, yield, and net economic return of sunflowers under various irrigation management regimes. Torrington Research and Extension Center, 2002 to 2004.

Irrigation timing	Oil content	Yield	Net economic return[1]	
			Furrow	Pivot
	--- % ---	-- lbs / acre --	---------- $ / acre ----------	
R1 only	36.2	1,500	97	93
R1 & R6	39.7	2,028	174	166
Weekly	40.3	2,491	176	142
Bi-weekly	40.1	2,103	161	144
Tri-weekly	39.0	1,664	106	93
No irrigation	35.8	665	--	--

[1]Net economic return is defined as the return to input and management, excluding land, compared to no irrigation.

on a sandy loam soil can have on the yield and net economic return for sunflower. If two irrigations are applied, one as sunflowers initiate buds (R1)[1] and one at seed fill (R6)[2], oil content and yield may be reduced slightly compared to weekly or bi-weekly irrigation; however, when the cost of these irrigations are considered, the net economic return for the R1 and R6 irrigation regime is greater than that for biweekly irrigations under both systems and weekly irrigation under the pivot system. A single irrigation at bud initiation or tri-weekly irrigations throughout the season reduced oil content, yield, and economic return compared to the other three treatments.

A single irrigation at the R1 stage increased sunflower yield by 125 percent compared to no irrigation, but improved oil content only slightly. Adding the second irrigation at the R6 stage further increased yield, and also raised the oil content by 3.5 percent. This difference had a large impact on the economic return, as the oil content factors heavily into the payment received. While the oil content from the R1 and R6 irrigation regime would likely not incur major discounts under most sunflower payment schedules, the lower oil content from the R1 or no irrigation treatments would almost certainly reduce the payment received per hundredweight.

Irrigating every other week provided yields and economic returns similar to weekly irrigation and, therefore, the additional irrigations are not recommended. If late-season irrigation will be available, an attempt should be made to apply water at the R1 and R6 stage of development in order to maximize yield and oil content.

Another factor that may influence sunflower yield and quality under limited irrigation is plant population. Table 2 illustrates the effect two seeding densities had on oil content and yield of irrigated sunflowers. While yields

1 R-1 stage of sunflower growth is reached when the terminal bud forms a miniature floral head rather than a cluster of leaves.

2 R-6 stage of sunflower growth is reached when flowering is complete and the ray flowers are beginning to wilt.

Table 2. Oil content and yield of furrow-irrigated sunflowers as influenced by seeded population. Torrington Research and Extension Center, 2002 to 2004.

Seeding rate	Oil content	Yield	Net Return[1]
-- seeds / Acre --	--- % ---	-- lbs / Acre --	---- $ / acre ----
20,000	38.0	1,719	177
30,000	39.1	1,765	184

[1]Net return is defined as the return to input and management, excluding land, compared to no irrigation.

were nearly identical for the two seeding rates, oil content was increased by 1 percent as the seeded population increased from 20,000 to 30,000. This difference was consistent across all three years of research and across all irrigation treatments. Although increasing the seeding rate would cost approximately $5- to $7-per-acre more at planting time, the greater oil content and yield would result in a $7-per-acre increase in net return above the additional seed cost. If supplemental irrigation is to be applied (even if it is limited), then it is recommended to plant at a higher population than would be recommended under dry land conditions.

Summary of recommendations for sunflower production under limited irrigation:

- Target late season irrigation timing for the R1 and R6 growth stage.
- Under extremely limited irrigation conditions, a single irrigation at bud initiation can boost yields and economic returns.
- Irrigating weekly has little to no benefit over bi-weekly irrigation intervals.
- Even under limited irrigation, increasing the seeded population above dry land recommendations can increase oil content and economic returns.

Figure 1. These photographs illustrate the R1 (left) and R6 (right) growth stages of sunflower. *Photos courtesy Extension Agronomy, Kansas State University.*

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