

Irrigation of soya beans in the US: A short overview

Irrigated soya bean systems are the most productive in the US, averaging over 48% more yield than dryland systems. Drought is the most damaging abiotic (non-living) stress to soya bean crops. Overcoming drought is a key factor to sustaining maximum soya bean yields, but only about 8% of US soya bean acres are irrigated. The ability to continue using irrigation will rely on maintaining the quantity and quality of ground and surface water resources.

Soya beans are a relatively drought-tolerant crop but respond well to irrigation. While irrigated soya bean acres can be found in every soya bean producing state, the largest percentage of irrigated acres occurs in the Central and Northern Great Plains, particularly Nebraska, Kansas and the Texas Panhandle.

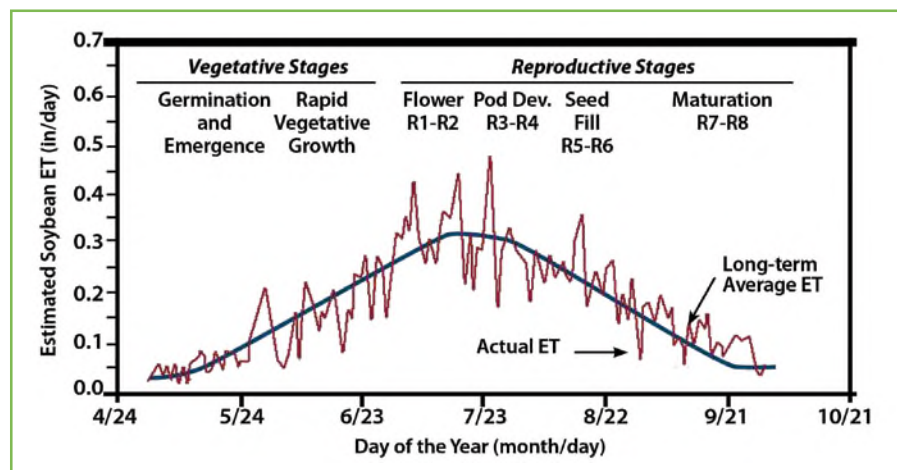
Plant characteristics

Soya beans are a relatively deep-rooted crop. In deep, well-drained soils with no restricting layers, roots can penetrate to 1,8m. As with all crops, most of the roots are concentrated in the upper half of the root zone. Managing a root zone of just below 1m (0,9m), is the general irrigation recommendation. Water use requirements, also known as evapotranspiration or ET, for soya beans range from 43 to 71cm depending on climatic conditions.

Water use rates

Daily water use varies according to the stage of growth and weather conditions. The typical peak water use rate is about 0,89cm per day as typical for all summer-grown

Figure 1: Soya bean water use of daily evapotranspiration (ET) from a well-watered crop. (Nebguide 1367 UNL).



field crops, which normally occurs near the beginning of the podfill stage (Figure 1).

Single-day peak water use rates can approach 1,2cm per day. Water use is low at the germination and seedling stages, peaks at or near the full-bloom stage, and then declines with maturity. The most critical time for adequate soil water availability is during the end of the reproductive period when podfill begins.

Soya beans produce many flowers relative to the final number of pods, so losing a few flowers to light water stress earlier in the reproductive cycle is not as critical to final productivity as the same water stress during podfill. Net irrigation requirements for soya beans in dry years range from around 35cm in western production regions to less than 12,7cm in the east. Requirements in an average rainfall year will be 5 to 10,1cm less.

Irrigation timing

Research studies throughout the High Plains confirm that the most beneficial timing for a limited amount of irrigation is during the latter part of the reproductive growth stages rather than earlier. This is generally true because early-season growth

and development can be satisfied by typical rainfall and stored soil water.

When full irrigation is possible, a managed allowable depletion level of 50% in the managed root zone is the recommended management guideline – the typical managed allowable depletion for most field crops. The peak water-use rate is generally later in the season than maize, which means soya beans may be used as a field acreage split with maize as a way to reduce water stress potential at tasseling for maize crop.

Irrigation scheduling using the soil water depletion method is a best management practice. Irrigation scheduling in this form can be accomplished using either soil water measurement devices (sensors/probes) or climatic-based (also known as evapotranspiration-based) irrigation scheduling. Many states provide an irrigation scheduling program. One example is the K-State Research and Extension KanSched irrigation scheduling program. Other free irrigation decision support software is also available. 🌱

Table 1: Example of soya bean water use (ET) by growth stage.

Growth stage	Water use (cm/day)
Germination and seedling	0,05 – 0,10
Rapid vegetative growth	0,10 – 0,20
Flowering to podfill (full canopy)	0,20 – 0,30
Beginning maturity to harvest	0,05 – 0,20

Source: Tacker, P and Vories, E, Arkansas Soybean Handbook, Chapter 8, Irrigation. MP197. www.uaex.edu.

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