



BLACKFOOT CHALLENGE IRRIGATION SCHEDULING PROGRAM ANNUAL REPORT 2019

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PROGRAM SUMMARY

The Blackfoot Challenge Irrigation Scheduling Program has provided information to irrigators for ten years now (2010–2019). Our goal is to help apply the right amount of water at the right time to meet crop goals and watershed objectives. Weekly reports are circulated basin-wide to over 100 irrigators and water managers that include crop water use, irrigation tips, drought strategies, soil and crop management options, soil health concerns and other information. Reports are also provided on the Challenge website. This work has identified an overall irrigation strategy that can provide both good crop production and adequate late-season stream flows during dry years. This year (2019) was the second in a row with good snowpack and soil moisture storage plus excellent growing conditions throughout most of the season. Rainfall was not excessive but well-timed and cool temperatures kept crop water use below average until August. This weather produced a second year of record crops but late-season rainfall delayed harvest in some fields.

2019 HIGHLIGHTS

- 8-12 inches of rain fell on Blackfoot croplands during the 2019 growing season depending on location (the historic average is about 7 inches). Some sites reported record totals for May and June.
- Early season soil moisture was almost as good as last year with most soils above 75% of their water holding capacity on May 1.
- Cool, moist weather dominated the early growing season – perfect for crop production.
- 2019 potential crop water use in inches:
hay = 26, pasture = 22, grains = 16-19
- High soil moisture levels, average snowpack and well-timed rainfall combined to make another good year for crop production in the Blackfoot Drainage.
- Good water availability and warm weather in September supported second cuttings, new seedings and abundant fall pasture for many.



BLACKFOOT CHALLENGE WEEKLY IRRIGATION REPORT Friday July 3, 2015

Independence Day could have been declared as a holiday for irrigators - most of them are extremely independent. This one will be warm and dry following another week of high potential crop water use (4-1/2 inches). A few drops were reported but virtually no rain fell on Blackfoot croplands again. Crops again responded well to warm temperatures and clear skies with impressive growth spurts in some fields. A condensed overview of the entire irrigation season is presented on the last page of this report as a reminder to plan ahead. More information about irrigation is available on the Challenge website.



WEATHER - WARM LAST WEEK AND WARM NEXT

Very warm, dry weather prevailed last week and will continue next week. Only scattered showers are predicted. Temperatures will again be in the 80 and 90s. The 30 and 60 day forecasts continue to suggest above normal temperatures and normal rainfall. Low streamflows are becoming very low streamflows.



HIGH CROP WATER USE CONTINUES

Crop water use continued to be above 1 1/2 inches for most crops last week - still above normal. It will continue to be high next week with hot temperatures and low humidity. The table and chart on Page 3 illustrate crop water use throughout the whole season.

WATER USE IN INCHES	LAST 7 DAYS	NEXT 7 DAYS ¹	SEASON TOTAL ²
HAY CROPS	1.7	1.7 (1.5 - 1.9)	13.20
PASTURE	1.4	1.4 (1.3 - 1.5)	11.50
SPRING GRAINS (planted May)	1.8	1.8 (1.7 - 2.1)	7.8
WINTER WHEAT	1.8	1.6 (1.7 - 2.1)	14.6
LAWNS	1.6	1.6 (1.5 - 1.6)	12.9

¹ Reported water use (larger if multiple basins) or below normal if below 1 inch. ² Total water includes April



SOIL MOISTURE - ADD WHAT YOU CAN

Ideally you have a full soil profile and are ready for your first cutting. However, most of those in the Blackfoot Drainage on Planet Earth are struggling to boost moisture at all. Do the best you can, leave time for the surface to dry out before cutting and get back on if you can as soon as possible.

2019 WEATHER

2019 was the second year in a row for great local crop weather. The winter snowpack on May 1 was average (last year was 175%). But almost every week throughout April, May and June had rain with up to 2 inches some weeks at some sites. Significant weekly rain continued until mid-July (the entire first hay cutting period). Temperatures from April to mid-July were generally mild without prolonged hot periods. Continued good weather into early September allowed second cuttings some places and extra pasture production but mid-August and mid-September rains hindered harvest and ended irrigation at many sites.

2019 CROP WATER USE

Figure 1 shows that rainfall and weekly crop water throughout the 2019 season for all crops was slightly above average. Figure 2 shows crop water use was below average from April to mid-July then above-average for August and September. Record crops were harvested due to good growing conditions throughout most of the season including mild temperatures and above-average rainfall.

It is important to remember that these ***potential crop water use*** figures are for a dense, robust stand that is well-irrigated, well-fertilized and mostly disease/insect free. Crops not in such good condition use less water. Actual crop water use across the drainage varies dramatically due to water availability, fertilizer, stand quality, micro-climate, management style, and many other factors. Working with individual irrigators across the drainage allows us to re-calibrate regional crop water use information to the Blackfoot area. It also provides accurate information for these irrigators at specific fields throughout the season and a record of using water efficiently.

One of the most significant results of this program is that it continues to reveal that over-irrigation is not common among sprinkler irrigators. Most sprinkler irrigators in the drainage apply only 50-75% of the *potential* crop water use when you consider the entire irrigation season. However, if you just consider the period before cutting, many irrigators participating in this program apply 75-100% of the *potential* crop water demand. This suggests irrigators are smartly concentrating on their first cutting which is where the most production is and the biggest bang for the buck. They then may irrigate in a more relaxed manner to produce pasture, start a new crop or keep alfalfa happy. Many cease irrigating due to water availability, water rights, stream flows or other reasons (boating and fishing?).

FIGURE 1. POTENTIAL CROP WATER USE THROUGHOUT THE 2019 IRRIGATION SEASON

BLACKFOOT 2019 GROWING SEASON WEEKLY RAINFALL & CROP WATER USE (INCHES OF WATER)										
WEEK ENDING	RAIN ¹	2019 WEEKLY POTENTIAL CROP WATER USE ²						AVERAGE POTENTIAL CROP WATER USE ³		
	RAIN	HAY CROPS ⁴	PASTURE	SPRING GRAINS 5-1 START	SPRING GRAINS 5-15 START	WINTER WHEAT	LAWNS	LONGTERM AVERAGE HAY WATER USE	HOT WEEK HAY WATER USE	COOL WEEK HAY WATER USE
5/3/2019	0.30	0.40	0.50	0.10	0.10	0.40	0.50	0.50	0.80	0.30
5/10/2019	0.30	0.50	0.40	0.10	0.10	0.50	0.50	0.80	1.00	0.50
5/17/2019	0.40	1.10	0.90	0.10	0.10	1.10	1.00	1.00	1.10	0.60
5/24/2019	0.10	0.90	0.80	0.20	0.10	1.00	0.90	1.20	1.30	0.80
5/31/2019	0.75	1.10	0.90	0.50	0.20	1.20	1.00	1.30	1.40	0.90
6/7/2019	0.30	1.50	1.30	1.00	0.60	1.60	1.40	1.40	1.50	1.00
6/14/2019	0.50	1.50	1.40	1.50	1.10	1.70	1.50	1.50	1.70	1.00
6/21/2019	0.10	1.30	1.10	1.40	1.20	1.50	1.20	1.50	1.90	1.10
6/28/2019	0.10	1.10	0.90	1.20	1.10	1.20	1.00	1.50	2.00	1.10
7/5/2019	0.40	1.20	1.00	1.30	1.20	1.30	1.10	1.60	2.10	1.30
7/12/2019	0.25	1.40	1.10	1.50	1.50	1.50	1.30	1.60	2.00	1.20
7/19/2019	0.50	1.30	1.00	1.40	1.40	1.00	1.20	1.50	2.00	1.20
7/26/2019	0.01	1.50	1.20	1.70	1.70	0.75	1.40	1.50	2.20	1.10
8/2/2019	0.01	1.60	1.30	1.80	1.80	0.50	1.50	1.40	1.70	1.00
8/9/2019	0.10	1.80	1.40	1.50	2.00	0.10	1.70	1.20	1.50	0.90
8/16/2019	0.40	1.20	0.90	1.00	1.25	0.00	1.10	1.00	1.30	0.70
8/23/2019	0.20	1.20	1.00	0.50	0.50	0.00	1.10	0.80	1.00	0.50
8/30/2019	0.20	1.10	0.90	0.10	0.10	0.00	1.00	0.60	0.80	0.40
9/6/2019	1.00	1.10	0.90	0.00	0.00	0.00	1.00	0.60	0.70	0.30
9/13/2019	1.50	0.70	0.60	0.00	0.00	0.00	0.70	0.50	0.70	0.30
9/20/2019	0.25	0.80	0.60	0.00	0.00	0.00	0.70	0.40	0.60	0.20
9/30/2019	0.50	0.70	0.50	0.00	0.00	0.00	0.60	0.40	0.60	0.20
TOTAL	9.67	26.00	21.80	17.00	16.15	16.45	24.60	24.80	31.40	17.10

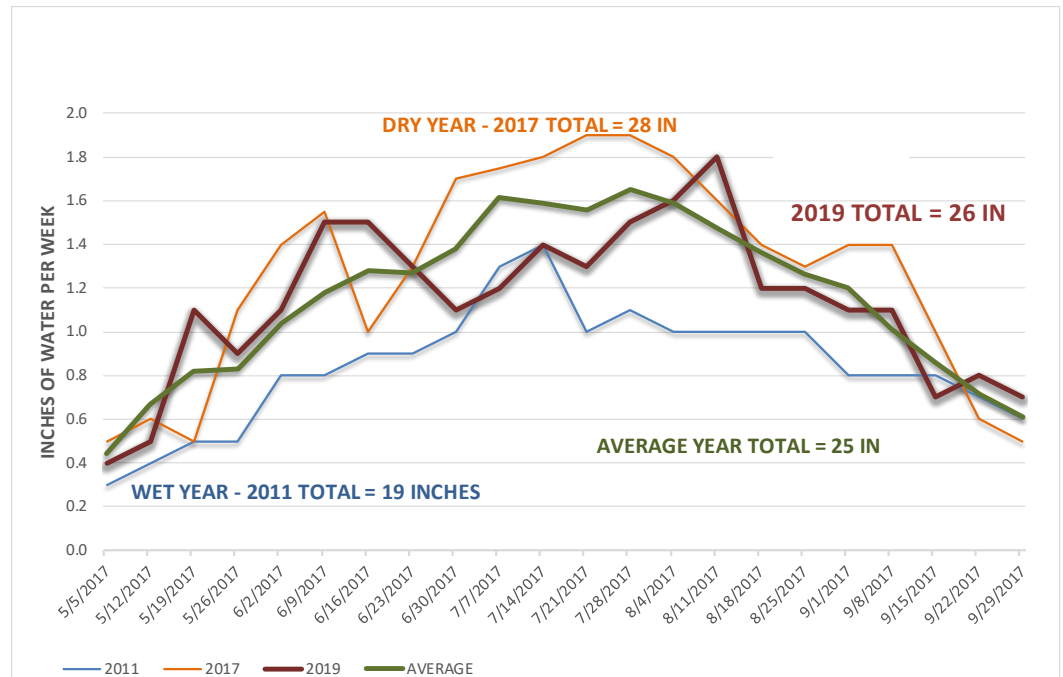
¹ Rainfall should be reduced to account for immediate evaporation from crop and soil surfaces (0.1-April, May and Sept, 0.15-June and August, 0.2-July)

² This years maximum water use by healthy crops that are well-fertilized and irrigated, disease and insect-free. Will vary slightly across the drainage.

³ Longterm average water use for each crop each week based on long-term historic data.

⁴ Hay Crop water use drops approximately 2/3 the first week after cutting, 1/2 the second and 1/3 the third.

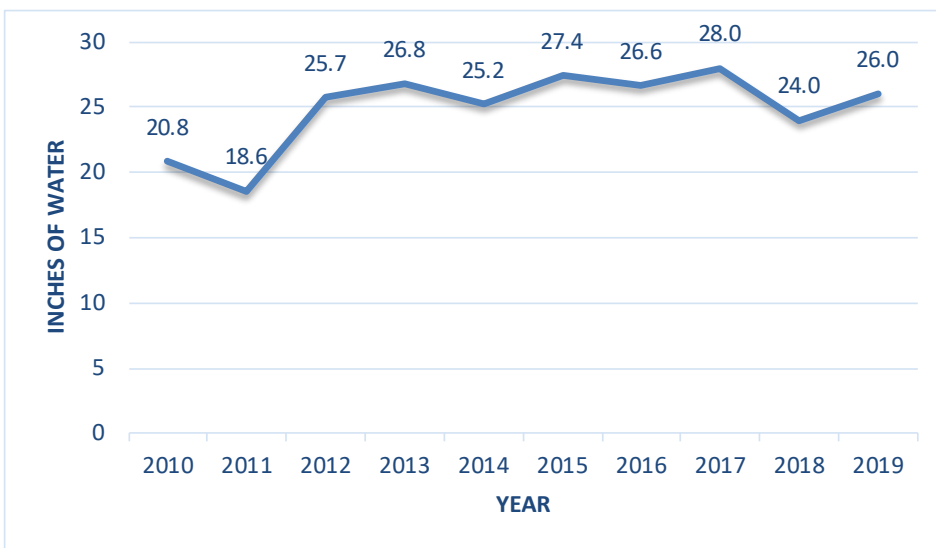
FIGURE 2. 2019 HAY WEEKLY WATER USE (RED) COMPARED WITH AVERAGE (GREEN), DRY AND WET YEARS



CROP WATER USE TRENDS

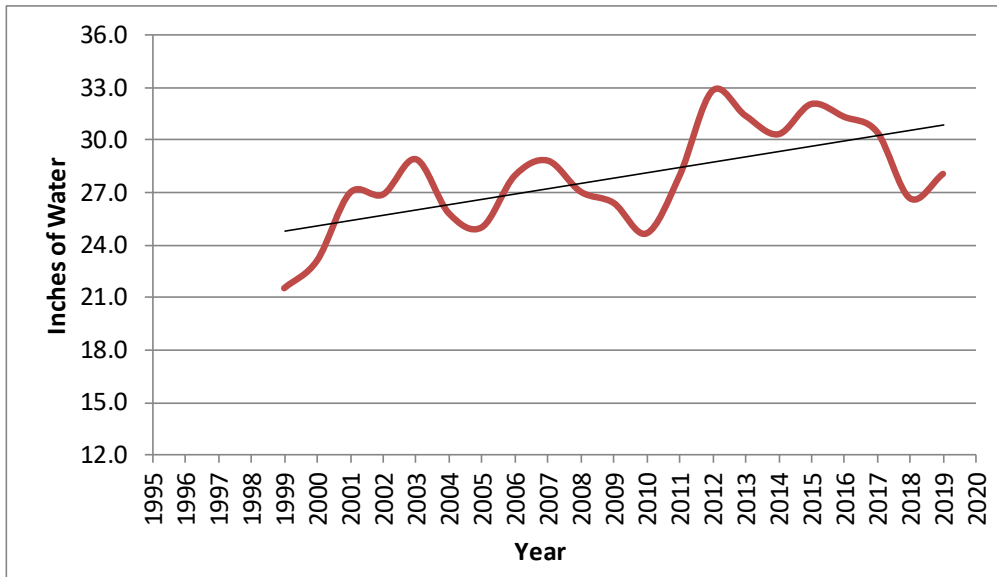
Crop water use in 2019 was slightly above average. Figure 3 shows annual hay crop water use for all 10 years of this program with an average of about 25 inches. There is a general increase in crop water use across all years with 2018 the most significant dip. This trend of increasing crop water use is also reflected in the Deer Lodge Agrimet weather station data (Figure 4). These two sources suggest current average crop water use for hay is 25-28 inches. It’s interesting to note that the NRCS irrigation guides from the 1980s list crop water use for hay as 15 inches but now it is 25-28 inches. With all water rights already allocated in the Blackfoot drainage it will be increasingly important for irrigators to recognize early and take advantage of above average water years.

FIGURE 3. ANNUAL POTENTIAL CROP WATER USE FOR HAY IN THE BLACKFOOT DRAINAGE 2010-2019 Data from BF Challenge Irrigation Reports



AVERAGE = 25 INCHES

FIGURE 4. ANNUAL POTENTIAL CROP WATER USE FOR ALFALFA HAY SHOWING UPWARD TREND OVER THE PAST 20 YEARS *Data from Deer Lodge Agrimet Weather Station*



2019	28.1
2018	26.7
2017	30.5
2016	31.4
2015	32.1
2014	30.4
2013	31.4
2012	32.9
2011	28.0
2010	24.7
2009	26.4
2008	27.1
2007	28.9
2006	28.0
2005	25.0
2004	25.8
2003	28.9
2002	26.9
2001	27.0
2000	23.1
1999	21.6
AVERAGE	27.9

<https://www.usbr.gov/pn/agrimet/agrimetmap/drlmda.html>

2019 SOIL MOISTURE

Early season soil moisture in 2019 was almost as good as last year due to an average snowpack and well-timed spring rains. At the beginning of May most local hay root zones held about 75% of their water holding capacity. Cool, rainy conditions throughout April, May and June helped irrigators keep soil moisture high due to lower than average crop water use. These high soil moisture contents translated into good crop yields. After mid-July, effective rainfall dropped and crop water use increased with temperatures. Soil moisture became more difficult to maintain without extra irrigation efforts. However, water was more available than in recent years for irrigation and second cuttings were more common.

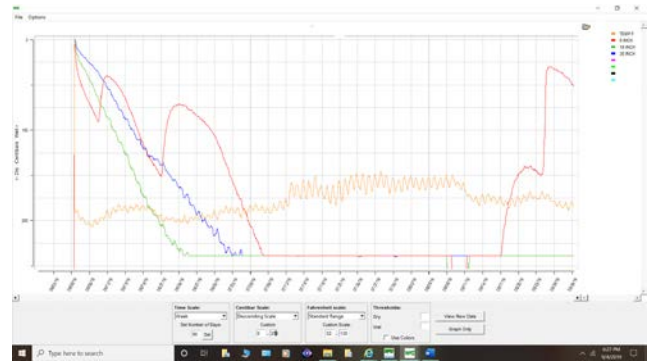
2019 IRRIGATION TIPS AND SPECIAL EFFORTS

Irrigation tips were provided each week according to crop stage, weather conditions and other factors. This year's tips concentrated on application rates, uniformity, and below-average crop water use during the early season due to cooler, wetter weather. Tips were expanded this year to include soil health concerns, soil moisture monitoring equipment and responses to irrigator questions. These discussions highlighted new crop choices, diversifying plantings and monitoring soil health improvements. We invite everyone interested in Soil Health to join the Soil Health listserv and receive announcements about this important topic. Anyone who wants to sign up can email (jennifer@blackfootchallenge.org) or Brad (brad@blackfootchallenge.org).



The Challenge is considering a new and improved soil moisture sensor program for irrigators. This summer the Challenge helped install and calibrate soil moisture sensors at 5 pivots and 1 wheel line irrigation system to provide instant soil moisture and temperature

readouts at each field. Data recorders take readings hourly for a detailed record of the entire irrigation season. These charts show the effects of individual irrigations including the depth of water penetration and how long before its depleted by crop use. This program could assist with equipment costs, installation and proper calibration of sensors as well as training in how to interpret and use the results. We can also help revive and recalibrate old installations. Contact Jennifer Schoonen if you might be interested.



Seasonal Soil Moisture and Temperature Chart

Interest in Soil Health increases in the Blackfoot drainage with more folks trying more options with great results. There are many examples including Scott Gordon and Bruce Menz who are using a cover crop to renovate an irrigated hayfield near Clearwater Junction. The site is challenged by a very rocky, sandy soil with low water and nutrient holding capacities and low organic matter content that just hasn't produced well. The goal is to end irrigation and convert the field to a native + non-native dryland mix dominated by grasses. But first they are improving the soil with cover crops to add organic matter, nutrients, aeration and encourage a more diverse microbiology. This year all 9 plants in the cover crop seed mix came up - including the turnips! The mix is listed below along with each plants role in the renovation. Thanks guys - for showing what cover crops can do in the Blackfoot. Scott says they had lots of good advice from the Blackfoot Challenge, Jim Stone, Brad Weitzen, the Lake County Conservation District and even myself. So spread the word – diverse cover crops are a local success and can be used to improve your soils too.



Their seed mix (suggested by NorthForty Ag) was seeded with a no-till drill and included Crimson Clover, 4010 Forage Peas, Diamond T Ryegrass, Spring Barley, Trophy Rapeseed, Purple Top Turnip, Black Oil Sunflowers and Baldy Spineless Safflower.

A **Best Management Strategy for Blackfoot Irrigators** to help both individual irrigators and water management across the entire drainage continues to be developed. We have combined experience from the best local irrigators with irrigation science to fine-tune recommendations. Individual recommendations have come together in an overall strategy for irrigation that can **provide both good crop production and late-season stream flows** for fish and recreationists. This strategy is condensed into our irrigation calendar (page 6) and its main points are:

- early evaluation of the coming irrigation season in April,
- heavy irrigation early in the season to fill up the soil water holding capacity,
- heavy irrigation throughout June and up to cutting in early-mid July
- reduced irrigation or no irrigation during low water flows in late July and August
- taking advantage of wet years for 2nd cuttings, new plantings and cover crops

In dry years, irrigators who applied water early and kept pouring it on up until haying in mid-July had excellent crops. In moist years like 2019, irrigators who took advantage of the abundant moisture and longer growing season had great production, great second cuttings and abundant fall pasture. There is little doubt that the future will only get more challenging for Blackfoot irrigators. However, with this challenge will likely come opportunities to influence critical water decisions and participate in future water markets from here to the Pacific Ocean. All while living and irrigating in a great place!

THE BLACKFOOT DRAINAGE IRRIGATION SEASON IN BRIEF

This is a summary of general activities and recommendations with more detail provided throughout our irrigation guide.

APRIL – GET READY AND PLAN YOUR IRRIGATION STRATEGY!

- Get your irrigation system ready, evaluate spring soil moisture and weather to determine start date.
- Evaluate season weather predictions then plan for drought if needed, start irrigating if dry.



MAY – CHECK SOIL MOISTURE & BE READY FOR UNUSUAL HEAT OR COLD!

- Check the soil moisture content at the start of growing season (May 1) and fill up the soil to its water holding capacity during early irrigations (2-4 inches).
- Watch for dry soil conditions, especially with new plantings and apply water to ensure good germination and emergence.
- Irrigate deeply at least once early in the season to promote deep root growth.
- Apply 2-5 inches of irrigation to hay and pasture crops in May depending on weather. Apply 0-2 inches to spring grains and new plantings as needed based on weather and growth. Apply extra water to fill up the soil (2-4 in).

JUNE – THIS IS THE TIME TO MAKE YOUR BIGGEST EFFORT SO POUR IT ON!

- Apply 6-8 inches of irrigation in June to hay and pasture crops and winter wheat depending on weather.
- Apply 5-8 inches to spring grains and new plantings as needed based on weather and growth.
- Consider irrigating deeply to fill up soil root zone and promote deep root growth.
- Be sure small grains are irrigated well during their critical periods of boot, bloom and early heading.



JULY – POUR IT ON UNTIL HARVEST AND RETURN QUICKLY

- Apply 1 - 2 ½ inches of irrigation per week in July to all crops - depending on weather.
- Cutting is a critical stress period for hay crops, especially alfalfa so irrigate deeply to fill up the root zone before cutting then get back across the field quickly after cutting. Crop water use declines when hay is cut so this is a good opportunity to fill up the soil again. Irrigate at least once after cutting.
- Stop irrigating small grains at the milk to soft dough stage but be sure there are 1- 2 inches of soil moisture left at this stage to prevent kernels from shrinking.

AUGUST- BE DROUGHT AWARE!

- Stop irrigating if you can during drought periods or irrigate less often.
- Apply 1 - 2 inches of irrigation per week in August to hay and pasture crops for full production depending on weather. Irrigate new plantings as needed.
- Many folks irrigate for pasture following their one hay cutting. Irrigate according to how much pasture you seek and with consideration for other water needs in the drainage, especially in drought years.
- Reduce river withdrawals by rotating systems and reducing the amount of irrigation at one time. This is the least efficient time to irrigate (lots of water lost to evaporation) so don't irrigate unless you need to.



SEPTEMBER – APPLY AS NEEDED/AVAILABLE & GET READY FOR SPRING!

- Stop irrigating if you can during drought periods.
- Apply ½ - 1 ½ inches of irrigation per week in September to hay and pasture crops for full production depending on weather. Irrigate new plantings as needed. Prepare the system for winter and an early start next spring.