Evaluating Conserved Consumptive Use in the Upper Colorado: 2020-2023 Summary Economics and Enterprise Budgeting

BACKGROUND

As Colorado River Basin water supplies shrink due to drying conditions and overallocation, the potential to balance supply and demand by paying farmers and ranchers to use less water under a voluntary program is one of the policy options that has been put on the table. Whether this is a viable option for particular producers depends on how the program is structured, specific aspects of the individual farm and ranch operations, and other external factors.

To address this, we investigated the economic impacts to Grand County, Colorado hay producers participating in a multi-year research study to evaluate the impact from withholding irrigation water. In the study, producers either entered into an agreement for full irrigation withdrawal or a partial-season withdrawal. For the full withdrawal, they agreed to turn off water for their fields for the entire irrigation season. Under the partial-season withdrawal, they agreed to turn off irrigation water on June 15th. These treatment fields were paired with additional reference fields which were managed and operated according to historic practices. Partial season withholding payments were set at $281 per acre and full irrigation withholding payments were $621 per acre for one year of reduced irrigation in 2020.

Interviews with a set of agricultural producers participating in the study were conducted to determine costs and revenues associated with their hay production on both reference (control) and treatment (variable) fields. Data related to operations were collected from producers and used to build enterprise budgets for each of their study fields to determine their overall profit/loss on a per acre and per field basis. The results of this small study are influenced by factors specific to the climate conditions of the 2020 treatment year (very dry) and geography (high elevation, short growing season), so the “break even” number, where total costs are equal to total revenues, is not generalizable to other circumstances. However, this report does identify important, broadly applicable factors that increase risks for those producers participating in programs that pay them to temporarily withhold irrigation water, and the magnitude of compensation that may be required to keep certain producers economically whole in dry years.

The 2020 report concludes that payments of $621 per acre of land subjected to a full season of irrigation withdrawal were sufficient to bring net economic gains of $393.22 per acre to producers that grew hay strictly for sale (i.e. no livestock also relied on grazing and the hay harvested from the fields). Producers who accepted partial season payments of $281 per acre experienced a net increase of $150.03 per acre. In both instances, these gains are compared directly to net profits from reference fields, not zero profit, that were irrigated normally during the same period.

However, producers that relied on their hay fields to feed cattle experienced a net loss of profit, despite the payments. The study found that producers with livestock would have needed an average payment of at least $970.66 per acre to fully compensate them for the additional costs they incurred by withholding irrigation on the study fields. After the conclusion of the withholding

season in 2020, further interviews were conducted with producers for the 2021 – 2023 seasons to determine any financial impacts after full irrigation was returned to the treatment fields.

RESULTS

Table 1. Results from reference field enterprise analysis for six operators participating in the study. Results reported are gross receipts, total operating and fixed costs, net receipts before factor payments, factor payments, and return to management and risk. In economics, factor payments are those costs associated with supplying factors of production, including land, labor, capital, or entrepreneurship. It is a good farm/ranch business principle to consider factor payments as an expense, even if you own the land, to account for payments made to scarce resources in return for productive services. Including factor payments helps producers to determine whether they are more profitable farming the land themselves, or if they would be better off renting or selling the land.

	Average			
REFERENCE FIELDS	**2020**	**2021**	**2022**	**2023**
Gross Receipts	$319.61	$529.50	$545.67	$519.83
Total Operating + Fixed Costs	$313.14	$402.35	$394.69	$390.04
Net Receipts Before Factor Payments	$7.47	$127.14	$150.93	$129.74
Factor Payments	$203.50	$203.50	$203.50	$203.50
Return To Management and Risk	$(196.03)	$(76.37)	$(52.60)	$(73.76)

Table 2. Results from treatment field enterprise analysis for the four operators participating in full season withholding. Results reported are gross receipts, total operating and fixed costs, net receipts before factor payments, factor payments, and return to management and risk.

	Average			
TREATMENT FIELDS – Full Season	**2020**	**2021**	**2022**	**2023**
Gross Receipts	$621.00	$399.50	$531.25	$530.75
Total Operating + Fixed Costs	$220.30	$339.77	$363.95	$364.12
Net Receipts Before Factor Payments	$400.69	$59.55	$167.33	$166.56
Factor Payments	$203.50	$203.50	$203.50	$203.50
Return To Management and Risk	$197.19	$(143.96)	$(36.17)	$(36.94)

Table 3. Results from treatment field enterprise analysis for the two operators participating in split season withholding for 2021, 2022, and 2023. Results reported are gross receipts, total operating and fixed costs, net receipts before factor payments, factor payments, and return to management and risk.

	Average			
TREATMENT FIELDS – Split Season	**2020**	**2021**	**2022**	**2023**
Gross Receipts	$467.50	$448.00	$520.00	$504.00
Total Operating + Fixed Costs	$310.00	$452.63	$460.79	$444.15
Net Receipts Before Factor Payments	$157.51	$(4.63)	$59.21	$59.86
Factor Payments	$203.50	$203.50	$203.50	$203.50
Return To Management and Risk	$(46.00)	$(208.13)	$(144.29)	$(143.65)

Table 4. Difference between treatment and reference fields results for 2020- 2023 for the four operators participating in full season withholding. Results reported are gross receipts, total operating and fixed costs, and return to management and risk.

	Average			
TREATMENT MINUS REFERENCE FIELDS – Full Season	**2020**	**2021**	**2022**	**2023**
Gross Receipts	$301.39	$(162.50)	$(25.00)	$1.50
Total Operating + Fixed Costs	$(92.84)	$(35.64)	$1.59	$1.03
Return to Management and Risk	$393.22	$(127.04)	$(26.50)	$0.47

Table 5. Difference between treatment and reference fields results for 2020- 2023 for the two producers participating in split season withholding. Results reported are gross receipts, total operating and fixed costs, and return to management and risk.

	Average			
TREATMENT MINUS REFERENCE FIELDS – Split Season	**2020**	**2021**	**2022**	**2023**
Gross Receipts	$147.89	$(16.50)	$(4.50)	$6.00
Total Operating + Fixed Costs	$(3.14)	$(3.63)	$1.44	$2.26
Return to Management and Risk	$150.03	$(12.87)	$(5.84)	$3.74

The 2020 rates are also reported in the above tables to serve as a reference for the continued interviews with producers in this study. Analysis of the fields used for growing hay after withholding water (2021, 2022, 2023) concludes that in the first subsequent season after withholding irrigation water (2021), the highest impacts are realized to producers financially. Under reference (control) conditions, on average, producers experienced a loss of $76.37 per acre in 2021, a loss of $52.60 in 2022, and a loss of $73.76 in 2023. These are all returns realized after factor payments are taken into account, also known as the actual cost or the opportunity cost of leasing or owning land. When directly comparing the treatment fields to the reference fields for each of the six producers in the study, we determined the financial impacts on the hay fields of the producers who withheld irrigation water. The main impacts that our producers realized were decreased yields and increased fertilizer input costs on their ground that was either fully or partially fallowed for one season in 2020. On average, in the 2021 season directly following withholding, producers received $88.98 less per acre than they would have under normal irrigation, not having participated in the study. In the second season following water withholding (2022), far less impact is realized at $19.61 less than reference conditions, and in 2023, production is mostly back to normal, showing $1.25 more per acre, meaning that treatment conditions have returned to reference conditions, with only small differences in yields and production due to trivial differences, such as location, between the reference and treatment fields. This would indicate that the total loss over the three years post participation of the study would total $107.37 per acre. If the payment program were designed to also offset costs in subsequent years of water withholding in order to account for lost production and increased input costs in future growing seasons for hay producers.

For each of the results reported in this section for the 2021 – 2023 growing seasons, there is an assumed threshold that any returns per acre for producers' reference and treatment fields within $50, positive or negative, is realizing similar returns in costs, income, and yields. This assumed threshold of $50 can be made as it is likely caused by insignificant variations between field location, topography, or factors in application of inputs. Also, differences between operating expenses, as evidenced between the full season and split season treatments is due to the different management decisions made by each individual producer. Management techniques for arid hay meadows can vary depending on the location, size, and land conditions for each operation. Important considerations taken from the 2020 report that need to be outlined include the severe drought producers experienced in 2020, causing below average returns per acre to the reference and treatments fields. In the years following withholding, growing conditions, precipitation levels. and water availability were closer to average, and additional baled hay was more readily available at a more reasonable price per ton. Direct comparisons of 2020 to 2021 – 2023 rates should be tempered with the drought conditions that affected producers during the withholding season.

DISCUSSION

As in the 2020 study, additional impacts to livestock producers in future years must also be analyzed to properly understand all impacts of the withholding water for the ranchers participating. Of the six operations analyzed, four operations also support livestock with the hay grown on their fields. Further interviews with livestock producers indicated that they had to purchase additional hay and pasture to feed their cows in the 2020 and 2021 growing seasons to offset lost yields. Fall grazing and hay storage were mostly back to typical levels in 2022 and 2023, and ranchers were

able to support their herds with their own hay (harvested) and forage (grazing) production. In 2021, three of the four livestock operations purchased both a one-month supply of hay and one month of additional pasture for cow-calf pairs, while one operation smaller in size only purchased one month of additional hay to feed yearling cattle, who have a lower consumption rate than mother cows with a calf. The average costs to the four livestock producers to purchase additional hay and pasture were $330.07 per acre in 2021, compared to $800.91 in 2020. All four producers also expressed that they over grazed their ground by 10 – 15% in order to stretch farther without having to purchase more feed to help minimize their additional costs. An additional week to two weeks of feed to offset the personal overgrazing would increase the cost by $137.66 per acre, on average. While this percentage of overgrazing in just one season is likely not harmful, chronic overgrazing, for example if a withholding program was implemented on a 3-to-5-year cycle, could lead to long-term implications such as species transition or degradation that could be very costly to mitigate down the road. Species transition can also have other implications such as destruction of wildlife habitat, erosion control, water infiltration, and other negative impacts. These identified financial impacts also indicate that, as was with the hay enterprise, payment rates for livestock producers would need to be further increased by the cost per acre of feed if the program were to account for lost production in future growing seasons.

There are also important considerations to recount regarding profitability for the livestock producers during water withholding in the 2020 growing season. When considering the impacts to the livestock portion of the operation, including costs of managing livestock to make up for lost hay/grazing from withheld fields, participating in the water conservation program resulted in a relative loss of $(349.66) per acre across all four fields relative to the reference field, leading to the conclusion that the payment rates needed to be $349.66 higher to return livestock producers participating in this study to normal (reference) conditions. Hay production provides both hay and regrowth late season grazing for livestock production, therefore reduced irrigation could negatively impact the profitability of any associated livestock enterprise, depending on the price and availability of supplemental hay and pasture.

CONCLUSION

It is evident from this study that most of the impacts after withholding irrigation water to hay meadows occur in the year in which water is withheld, 2020. Additional impacts are further realized in the first subsequent growing season after withholding, in this case the 2021 season. Cattle producers had additional impacts to production losses from purchasing hay and pasture to supplementally feed their herds during the fall but found that production returned to mostly normal after one season. This was a very small study on a very small geographic area. Further studies and replications would help increase our understanding of the economic impacts of withholding irrigation water in a producer payment program.