Economic Impact Estimate of Irrigation Water Shortages on the Lower Rio Grande Valley Agriculture

Luis A. Ribera[1] and Dean McCorkle[2]
[1]Associate Professor and Extension Economist
[2]Extension Program Specialist
Texas A&M AgriLife Extension Service

The value of agricultural production in the Lower Rio Grande Valley (LRGV) region, which includes Cameron, Hidalgo, Starr and Willacy counties, was approximately $820 million in 2012 (Table 1). Total crop production accounted for about $666 million or 81.2 % of total agricultural production led by feed crops, cotton, vegetables, miscellaneous crops, and fruits and nuts. Livestock production and agricultural related production was $67.5 and $87.7 million, respectively.

Table 1. Estimated Value of Agricultural Production for the LRGV, 2012

	Cameron	Hidalgo	Starr	Willacy	Total LRGV
		(Thousands of Dollars)			
Feed Crops	52,639	66,410	5,718	53,392	178,159
Cotton	60,034	37,317	1,890	27,669	126,910
Oil Crops	374	9,836	2,342	0	12,552
Vegetable Crops	7,955	100,000	3,931	7,857	119,743
Fruits & Nuts	7,494	64,196	0	318	72,008
Sugar Cane	12,186	24,402	0	5,231	41,819
Misc. Crops	50,000	64,503	0	0	114,503
Beef	1,860	20,353	32,874	6,675	61,762
Other Meat Animals	0	5,550	58	31	5,639
Livestock Products	0	70	0	0	70
Ag. Related	51,454	31,200	3,400	1,682	87,736
Total Crops	190,682	366,664	13,881	94,468	665,695
Total Livestock	1,860	25,973	32,932	6,706	67,471
Ag. Related	51,454	31,200	3,400	1,682	87,736
Total Agriculture	**243,996**	**423,837**	**50,213**	**102,856**	**820,902**

Source: Estimated Value of Agricultural Production and Related Items, Texas AgriLife Extension Service, May 2013.

Irrigation water is very important to agricultural production in the LRGV region where about half of its crop production acreage is irrigated. Irrigation water shortages in the LRGV have occurred since the mid-1990s (Robinson, 2002). These shortages followed the point in 1992, when Mexico began undersupplying the average minimum annual amount of 350,000 acre-feet of water into the Rio Grande and continue nowadays. The treaty of 1944 requires Mexico to deliver the 350,000 minimum average annual acre-feet over the defined five-year cycles. The water deficit for the current five-year cycle is 430,000 acre-feet (TCEQ, 2013).

The purpose of this paper is to estimate the economic impact of the absence of irrigation water for crop production in the LRGV region. The crops affected by the absence of irrigation water are row crops (mainly sorghum, cotton and corn) and specialty crops (mainly vegetables, citrus and sugarcane). Row crops can be grown either irrigated or dryland while specialty crops can only be grown irrigated. All row crops and specialty crops are annual crops except for citrus and sugarcane. The lifespan of a citrus tree is over 30 years while sugarcane is typically five years. The methodology used in this study is an *ex post* historical crop damage approach where the economic impacts are estimated by measuring the change in farm gate or regional gross value of affected row crops and specialty crops.

Row Crops

To estimate the impact of the lack of irrigation water in row crops, the difference between irrigated and dryland yields are estimated and multiplied by the irrigated acreage for the crop. To account for the year-to-year fluctuations in yields and crop acres, a 5-year average (2008-2012) of crop yields and acreage is used to project the impacts for 2013. For example, using the estimated cotton yield difference between irrigated and dryland production (488 lbs. per acre), the 5-year average irrigated cotton acres, and the 2013 estimated cotton price; the loss in farm-gate cotton revenue is estimated at $12.5 million for 2013 (Table 2). Therefore, with the absence of water, irrigated row crops will produce dryland yields, causing a reduction in row crop farm-gate values of $12.5, $4.5 and $14.1 million for cotton, corn and sorghum, respectively. The total farm-gate loss for row crops is estimated at $31.2 million.

Table 2. Row Crop Losses due to Lack of Irrigation Water in the LRGV

	Yield[1]	Yield Loss[1]	Acreage[2]	2013 Price[3]	Total
	5-year average				Farm Gate
Cotton					
Irrigated	1,017 (lbs)	-488 (lbs)	32,273	$0.80/lb	$12,554,709
Dryland	528 (lbs)		76,572		
Corn					
Irrigated	99 (bu)	-22 (bu)	31,317	$6.61/bu	$4,533,345
Dryland	77 (bu)		8,034		
Sorghum					
Irrigated	77 (bu)	-29 (bu)	80,267	$6.00/bu	$14,134,952
Dryland	48 (bu)		284,450		
Total Row Crop Loss					$31,223,006

[1/] USDA-NASS Quick Stats for LRGV region, 2008-2012.
[2/] USDA-FSA annual crop acreage report for LRGV region, 2008-2012.
[3/] CME Group Cotton, Corn and Sorghum July 2013 Prices.

Specialty Crops

To estimate the impact of the lack of irrigation water in specialty crops, these crops were divided between perennial, i.e. citrus, and annual crops, i.e. vegetables and sugarcane. Citrus production would be close to zero, but in general, trees would survive a season without irrigation water. It is assumed that citrus orchards would not be turned into an annual crop since replacing mature trees is very expensive. Therefore, the economic loss of the lack of irrigation water at the farm-level would be the 5-year average value of citrus production in the LRGV region, $45.82 million (Table 3). Vegetables and sugarcane production would be lost as well as irrigation water is needed for their production. Estimated economic loss at the farm-level would be the 5-year average value of production, $128.21 and $47.36 million for vegetable and sugarcane production, respectively (Table 3). The total value of specialty crop production is $221.3 million.

Table 3. Specialty Crop Acreage and Value of Production Loss

	Acreage[1]	Value of Production[2]
	5-year average	
Citrus	27,038	$45,822,200
Vegetables	29,303	$128,211,200
Sugarcane	40,812	$47,361,180
Total Specialty Crop Loss		$221,394,580

[1/] USDA-FSA annual crop acreage report for LRGV region, 2008-2012.
[2/] Estimated Value of Agricultural Production and Related Items, Texas AgriLife Extension Service, May 2013.

However, it is improbable that the acreage used in vegetable and sugarcane production would remain out of crop production; instead they would be converted into dryland crop production, which for the LRGV region would most likely be cotton, corn or sorghum. The methodology used to redistribute this acreage includes the 5-year average crop mix in the LRGV region and using the same crop mix ratio to convert the vegetable and sugarcane acreage into row crops (Table 4). Therefore, 21% of the converted acreage would go into cotton, 8% into corn and 71% into sorghum production; accounting for $23.39 million in production value at the farm-level. This value, $23.39 million, is subtracted from the total loss of specialty crop production. Therefore, the total crop production loss due to the lack of irrigation water in the LRGV region is estimated at $229.24 million, which includes row crop losses of $31.22 million, plus the specialty crops losses of $221.39 million, less the value of row crop production of the converted vegetable and sugarcane acreage, $23.39 million.

Table 4. Value of Production of Vegetables and Sugarcane Acreage Turned Into Row Crop Production

	Crop Mix[1]	Acreage Mix	Yield[2]	Price[3]	Value
	5-year average		Dryland		
Cotton	21%	14,879	528	$0.80	$6,284,925
Corn	8%	5,379	77	$6.61	$2,737,867
Sorghum	71%	49,857	48	$6.00	$14,358,794
Total Gross Revenue					$23,381,586

[1/] USDA-FSA annual crop acreage report for LRGV region, 2008-2012.
[2/] USDA-NASS Quick Stats for LRGV region, 2008-2012.
[3/] CME Group Cotton, Corn and Sorghum July 2013 Prices.

Total Economic Impact

The IMPLAN input-output model was used to assess the broader economic effects associated with the estimated $229.24 million crop revenue loss associated with a loss of irrigation water. These effects are measured via three indicators – employment, value added, and economic output. Employment represents both full and part-time jobs, value added is a measure of net business income and employee compensation, and economic output represents gross business activity (spending) associated with irrigated crop production. Value added also represents a contribution to Texas' Gross Domestic Product (GDP), the most commonly used indicator of the health of the state's economy.

Each of these indicators is measured at three different levels: direct effects represent the farm-level effects; indirect effects represent effects in industries that provide input supplies (fertilizer, fuel, etc.) to farms, and induced effects represent the economic impacts associated with the spending of salaries and wages on household goods. The loss of irrigated crop production in the LRGV region would lead to an estimated $394.9 million loss in economic output (Table 5). Likewise, the loss of irrigated crop production in the LRGV region would generate a loss of $217.61 million in value added. In terms of employment, the loss of irrigation would result in an estimated loss of 4,840 jobs that depend on the production and sales of these commodities for some portion of their income.

Table 5. 2013 Projected Economic Losses Associated with Lack of Irrigation Water in the LRGV

Impact Type	Employment	Total Value Added	Output
Direct Effect	3,041.6	$117,175,997	$229,235,999
Indirect Effect	1,292.2	$66,615,832	$109,530,397
Induced Effect	506.3	$33,820,341	$56,130,084
Total Effect	4,840.1	$217,612,170	$394,896,481

Value added and economic output are two distinct indicators, and as such are not to be added together.

This analysis represents the impacts of all economic activities that occur in the production of the described crops, up until the point of sale of the crops at the farm-level. These results are on the conservative side as they do not include the impacts (losses) that occur beyond the farm-level sale of the crops, such as transportation, storage, processing, packaging, and marketing.

References

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