Comparative Economics of Producing Lesquerella in Various Areas of the Southwestern United States

by

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Abstract: Lesquerella is a new oilseed crop under development in Arizona, New Mexico, and Texas. A sensitivity analysis was prepared that estimates net returns per acre given varying combinations of production costs, seed yields, and seed prices. Twenty-one counties in the three states have been identified as areas where lesquerella production would be technically feasible. Estimated net returns of traditional crops in these counties were analyzed to assess lesquerella's chances of being economically competitive with other crops.

Keywords: Lesquerella, alternative crops, net returns, cost of production.

Lesquerella is a new oilseed crop under development in Arizona, New Mexico, and Texas. Efforts to commercialize lesquerella have been underway for less than 10 years (4) and more work needs to be done for it to become commercially viable. However, if commercialization is successful, it would provide southwestern farmers with another source of revenue and an additional crop to use in rotations.

Lesquerella is of interest because of its oil, which has triglycerides that contain hydroxy fatty acids. Currently, the only source of hydroxy fatty acids is castor oil or its derivatives. Imports of castor oil, which is not produced in the United States, have averaged 40,871 metric tons during the last 5 years (table 52).

Researchers and private industry are looking for areas within the three states where lesquerella has the greatest potential so they can focus their research efforts and develop relationships with extension agents and farmers. The purpose of this analysis is to begin that process of identifying areas within the three states where lesquerella production would be technically feasible and economically viable.

Crop and Product Characteristics

Over 100 species of *Lesquerella* have been identified, of which 83 are native to the United States. An extensive germplasm collection from native populations was made by the U.S. Department of Agriculture (USDA), Agricultural Research Service, U.S. Water Conservation Laboratory (USWCL) during 1993 to 1996. Breeding and development work has focused primarily on *L. fendleri*, a species native to the southwestern United States, because of its relatively high seed yields, good seed retention, upright growth habit, and other favorable characteristics needed for commercial crop development. Breeding has focused on increasing the seed oil, gum, and lesquerolic acid content (the hydroxy fatty acid in *L. fendleri* oil); developing self-pollinating plant varieties; increasing average plant heights and plant uniformity; reducing oil pigmentation; and developing varieties with higher seed yield (2).

Agronomic research also is underway to determine the best production practices for lesquerella, such as planting dates and methods, irrigation scheduling, level and timing of fertilizer applications, weed control, and harvesting procedures. Weed control is a particular problem because after lesquerella germinates, it grows very slowly and can be dominated by early season weeds. The research conducted thus far and limited grower experiences have been used to compile a preliminary production guide (3). In the Southwest, lesquerella could fit well in a 2-year, 3-crop rotation of lesquerella, grain sorghum, and cotton (2). Many farmers in the area already own the equipment necessary to plant and harvest lesquerella. It should be seeded when temperatures are moderate, typically August 15 to September 1 in Texas and New Mexico and October 1 to 15 in Arizona. Harvest occurs 8 or 9 months later.

Lesquerella seed is comprised of oil, seed coat gums, protein, and meal. Because the oil and its lesquerolic acid are the focus of commercial interest, researchers are working to increase the content in the seed. In 1996, USWCL made three populations of lesquerella germplasm available to other researchers (1). One population had a seed oil content of 26 percent, while another had a lesquerolic-fatty-acid content in the oil of about 55 percent. Potential exists for the

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seed to contain up to 37 percent oil with a lesquerolic acid content of up to 65 percent.

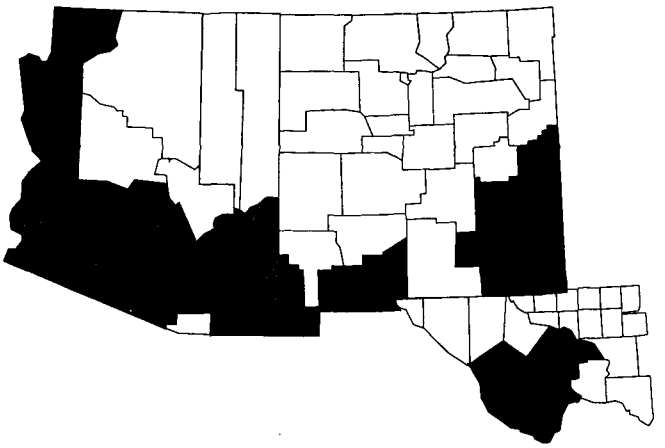
Hydroxy fatty acids are currently used in a variety of products, such as multipurpose lubricating greases, beverage can coatings, toiletries, lipstick and other cosmetics, polishes, and inks. The unique chemical structure of lesquerella oil, although similar to castor oil, holds potential for developing new product applications as well as replacing castor oil in some traditional uses. Recent research on the gums extracted from lesquerella's seed coat indicate they too have significant industrial potential. The meal could be used as a protein supplement in livestock feed. (See the December 1993 issue of this report for additional information on crop and product characteristics).

Potential Lesquerella Production Areas And Net Returns

Agricultural extension personnel, USDA scientists, and representatives from International Flora Technologies, Ltd. (IFT), one of the private firms working to commercialize lesquerella, identified 21 counties in Arizona, New Mexico, and Texas they believe have the best potential for lesquerella production (figure B-1). In 1992, irrigated acreage in these counties totaled almost 1.4 million (table B-1). Scientists working with lesquerella indicate that it could be planted on wheat acreage where farmers are having problems with karnal bunt, a fungal disease of wheat currently a problem in some parts of the area. In 1992, wheat was produced on

Figure B-1

Counties in Arizona, New Mexico, and Texas That Have the Best Potential for Lesquerella Production



321,446 acres in 17 of the 21 counties (5). Lesquerella could also be grown on land used for barley, cotton, hay, and sorghum.

In 1991, using the latest agronomic research results, University of Arizona economists estimated lesquerella production costs at between $307 and $415 per acre (table B-2). The higher value assumed abundant irrigation and weed control, plus generous cost allowances for other inputs (6). The lower value reflected more prudent irrigation and reduced fertilizer and chemical applications. More recently, private sector and government researchers estimated current

Table B-1–Total cropland, irrigated cropland, and acres of selected crops in selected counties in the southwestern United States, 1992

State and county	Total cropland	Irrigated cropland	Crop acreage				
			Sorghum	Wheat	Barley	Cotton	Hay
				–Acres–			
Arizona							
Cochise	120,472	52,434	N.A.	97	667	9,678	10,484
Graham	54,762	41,219	N.A.	509	590	26,913	2,164
Greenlee	10,210	4,480	N.A.	D	0	D	1,296
La Paz	115,686	95,178	N.A.	8,172	193	44,858	38,282
Maricopa	376,423	273,339	N.A.	19,103	9,513	142,345	52,860
Mohave	23,150	18,638	N.A.	298	0	6,203	10,740
Pima	36,043	27,455	N.A.	2,579	174	15,160	1,137
Pinal	299,656	213,265	N.A.	13,254	7,332	155,393	16,180
Yuma	207,385	189,736	N.A.	35,956	1,352	27,210	45,999
New Mexico							
Chaves	120,517	57,744	447	D	N.A.	8,536	31,291
Curry	454,101	84,377	63,745	150,077	N.A.	D	5,719
Dona Ana	94,405	80,029	64	4,261	N.A.	20,896	14,905
Eddy	D	47,209	317	D	N.A.	9,299	29,869
Hidalgo	D	9,081	761	352	N.A.	2,404	604
Lea	98,045	35,126	5,689	5,177	N.A.	4,589	7,032
Luna	D	29,732	977	1,881	N.A.	3,887	2,730
Roosevelt	378,637	76,365	85,087	79,565	N.A.	2,662	16,858
Texas							
Brewster	3,144	D	0	0	N.A.	0	693
Jeff Davis	1,525	197	0	0	N.A.	0	0
Pecos	64,691	26,716	D	165	N.A.	7,713	8,537
Presidio	17,937	3,584	0	D	N.A.	D	1,425
Total	2,476,789	1,365,904	157,087	321,446	19,821	487,746	298,805

N.A. = Not available. D = Data withheld to avoid disclosing data for individual farms.

Source: 1992 Census of Agriculture, U.S. Department of Commerce, Bureau of the Census, Washington, DC, 1994.

Table B-2--Estimated lesquerella costs of production, Arizona, 1991

Cost	High estimate	Low estimate
	Dollars per acre	
Paid labor	88	65
Seed	42	8
Fertilizer and chemicals	64	42
Farm machinery and hauling	59	59
Irrigation	133	110
Other costs	29	23
Total 1/	415	307

1/ Includes variable costs, but not returns to land or management.

Source: J.C. Wade, P.N. Wilson, and D. McKenon, "Anticipated Production Costs, Revenues, and Commercialization Issues for Lesquerella," report submitted to USDA, Cooperative State Research Service, Office of Agricultural Materials, June 1992.

production costs at $450 to $550 per acre on the limited acreage grown to date. However, with additional research and fine tuning of production practices resulting from commercialization, production costs could drop to $230 to $240 per acre when yields of 1,800 pounds of seed per acre are achieved (3). These estimates include all variable costs, but no land charge or returns to management.

The lesquerella seed produced thus far has been used for planting in subsequent years and for oil-processing studies and product development work. Seed has not been sold in any market.

Since costs are changing rapidly because of advances in lesquerella breeding and production practices and revenues have yet to be determined, a sensitivity analysis was prepared that estimates net returns per acre given varying combinations of production costs, seed yields, and seed prices (table B-3). With production costs of $225 per acre, a yield of 1,500 pounds per acre, and a seed price of 15 cents per pound, farmers would just break even. If costs increase to $250 per acre and yields reach 1,800 pounds per acre and seed prices were 21 cents per pound, the estimated net revenue would be $128 per acre. Higher yields or seed prices might be needed to offset higher production costs or induce farmers to grow a risky new crop.

Costs and Returns of Competing Crops

Not only are lesquerella's net returns important in determining where it could be profitably produced, so are the costs and returns of competing crops. Lesquerella must be able to compete with net returns from other crops before farmers will be interested in growing it. For example, several states, including Iowa and North Dakota, were involved in commercializing crambe, an oilseed with high amounts of erucic acid in its oil. Although yields of crambe were much higher in Iowa, the industry developed in North Dakota primarily because crambe could not compete with corn and soybeans in Iowa, but it could compete with traditional crops in North Dakota. Also, a company in North Dakota involved in oilseed crushing was willing to buy crambe seed and crush it.

The agricultural extension service in most states, including Arizona, New Mexico, and Texas, estimates costs and returns for the coming year for the crops produced in that state on a regional or county basis. These crop budgets are designed to help farmers in their planting decisions for the year. The University of Arizona study evaluated 138 crop budgets for various counties in Arizona, New Mexico, and Texas (6). The estimated costs and returns for 1991 were evaluated for six crops in Cochise County, Arizona, including alfalfa, upland cotton, pima cotton, durum wheat, grain sorghum, and corn. Budgets for traditional crops, excluding vegetables, were examined for the remaining counties in Arizona, plus those in New Mexico and Texas in which lesquerella might be produced.

According to the analysis, wheat had the largest numbers of crop budgets with estimated negative net returns, followed by grain sorghum and barley (table B-4). None of the three crops had estimated net returns in excess of $200 per acre. Federal government payments were not included in the analysis. Estimated net returns for the various crops were also sorted and categorized by state. Arizona had the highest number of profitable crop budgets, and Texas the least. Thus, according to these 1991 estimates, lesquerella might be more competitive with other crops in Texas, followed by New Mexico and Arizona.

Budgets for the 1996 crop year were studied for the same counties in Arizona, New Mexico, and Texas. While overall average returns were estimated to be higher in 1996 than 1991, the relative profitability of the crops remained similar. The most profitable crops in 1996 continued to be alfalfa and upland and pima cotton with estimated net returns of more than $200 per acre in most of the budgets (table B-5). Both corn and wheat were expected to be somewhat more profitable in 1996, with most net returns ranging from $0 to $199, primarily because of higher prices than those in the

Table B-3--Estimated net returns of producing lesquerella with varying production costs, yields, and seed prices

Production costs	Yield	Seed price per pound			
		12 cents	15 cents	18 cents	21 cents
Dollars per acre	Pounds per acre	Net returns --Dollars per acre--			
225	1,200	-81	-45	-9	27
	1,500	-45	0	45	315
	1,800	-9	45	99	378
	2,100	27	90	153	441
250	1,200	-106	-70	-34	2
	1,500	-70	-25	20	65
	1,800	-34	20	74	128
	2,100	2	65	128	191
300	1,200	-156	-120	-84	-48
	1,500	-120	-75	-30	15
	1,800	-84	-30	24	78
	2,100	-48	15	78	141

Table B-4--Estimated net returns of selected crops in potential lesquerella production areas in Arizona, New Mexico, and Texas, 1991 1/

Item	Net return (Dollars per acre)			
	Negative	0 to 99	100 to 199	200+
	Frequency by category			
Crop				
Alfalfa	2	3	7	12
Barley	5	2	2	0
Corn	4	9	2	1
Cotton	3	9	8	13
Grain sorghum	6	6	2	0
Oats/oat hay	0	2	0	1
Pasture	2	1	0	0
Peanuts	0	0	1	6
Soybeans	3	0	0	0
Sudan grass	1	0	2	0
Sugar beets	0	0	1	
Sunflowers	1	0	0	0
Wheat	9	7	5	0
Total	36	39	30	33
State				
Arizona	5	12	16	19
New Mexico	18	20	12	12
Texas	13	7	2	2
Total	36	39	30	33

1/ According to State Cooperative Extension Service crop budgets.
Source: J.C. Wade, P.N. Wilson, and D. McKenon, "Anticipated Production Costs, Revenues, and Commercialization Issues for Lesquerella," report submitted to USDA, Cooperative State Research Service, Office of Agricultural Materials, June 1992.

Table B-5--Estimated net returns of selected crops in potential lesquerella production areas in Arizona, New Mexico, and Texas, 1996

Item	Net return (Dollars per acre)			
	Negative	0 to 99	100 to 199	200+
	Frequency by category			
Crop				
Barley	0	2	0	0
Corn	0	2	2	1
Cotton	1	2	3	13
Grain sorghum	1	7	0	0
Oats/oat hay	0	0	0	2
Peanuts	0	0	0	3
Sudan grass	0	0	1	1
Sunflowers and safflower	0	0	0	1
Wheat	1	5	7	0
Total	3	18	13	21
State				
Arizona	2	7	7	12
New Mexico	0	9	6	14
Texas	1	2	0	2
Total	3	18	13	28

Source: Estimated cost of production budgets for 1996 from the State Cooperative Extension Services of Arizona, New Mexico, and Texas, 1996.

1991 budgets. Barley and grain sorghum most frequently had estimated net returns of $0 to $99 per acre. In the possible 2-year, 3-crop rotation of lesquerella, grain sorghum, and cotton mentioned earlier, lesquerella returns could supplement the lower returns received for grain sorghum and provide farmers with a crop rotation sequence as an alternative to continuous cotton.

Conclusions

This analysis of net returns for lesquerella and competing crops gives researchers some parameters to work within as they continue to develop lesquerella as a commercial crop. Initially, lesquerella's net returns will probably need to be higher than those for well-known alternatives to induce farmers to experiment with this new crop and learn how to efficiency grow it. Over the longer term, lesquerella's net returns will need to remain competitive with other crops farmers have the opportunity to produce.

Based on this preliminary analysis of per-acre returns, Texas seems to have the advantage over the other two states as a potential lesquerella site. However, other factors also will influence where commercial production of lesquerella occurs. For example, IFT's oilseed crushing facility is in Arizona. The company will have to balance transportation costs with the price paid to farmers when deciding where to contract for acreage. Thus, New Mexico, with less demands from competing crops than in Arizona and its closer proximity to the processing plant, might be a likely target.

Researchers and private industry point to the lack of sustained extension involvement as one of the key hindrances to lesquerella commercialization. This research on costs and returns may provide extension personnel with basic data and help all parties focus on the areas where lesquerella has the greatest potential to be technically feasible and economically viable.

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