Best Agricultural Uses of the Arizona Water Settlement Act Water and Funds: Estimated Investment Needed for, and Returns from, a Selection of High Value, Low Water Use Crops

Final Report

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BEST AGRICULTURAL USES OF THE AWSA WATER AND FUNDS: ESTIMATED INVESTMENT NEEDED FOR, AND RETURNS FROM, A SELECTION OF HIGH VALUE, LOW WATER USE CROPS

Background

The 2004 Arizona Water Settlements Act provides for additional water and funding for projects that meet a "water supply demand" in Catron, Grant, Hidalgo and/or Luna Counties.

However, obtaining the new water of 14,000 acre-feet per year, and much of the funding (up to $66 million out of $128 million in total) is not automatic. Proposals to use this water and funding must be provided to the Secretary of the Interior by December 2014, or some or all of the water and/or money will be forfeited. Failing to capitalize on this water and funding would be a tragedy for New Mexico, as there will be very few such opportunities available anywhere in the western United States in the future.

Various proposals to use the water and funding have been evaluated through a two stage process, and some of them have been short-listed for further development. But despite the work done to date on these proposals, many technical, economic and other parameters are not yet specified in detail.

To provide more consideration to maximizing the *economic* benefits to the four affected counties from the AWSA water and funds (and by extension to New Mexico as a whole), this report follows on from an earlier report[1] on examples of high value crops *per unit of water consumed*, by researching the necessary investment and other factors involved in establishing and sustaining those crops, as listed in the Table 1 below.

Crop/Product	**Annual Gross Revenue, $ per acre-ft of Irrigation Water Consumed**
Pecans	1,000
Chile	1,600
Onions	5,000
Wine Grapes	1,900
Wine	19,000
Lavender Oil	8,000

Table 1: Examples of Crops Grown in New Mexico with a High Value per Acre-Ft of Water Consumed

The crops above that have been selected for further study are not meant to be a definitive list, or a set of recommendations, or to exclude non-agricultural uses for the AWSA water and funds, but to stimulate thinking on maximizing the economic value from the AWSA via agriculture. Since many of the short-listed proposals' parameters are quite open, for example the end uses for the AWSA water, there is still time to add features and detail to them to

[1] See http://nmawsa.org/ongoing-work/examples-of-high-value-low-water-use-crops/view

improve their economic benefits (both direct and indirect), as part of developing them to the point where they are suitable for submission to the Secretary of the Interior.

The greatest limitation on using the AWSA water is that it is only to be skimmed once flood flow exceeds a certain level, and so cannot be diverted in the same quantity every year or when the water is most needed. This factor mandates some form of water storage[2]. Money attached to the AWSA can presumably be used to construct at least some of the needed infrastructure, to make water available to users when needed. What happens in this regard will greatly influence what sort of crops (or other potential uses) are viable uses of the AWSA water; uncertainties about annual quantities would stifle most potential uses of this water. Flood water would also be too dirty for many uses or for pumping to higher elevation; storage is needed to settle the contaminants out of the water.

During discussions with growers in the southwest counties, they could not commit to uses of the water without knowing how much it would cost and what the availability will be. Of course, the answers to these questions *depend on the projects to be implemented*, which are not known at this stage and in part depend on what end users are willing to pay for the water. So, there is still much development of proposals to be done on the "demand side" not just the "supply side", including defining the end uses, water availability and water price. Discussions with growers indicated that some might be prepared to pay up to $100/acre-ft (in the Virden area for water that would "finish off" crops), while one grower of high value crops indicated that $600-700/acre-ft could be acceptable.

Finally, during discussions with local interests in the four county area, several potential high value non-agricultural uses for the AWSA water came up, namely solar thermal energy development, producing bio fuel from algae, and aquaculture. As these possibilities were outside the scope of this research, they were noted but not followed up. However, these and possibly other concepts may offer a high enough value use for the AWSA water to justify its long distance transfer, eg to the Deming area and/or to other locations along or north of the I-10 corridor. More needs to be done to develop business plans to use the AWSA water, both in agriculture and otherwise.

[2] This point has been made repeatedly by farmers in discussions on potential uses for the AWSA water.

Investment per Acre and Lead Time to Establish a Selection of High Value Crops

Estimates of investment needed to establish each subject crop/product, and the lead time until the crop/product produces income, are shown in Table 2 below. As can be seen, pecans and wine have the longest lead time and highest cumulative investment needed before positive returns are generated, let alone payback achieved. This does not seem to be preventing expansion of pecan growing in New Mexico, but the exacting technical requirements of wine grape growing, the more limited climatic options for vineyard location, the high technical skill required for winemaking, and wine distribution factors are significant barriers to growth in the wine grape and wine businesses.

Crop	**Investment, $/Acre**	**Lead Time until Income-producing, Years**	**Comments**
Pecans	12,000	7-12	Initial investment = cumulative losses from years 1 to 7 assuming nut price of $1.75/lb (there is some yield from year 3). Acceptable yield from year 7, maximum production by years 10-12, around 2,000 lb/acre/yr. Profitable from year 10. Breakeven at year 15. Flood irrigated. See appendix 3.
Chile	900-1000[3]	1	Costs for one year prior to harvesting. See Appendix 4.
Onions	1400-2000[4]	1	Ditto
Wine Grapes	12-15,000	3-5	7-12,000/acre initial set up, but some costs allowed until year 3 before the first suitable grapes are produced. See Appendix 5.
Wine	11-13,000	1-5 in addition to vineyard lead time as above	Lead time depends on the type of wine produced. Some wines are ready to sell in year 1 but good reds need 3-5 years to produce. Breakeven ~10 years[5]. See Appendix 6.
Lavender Oil	5,000-8,000	2-3	Full production from year 3, plant life approx. 10 years. Assumes 50+ acre farms. See Appendix 7.

Table 2: Estimates of Investment and Lead Time for a Selection of High Value Crops

[3] Source: http://aces.nmsu.edu/cropcosts/
[4] Ditto
[5] http://www.winetwo.net/profiles/blogs/how-much-does-it-really-cost

Income per Acre per Year for a Selection of High Value Crops

Table 3 below shows net income/acre/year for an established farm for the same set of crops/products as discussed above. Following this table is a discussion of each subject crop/product.

Crop	**Net Operating Profit, $/Acre/year**	**Comments**
Pecans	2,000-2,500	Pecan prices are quite volatile from year to year and the crop also has alternate high-bearing and low-bearing years. Recent prices at $2.80/lb are at record highs due to demand from China, however a more typical price of $1.75/lb for the nuts has been used in these estimates. See Appendix 3.
Chile[6]	1400-2600	2012 estimates. Flood irrigated. Based on a farm of about 400-640 acres with above average management[7]. See table 4 and Appendix 4.
Onions	200-1400	Based on a farm of about 400-640 acres with above average management[8]. See table 5 and Appendix 4.
Wine Grapes[9]	1900-3000	Profit is highly sensitive to grape prices and yields. Some insulation from price changes occurs if the grower also makes wine. See Appendix 5.
Wine	1000-4000	2-10% profit on $40,000 revenue/acre/year. See Appendix 1.
Lavender Oil	5000-12000	Assumes 50+ acre farms and mechanized harvesting. See Appendix 7.

Table 3: Estimates of Profitability of a Selection of High Value Crops

Pecans

In New Mexico there are approximately 1750 pecan operations and about 40,000 acres in production[10]. The U.S. is the largest pecan producer globally, and New Mexico is among the largest producing states in the U.S. In southwest New Mexico, Luna and Hidalgo Counties have seen new orchards established recently, which is a sign that growers regard pecans as a good future prospect.

As shown in Appendix 3, although ultimately a profitable crop (very profitable at recent record nut prices of $2.85/lb, well above previous years' prices of more like $1.30-1.75/lb), high investment costs and the long lead time to full production are barriers to entry. Various

[6] Source: http://aces.nmsu.edu/cropcosts/
[7] This is the most commonly reported way that NMSU standardizes its crop profitability estimates.
[8] Ditto.
[9] Sources: Sharp, R. and Caspari, H. The Cost of Growing Wine Grapes in Western Colorado, CSU 2010 and Woods, T. et al, 2010 Grape Cost and Return Estimates: Summaries and Assumptions, KSU. No similar recent data exists for New Mexico.
[10] Source: NMSU, Pecan Marketing Channels in New Mexico, Guide Z-307, 2010

sources indicate that a cumulative investment of about $12,000/acre over the first 7-10 years is needed after orchard establishment to achieve an annual profit, which timeframe also depends on nut prices and input costs (some of which such as fuel and fertilizer have increased over recent years due to rising oil prices). And while 7-10 years passes until returns become positive, the breakeven point on the investment may not occur until about year 15. It is also not possible to avoid most ongoing costs or switch to other crops in bad years; once a pecan orchard is established it is a long-term commitment.

Another significant barrier to any new pecan grower would be the education and mentoring required for those unfamiliar with this crop. It would be easier for existing producers (who may also have existing cold storage and processing facilities) to establish new orchards rather than having new growers enter the field, however it would not be impossible for new growers to enter this market as long as they have access to technical support and patient capital.

Labor shortages are a problem for New Mexico agriculture, but as pecans are highly mechanized they are less affected by this than crops that require a lot of manual field work.

Downstream processing possibilities associated with pecans are significant, with some growers, as mentioned above, owning their own processing facilities. Expansion of pecan acreages may increase utilization of such facilities and/or result in new facilities being built. All such activity would have a positive economic impact in the southwest counties.

Chile

The New Mexico chile industry is in long-term decline due mainly to foreign competition and local labor shortages. In 2011 there were approximately 9,500 acres of chile grown in the state, down from 34,500 acres in 1992.

Chile is not suitable for growing in most of the valleys of the Gila/San Francisco region because the winter temperatures are too low and late frosts occur. While additional water, if made available in some areas in Luna and Hidalgo Counties, could be used to grow more chile, lack of water is not a major reason that the crop is in decline.

Chile has been described by growers and NMSU as a "high risk crop", with comments that it is "not easy to get right", so despite returns of $1400-2000/acre/year (much higher than for grain crops and hay), those returns are evidently being cancelled out by the complexity of the crop and worries about whether there will be available labor at harvest time.

As shown in Table 4 below, projected chile profits[11] have been static at best in recent years, in some cases declining, in the relevant counties. However, at about $1,000/acre to establish, payback is much faster than for pecans, wine grapes, wine or lavender. There have been efficiency improvements through drip irrigation, but efforts to solve the field labor issue via mechanical harvesting have so far not met with success for green chile[12].

[11] Source: http://aces.nmsu.edu/cropcosts/documents/luna-12.pdf. See Appendix 4.
[12] There is mechanical harvesting equipment for red chile, however it is costly at $400,000 for equipment that will last about 10 years.

	Green, $/acre/year	Red, $/acre/year
Hidalgo County (Cotton City/Animas area)	1400-1500 (2012) 1600 (2011) 1700-2500 (2010)	1800 (2012) 1800 (2011) 1700 (2010)
Luna (Deming area)	2600 (2012) 2700 (2011) 2800 (2010)	1800 (2012) 2000 (2011) 2000 (2010)

Table 4: Reported Estimates of Net Income per Acre per Year for a 400-640 Acre Farm with "Above Average Management", Flood Irrigated, Hidalgo and Luna Counties

Onions

Onions are described by the National Onion Association as "very expensive to grow" with a steep learning curve, and these comments are reinforced by growers and crop experts in New Mexico. Varieties need to be closely matched to local growing conditions, and growers in the southwest counties have stated that returns have historically been very variable. The Cliff/Gila valley has been described as a tough place to grow onions ("a gamble"). As with chile, the best growing areas in the four county region are in the southern parts, with perhaps Virden as the exception.

In 2010 there were approximately 6,000 acres of onions grown in New Mexico. Acreages of onions have steadily declined over the years and prices have varied markedly from year to year, with estimated profits of between $200 and $1400/acre/year over the past 3 years. Establishment costs, at $1400-2000/acre are higher than for chile, but low compared to pecans, wine grapes, wine or lavender, and with a much faster return on the investment.

	Fall Onions	Midseason Onions	Late Onions
2012	1200	200	200
2011	1300	500	500
2010	800-1400	100-600	400-500

Table 5: Reported Estimates of Net Income per Acre per Year for a 400-640 Acre Farm with "Above Average Management", Flood Irrigated, Luna County[13]

Wine Grapes/Wine

Vineyards

There are about 1,200 acres under vines in the state and 52 wineries/tasting rooms. An economic vineyard size is estimated at 10 acres minimum, as shown in Figure 2, however larger scale operations would be more profitable[14]. Equipment and land costs make a big difference to per acre returns, especially since expensive equipment needs to be used on large acreages to be economical.

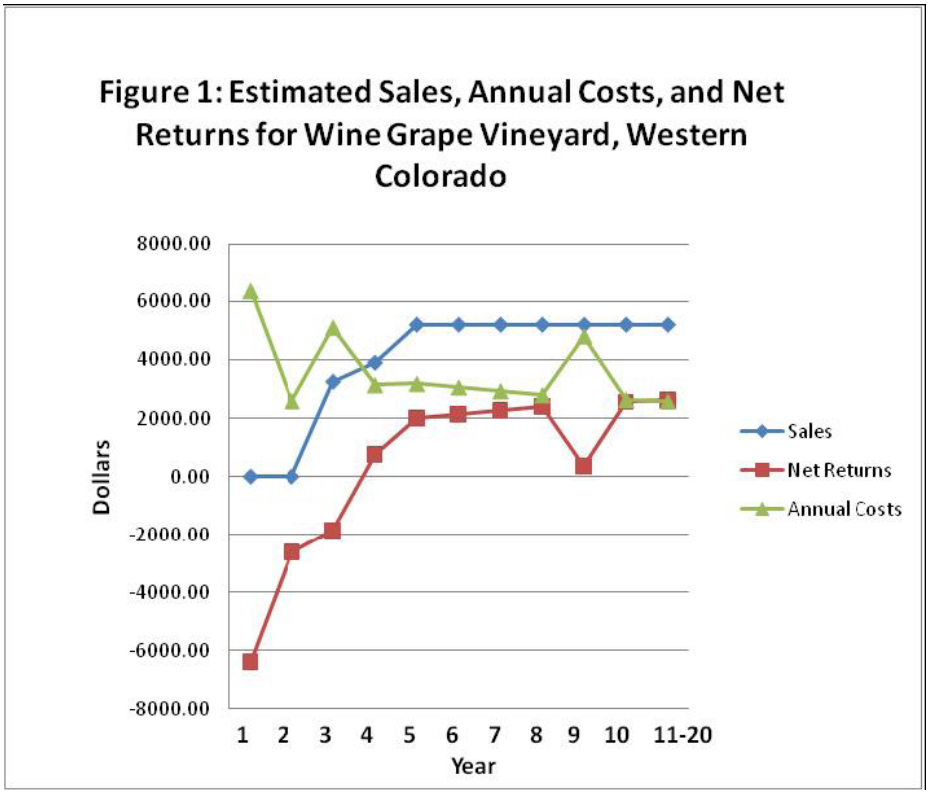
[13] Source: http://aces.nmsu.edu/cropcosts/documents/luna-12.pdf. See Appendix 4.
[14] Source: Sharp, R. and Caspari, H. The Cost of Growing Wine Grapes in Western Colorado, CSU 2010

Accumulated establishment costs peak in about year 3 at about 12-15,000/acre according to New Mexico expert estimates and other sources[15]. Grape yields are about 30-40% of full production in year 3, 50-80% in year 4 and 100% from year 5.

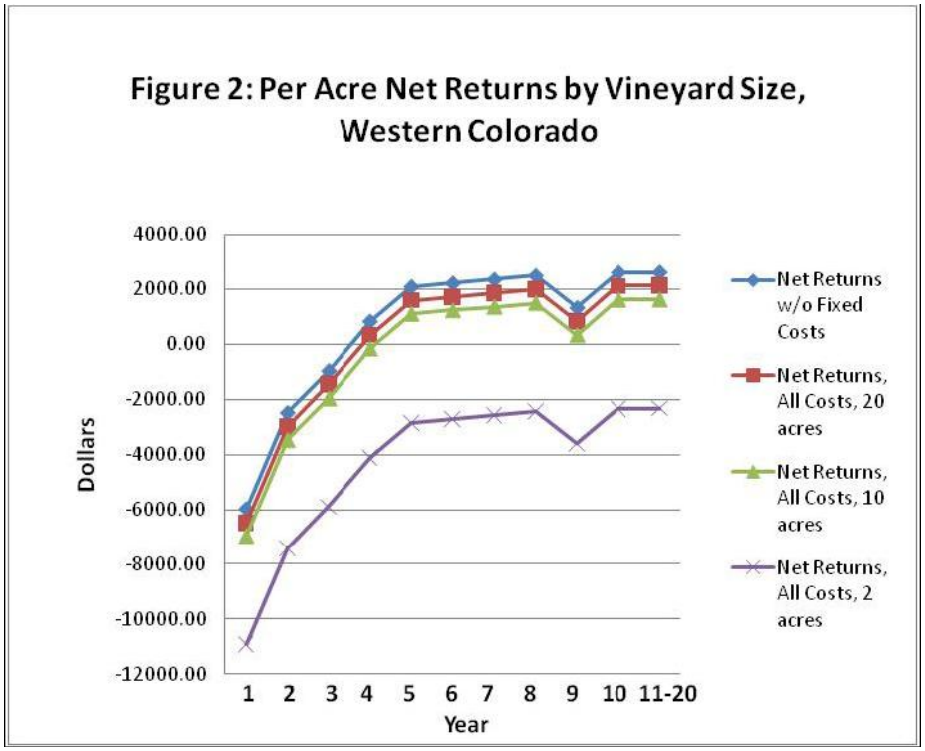
Wine grape prices are reported from various sources at $600 to $1500/ton (very sensitive to grape quality) with exceptional grape quality fetching up to $4000/ton, and a typical yield of 4 tons/acre/year for high quality wine grapes. Recent New Mexico prices have been stated at approximately $1000/ton.

Since higher quality wine is produced from grapes that have been deficit irrigated, and hence with a low tonnage/acre, lower grape yields are needed to maximize the wine value per bottle. However, expert advice is that cheaper wine can be more profitable to make as it does not need long storage. Since there is a tradeoff between profits from the grapes and profits from the wine, this section combines discussion of both grapes and wine.

Figures 1 and 2[16] below show how profits from wine grape growing occur only after year 3 and that they settle down to an indicative $2,000/acre/year after about year 5. Other sources indicate profit of $1900-3000/acre/year, but data from Kentucky indicates a profit of more like $350/acre/year at $1000/ton and 4 tons/acre[17], so the most commonly cited return figures may not always be achievable (this was borne out by discussions with experts in the field.) Payback occurs by about year 10, or perhaps later in New Mexico, as the 10 year estimate is based on higher grape prices/ton than is cited in New Mexico.



[15] See Appendix 5 for example.
[16] Ditto
[17] See Appendix 5.



In the past, some vineyards in New Mexico have been poorly sited and have failed. Suitable sites in the southwest counties are confined to Luna and Hidalgo Counties, however even there harsh weather can severely damage grapes. In the Deming area 50% of the crop was lost last winter due to late frost. Irrigated areas[18] in the valleys of the Gila and San Francisco Rivers are too cold for grape growing, meaning that either transfer of the AWSA water to southern parts of the four county region would be needed, or some sort of swap arrangement made, perhaps using the Mimbres Aquifer as the buffer/transfer mechanism.

Winemaking

Only about 3% of wine sold in New Mexico is produced in state, indicating potential local market growth for local producers. However, marketing of wine is controlled to a large extent by wine distributors, who take a large cut of the wholesale revenue and tend to have exclusive marketing deals with major sales outlets. This is a sales barrier to local wine distribution for New Mexican wineries, many of which therefore market through their own tasting rooms, at wine events and through direct marketing, rather than through large retail outlets. Currently, New Mexico would not be able to absorb much more wine production without enhancing sales channels. Some larger winemakers augment their businesses with restaurants and combined tasting rooms.

Marketing barriers, combined with the technical requirements of the crop and winemaking, indicate that possible expansion of the wine grape/wine industry in New Mexico would best

[18] The AWSA water can only be used on land that is irrigated or has been irrigated before.

be handled by existing producers, either in-state or out-of-state. If New Mexico offered cheaper production costs than in other states, large beverage companies may agree to establish new vineyards here, and large winemakers may be attracted to the state if more high quality grapes were available. Such companies also already have access to established sales channels both inside and outside of New Mexico.

Even a small winery involves investment of at least a few hundred thousand dollars[19]. Appendix 6 provides details of establishment costs for small wineries of 5,000-20,000 gallons/year fermentation capacity totaling $200,000-800,000 (equivalent to $11,000-13,000/acre of supporting vineyard), however other sources estimate the cost at more like $2-3 million[20].

The two largest wineries in New Mexico produce about 300,000 gallons/year each, however scale economies beyond 20,000 gallons/year may be small, because of the increased mechanization needed for larger wineries. Profits once in full production are estimated at 2-10% on annual revenue of about $40,000/acre/year, ie about $1,000-4,000/acre/year. While winery profits would not be looked at this way, the per acre figures are provided to allow comparison with the other subject crops/products.

Lavender Oil

Most lavender grown commercially in the world is grown for its oil, which is the focus of this report, although the lavender industry ultimately relies on a multitude of products and is associated with "agritourism"[21].

Fig 3 Lavender Harvesting in Tasmania[22] on a 200+ acre plantation

[19] http://www.winetwo.net/profiles/blogs/how-much-does-it-really-cost
[20] http://www.smallfruits.org/BunchGrapes/production/EconomicsofaSmallPremiumWinery.pdf
[21] A recent Sequim, WA Lavender Festival brought in an estimated 35,000 attendees, and similar festivals in New Mexico have attracted up to 20,000 people. Such festivals are a good fit for New Mexico.

Lavender is already grown successfully in New Mexico, and is an increasingly popular specialty high-value crop that does not require much water. It tolerates heat, and prefers arid conditions and well drained, relatively poor, soils. Species and cultivar selection is important to obtain high oil quality based on local growing conditions.

Discussions with a leading New Mexico grower indicated that the current 1-5 acre lavender farms in New Mexico are not really viable as stand-alone businesses, so scaling up is important to establishing a significant commercial lavender industry here. Lavender grown in New Mexico currently requires high labor input during establishment and harvesting/oil production. In contrast, economic viability of lavender oil production demands mechanization to reduce harvest times and costs[23]. Commercial lavender farms around the world are often hundreds of acres.

In a report that studied how lavender production could be scaled-up in England, recommendations included to establish grower co-ops and having a production area of a minimum of 50 acres/producer or /co-operative. Efficiencies could be achieved by sharing distillation or harvesting equipment between producers (or by contracting out these functions or forming co-operatives), and in the choice of high yielding varieties and agronomic practices to improve oil yield and quality. The French industry uses co-operatives to reduce oil distillation costs, share R&D costs, and obtain marketing advantages. The possibility of freezing plant material prior to distillation could be investigated: this is used in Australia to cope with the short harvest window without requiring too high an investment in oil extraction equipment.

A large New Mexico producer of lavender products has stated that it would buy more lavender oil from local producers if it was available and has expressed interest in establishing lavender fields in the southwest counties if water was available. And apparently there are some vineyards in California that also grow lavender; perhaps this combination would increase the viability of both crops in New Mexico.

The main cost for establishing lavender farms are lavender plant purchases and the distillation units, and for large farms the specialised harvest equipment. The average cost of a fully developed lavender plant is around $9, with younger specimens costing around $4-6[24] and plugs, suitable for transplanting, available at $0.65 each in wholesale quantities[25]. With planting density commonly 2,500-3,000 plants/acre, this equates to a cost for the plants alone at $1600-2000/acre. Other establishment costs include labor and weed cloth. Costs for small-scale steam distillation equipment to extract the oil are reported at $8-10,000 per unit[26], but large scale production would see this cost increase. Total establishment costs are estimated at $5,000-8,000/acre as described in Appendix 7.

Reported oil yields for the many different varieties of lavender vary widely, as does the oil quality. Maximum oil yield is obtained via optimized harvest timing, post harvest handling,

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[22] Source: http://www.bridestowelavender.com.au/
[23] Beus, C. Growing and Marketing Lavender, Washington State University Extension EB2005, 2006, p 14-15.
[24] http://www.ehow.com/about_6365697_economics-growing-lavender.html
[25] http://victorslavender.com/wholesale-only/
[26] Ditto, and http://www.buzzle.com/articles/growing-lavender-for-profit.html

and distillation procedures. Yields for the Grosso variety, a hardy variety and the most common one grown commercially in New Mexico, are among the highest, at 27-192 liters/acre/year, with most estimates between 50 and 100 liters/acre/year[27].
Lavender plants can last for 10 to 15 years or longer if managed correctly but then need to be replaced. The highest yields are in years 3-5, with oil production dropping after 8-10 years. Bad weather or disease will reduce plant lifespan[28]. Northern New Mexico is reportedly more challenging regarding climate that further south, opening up the possibility of expanding lavender production in the southwest counties.

The price of lavender oil varies greatly (influenced by quality and unit of sale) at $40-1000/liter, with the highest unit price for oil sold in 10ml bottles but more commercial quantities selling for about $200/liter[29]. Certified organic oil may command a higher price.

Annual costs and revenue for a 50 acre+ farm that produces lavender oil only are summarized in Appendix 7, with annual profits estimated at $5,000-12,000/acre.

Conclusion

The crops and derived products which are the subject of this report all have high income potential, as well as high returns per acre-ft of water consumed, thus providing an opportunity to increase agricultural income while reducing water demand. However, all are technically demanding compared to grain and fodder crops, and most have high investment requirements and lead times of 3-12 years to full profitability. Of these crops, pecans are the fastest expanding currently in the southwest counties.

Discussions with growers in the southwest counties of New Mexico indicated most interest and ability to use the AWSA water for high value uses is in the Deming area, and also possibly in Virden[30].

Marketing arrangements (wine), co-operative production and/or processing (lavender, pecans) and attracting out-of-state investment (wine grapes, wine) are important factors affecting viability of these crops.

Transport of water to the Deming area or along the I-10 corridor will be expensive, but could be the most viable use of the AWSA water if high-value users will commit to water purchases.

Finally, regardless of location and end use, reliable year-to-year supply is essential, meaning that some form of supply buffering is required to put the AWSA water to use.

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[27] For more details on oil yields from various varieties see http://nmawsa.org/ongoing-work/examples-of-high-value-low-water-use-crops/view

[28] Source: South African Dept. of Agriculture, Forests and Fisheries, Lavender Production, 2009, p. 11. http://www.daff.gov.za/docs/Brochures/EssOilsLavender.pdf

[29] Ditto

[30] Virden only has about 280 acres of suitable unused land not being irrigated, which would only use about 10% of the AWSA water, however crop substitution is possible there. The main potential high value non-agricultural uses are along the I-10 corridor.

Table 2: Major Crops Grown in New Mexico, (2010). Latest year available.

Crop	Irrigated Harvested Acreage	Total Harvested Acreage	Gross Value of Crop Production ($)	Gross Value of Crop Production from Irrigated Crops ($)	Gross Value of Irrigated Crop Production ($/acre/yr)	Irrigation Water Consumption/ Acre (ft)	Irrigation Water Consumption (acre-ft/yr)	Gross Value of Irrigated Crop Production/Volume Irrigation Water Consumed ($/acre-ft)
Alfalfa Hay	220,000	220,000	182,000,000	182,000,000	827	5	1,100,000	165
Corn	138,000	138,000	127,000,000	127,000,000	920	3	414,000	307
Other Hay	90,000	90,000	24,000,000	24,000,000	267	3	270,000	89
Wheat for Grain (1)	47,000	290,000	35,000,000	11,000,000	234	3	141,000	78
Upland Cotton	47,000	47,000	47,000,000	47,000,000	1,000	3	141,000	333
Pecans (2)	36,000	36,000	187,000,000	187,000,000	5,194	5	180,000	1039
Sorghum Grain (3)	27,000	68,000	22,000,000	13,000,000	481	3	81,000	160
Dry Beans	14,000	14,000	N/A	N/A				
Peanuts	10,000	10,000	13,000,000	13,000,000	1,300	3	30,000	433
Chile	9,000	9,000	42,000,000	42,000,000	4,667	3	27,000	1556
Onions	6,000	6,000	91,000,000	91,000,000	15,167	3	18,000	5056
Potatoes	6,000	6,000	24,000,000	24,000,000	4,000	3	18,000	1333
Wine Grapes (4)	1,200	1,200	4,600,000	4,600,000	3,833	2	2,400	1917
Wine (5)	1,200	1,200	46,000,000	46,000,000	38,333	2	2,400	19167
Lavender Oil (6)	20	20	N/A	300,000	15,000	2	40	7500

1. For irrigated wheat for grain, value is 55.3 bushels/acre @ $4.30/bushel for 47,000 acres = $11 million.
2. Pecan acreage is based on 2007 census.
3. For irrigated sorghum for grain, value is 100 bushels/acre @ $4.98/bushel for 27,000 acres = $13 million.
4. U.S. Average $571/ton in 2010 but NM believed to be more like $950/ton. Yield is about 4 tons/acre.
5. NMSU est. 900,000 gals/yr from 1200 acres = 750 gal/acre/yr. Assume $10/bottle. Second estimate 800 bottles/ton @ $12/bottle gives the same result.
6. All dollar-related figures are theoretical, assuming all production was used for oil, which is not the case.

For some crops there are big year/year changes eg onion prices increased by 40%, potatoes by 50% and pecans by 60% between 2009 and 2010, so all figures can only be taken as indicative.

Table 3: Major Crops Grown in Catron, Grant, Hidalgo and Luna Counties (2010 except where stated).

Crop	Irrigated Harvested Acreage	Production Amount	Unit of Production	Statewide Gross Value/Unit of Production	Gross Value of Crop Production ($)	Gross Value of Crop Production ($/acre/yr) (1)	Irrigation Water Consumption/Acre (ft)	Irrigation Water Consumption (acre-ft/yr)	Gross Value of Crop Production/Volume Irrigation Water Consumed ($/acre-ft)
Alfalfa Hay	7,500	49,000	Ton	159	7,791,000	1,039	5	37,500	208
Corn Silage	3,400	109,000	Ton	35	3,815,000	1,122	3	10,200	374
Upland Cotton	3,100	4,100,000	Lbs.	0.927	3,800,700	1,226	3	9,300	409
Pecans (2)	1,000	1,700,000	Lbs.	2.83	4,811,000	4,811	5	5,000	962
Chile	3,700	30,000	Ton	625	18,750,000	5,068	3	11,100	1689
Onions (3)	2,600	1,354,000	Cwt.	27.4	37,099,600	14,269	3	7,800	4756
Wine Grapes (4)	700	2,800	Ton	950	2,660,000	3,800	2	1,400	1900
Wine	700	2,800	Ton	950	27,000,000	38,571	2	1,400	19286

1. Based on state-wide average prices; county/county prices not available
2. Figures are for Luna county only, acreage inferred from nut production and is based on 2007 census.
3. Figures are for District 70 in total.
4. U.S. Average $571/ton in 2010 but NM believed to be more like $950/ton. Yield is about 4 tons/acre.

Other crops may be grown, but acreages are not disclosed.

For some crops there are big year/year changes eg onion prices increased by 40%, potatoes by 50% and pecans by 60% between 2009 and 2010, so all figures can only be taken as indicative.

Appendix 3: Pecan Cost and Return Estimates, 2012

	(YEAR 1)	(YEAR 2)	(YEAR 3)	(YEAR 4)	(YEAR 5)	(YEAR 6)	(YEAR 7)	(YEAR 8)	(YEAR 9)	(YEAR 10)
PRIMARY YIELD			10	30	50	250	400	900	1,200	1,500
PRIMARY PRICE			$1.75	$1.75	$1.75	$1.75	$1.75	$1.75	$1.75	$1.75
GROSS RETURN			$17.50	$52.50	$87.50	$437.50	$700.00	$1,575.00	$2,100.00	$2,625.00
CASH OPERATING EXPENSES										
TREES	$1,008.00	$42.00								
FERTILIZER	$41.97	$18.03	$76.17	$76.17	$76.17	$76.17	$76.17	$76.17	$76.17	$76.17
CHEMICALS		$35.00	$157.89	$157.89	$157.89	$157.89	$157.89	$157.89	$157.89	$157.89
CROP INSURANCE										
OTHER PURCHASED INPUTS										
CANAL WATER	$0.00	$0.00	$1.51	$1.51	$1.51	$1.51	$1.51	$1.51	$1.51	$1.51
FUEL, OIL & LUBRICANTS-EQUIPMENT	$51.30	$48.73	$94.90	$94.90	$94.90	$94.90	$94.90	$94.90	$94.90	$94.90
FUEL-IRRIGATION	$32.12	$32.12	$128.48	$128.48	$128.48	$128.48	$128.48	$128.48	$128.48	$128.48
REPAIRS	$42.10	$10.59	$19.06	$19.06	$19.06	$19.06	$19.06	$19.06	$19.06	$19.06
CUSTOM CHARGES	$0.00	$0.00	$25.80	$27.40	$29.00	$45.00	$57.00	$97.00	$121.00	$145.00
LAND TAXES		$28.59	$28.59	$28.59	$28.59	$28.59	$28.59	$28.59	$28.59	$28.59
OTHER EXPENSES	$0.00	$138.64	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
TOTAL CASH EXPENSES	$1,175.49	$353.70	$532.39	$533.99	$535.59	$551.59	$563.59	$603.59	$627.59	$651.59
RETURN OVER CASH EXPENSES	-$1,175.49	-$353.70	-$514.89	-$481.49	-$448.09	-$114.09	$136.41	$971.41	$1,472.41	$1,973.41
FIXED EXPENSES	$57.01	$61.43	$97.05	$97.05	$97.05	$97.05	$97.05	$97.05	$97.05	$97.05
TOTAL EXPENSES	$1,232.50	$415.12	$629.44	$631.04	$632.64	$648.64	$660.64	$700.64	$724.64	$748.64
NET FARM INCOME	-$1,232.50	-$415.12	-$611.94	-$578.54	-$545.14	-$211.14	$39.36	$874.36	$1,375.36	$1,876.36
LABOR AND MANAGEMENT COSTS	$247.60	$300.29	$1,566.59	$1,566.59	$1,566.59	$1,566.59	$1,566.59	$1,566.59	$1,566.59	$1,566.59
NET OPERATING PROFIT	-$1,480.10	-$715.41	-$2,178.53	-$2,145.13	-$2,111.73	-$1,777.73	-$1,527.23	-$692.23	-$191.23	$309.77
CAPITAL COSTS										
INTEREST ON OPERATING CAPITAL		$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$26.66	$26.66	$26.66
INTEREST ON EQUIPMENT INVESTMENT		$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$65.60	$65.60	$65.60
TOTAL CAPITAL COSTS	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$92.26	$92.26	$92.26
RETURN TO LAND AND RISK	-$1,480.10	-$715.41	-$2,178.53	-$2,145.13	-$2,111.73	-$1,777.73	-$1,527.23	-$784.49	-$283.49	$217.51

	(YEAR 11)	(YEAR 12)	(YEAR 13)	(YEAR 14)	(YEAR 15)	(YEAR 16)	(YEAR 17)	(YEAR 18)	(YEAR 19)	(YEAR 20)
PRIMARY YIELD	1,800	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000
PRIMARY PRICE	$1.75	$1.75	$1.75	$1.75	$1.75	$1.75	$1.75	$1.75	$1.75	$1.75
GROSS RETURN	$3,150.00	$3,500.00	$3,500.00	$3,500.00	$3,500.00	$3,500.00	$3,500.00	$3,500.00	$3,500.00	$3,500.00
CASH OPERATING EXPENSES										
TREES										
FERTILIZER	$76.17	$76.17	$76.17	$76.17	$76.17	$76.17	$76.17	$76.17	$76.17	$76.17
CHEMICALS	$157.89	$157.89	$157.89	$157.89	$157.89	$157.89	$157.89	$157.89	$157.89	$157.89
CROP INSURANCE										
OTHER PURCHASED INPUTS										
CANAL WATER	$1.51	$1.51	$1.51	$1.51	$1.51	$1.51	$1.51	$1.51	$1.51	$1.51
FUEL, OIL & LUBRICANTS-EQUIPMENT	$94.90	$94.90	$94.90	$94.90	$94.90	$94.90	$94.90	$94.90	$94.90	$94.90
FUEL-IRRIGATION	$128.48	$128.48	$128.48	$128.48	$128.48	$128.48	$128.48	$128.48	$128.48	$128.48
REPAIRS	$19.06	$19.06	$19.06	$19.06	$19.06	$19.06	$19.06	$19.06	$19.06	$19.06
CUSTOM CHARGES	$169.00	$185.00	$185.00	$185.00	$185.00	$185.00	$185.00	$185.00	$185.00	$185.00
LAND TAXES	$28.59	$28.59	$28.59	$28.59	$28.59	$28.59	$28.59	$28.59	$28.59	$28.59
OTHER EXPENSES	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
TOTAL CASH EXPENSES	$675.59	$691.59	$691.59	$691.59	$691.59	$691.59	$691.59	$691.59	$691.59	$691.59
RETURN OVER CASH EXPENSES	$2,474.41	$2,808.41	$2,808.41	$2,808.41	$2,808.41	$2,808.41	$2,808.41	$2,808.41	$2,808.41	$2,808.41
FIXED EXPENSES	$97.05	$97.05	$97.05	$97.05	$97.05	$97.05	$97.05	$97.05	$97.05	$97.05
TOTAL EXPENSES	$772.64	$788.64	$788.64	$788.64	$788.64	$788.64	$788.64	$788.64	$788.64	$788.64
NET FARM INCOME	$2,377.36	$2,711.36	$2,711.36	$2,711.36	$2,711.36	$2,711.36	$2,711.36	$2,711.36	$2,711.36	$2,711.36
LABOR AND MANAGEMENT COSTS	$230.54	$230.54	$230.54	$230.54	$230.54	$230.54	$230.54	$230.54	$230.54	$230.54
NET OPERATING PROFIT	$2,146.82	$2,480.82	$2,480.82	$2,480.82	$2,480.82	$2,480.82	$2,480.82	$2,480.82	$2,480.82	$2,480.82
CAPITAL COSTS										
INTEREST ON OPERATING CAPITAL	$26.66	$26.66	$26.66	$26.66	$26.66	$26.66	$26.66	$26.66	$26.66	$26.66
INTEREST ON EQUIPMENT INVESTMENT	$65.60	$65.60	$65.60	$65.60	$65.60	$65.60	$65.60	$65.60	$65.60	$65.60
TOTAL CAPITAL COSTS	$92.26	$92.26	$92.26	$92.26	$92.26	$92.26	$92.26	$92.26	$92.26	$92.26
RETURN TO LAND AND RISK	$2,054.56	$2,388.56	$2,388.56	$2,388.56	$2,388.56	$2,388.56	$2,388.56	$2,388.56	$2,388.56	$2,388.56

Appendix 4: Projected Costs and Returns for Chile and Onions in Luna and Hidalgo Counties, 2012

TABLE 16. Summary of per acre costs and returns for a 640 acre farm with above average management, Deming area, Luna County, Projected 2012.

	WHEAT	GRAIN SORGHUM	PICKER COTTON	GREEN CHILE	RED CHILE	SPRING LETTUCE	FALL LETTUCE	FALL ONIONS	MIDSEASON ONIONS	LATE ONIONS
	CWT	CWT	LBS	TONS/LBS	LBS	CARTONS	CARTONS	SACKS	SACKS	SACKS
PRIMARY YIELD	50	70	750	11	4,000	475	500	820	670	820
PRIMARY PRICE	$10.83	$8.63	$0.85	$475.00	$1.00	$5.91	$5.78	$7.64	$7.98	$7.15
GOVERNMENT PAYMENTS	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
SECOND INCOME	$0.00	$0.00	$84.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
GROSS RETURN	$541.67	$603.75	$721.50	$5,225.00	$4,000.00	$2,807.25	$2,890.00	$6,264.80	$5,346.60	$5,863.00
CASH OPERATING EXPENSES										
SEED	$50.00	$15.76	$144.00	$152.00	$152.00	$6.20	$6.60	$340.00	$940.00	$940.00
FERTILIZER	$167.05	$141.80	$129.55	$252.60	$226.35	$226.75	$226.75	$339.00	$339.00	$320.25
CHEMICALS		$45.65	$26.70	$31.08	$31.08	$92.45	$111.14	$107.11	$140.94	$140.94
CROP INSURANCE	$0.74	$0.53	$0.18	$72.58	$76.22					
OTHER PURCHASED INPUTS										
CANAL WATER										
FUEL, OIL & LUBRICANTS-EQUIPMENT	$21.42	$63.46	$123.53	$214.95	$147.46	$77.67	$79.45	$84.93	$84.93	$84.93
FUEL-IRRIGATION	$51.19	$76.78	$66.54	$138.21	$122.65	$61.43	$102.38	$143.33	$122.85	$122.85
REPAIRS	$5.58	$14.42	$16.49	$47.58	$33.63	$17.54	$18.98	$20.93	$20.34	$20.34
CUSTOM CHARGES	$35.50	$28.30	$189.20	$1,252.33	$970.00	$1,883.00	$2,035.66	$3,627.16	$3,019.52	$3,591.00
LAND TAXES	$1.86	$1.86	$1.86	$1.86	$1.86	$1.86	$1.86	$1.86	$1.86	$1.86
OTHER EXPENSES	$75.65	$76.03	$76.32	$76.74	$76.94	$76.11	$76.26	$76.73	$76.73	$76.73
TOTAL CASH EXPENSES	$408.98	$464.61	$774.38	$2,239.92	$1,838.39	$2,443.01	$2,659.07	$4,741.05	$4,746.18	$5,298.90
RETURN OVER CASH EXPENSES	$132.69	$139.14	($52.88)	$2,985.08	$2,161.61	$364.24	$230.93	$1,523.75	$600.42	$564.10
FIXED EXPENSES	$34.15	$53.76	$98.67	$110.45	$89.04	$58.31	$73.78	$92.86	$85.57	$85.57
TOTAL EXPENSES	$443.13	$518.37	$873.05	$2,350.37	$1,927.44	$2,501.32	$2,732.85	$4,833.91	$4,831.75	$5,384.47
NET FARM INCOME	$98.54	$85.38	($151.55)	$2,874.63	$2,072.56	$305.93	$157.15	$1,430.89	$514.85	$478.53
LABOR AND MANAGEMENT COSTS	$63.87	$95.27	$125.01	$282.86	$235.67	$151.59	$180.07	$263.40	$323.95	$322.07
NET OPERATING PROFIT	$34.66	($9.89)	($276.56)	$2,591.77	$1,836.89	$154.34	($22.92)	$1,167.49	$190.91	$156.46
CAPITAL COSTS										
INTEREST ON OPERATING CAPITAL	$9.20	$10.00	$14.32	$29.05	$26.34	$23.96	$25.88	$51.82	$70.09	$72.77
INTEREST ON EQUIPMENT INVESTMENT	$8.43	$16.17	$29.77	$44.72	$31.45	$20.64	$22.36	$26.13	$25.48	$25.48
TOTAL CAPITAL COSTS	$17.63	$26.17	$44.09	$73.77	$57.79	$44.59	$48.24	$77.95	$95.58	$98.26
RETURN TO LAND AND RISK	$17.03	($36.06)	($320.65)	$2,518.00	$1,779.10	$109.74	($71.15)	$1,089.54	$95.33	$58.20

TABLE 10. Summary of per acre costs and returns for a 400 acre farm with above average management, Cotton City-Animas area, Hidalgo County, Projected 2012.

	GRAIN SORGHUM	PICKER COTTON	GREEN CHILE	RED CHILE
	----------FLOOD----------			
	CWT	LBS	TONS	LBS
PRIMARY YIELD	62	1060	10	3500
PRIMARY PRICE	$5.75	$0.69	$380.00	$1.00
GOVERNMENT PAYMENTS	$0.00	$83.36	$0.00	$0.00
SECOND INCOME	$0.00	$82.68	$0.00	$0.00
GROSS RETURN	$356.50	$897.44	$3,800.00	$3,500.00
CASH OPERATING EXPENSES				
SEED	$15.76	$200.00	$152.00	$72.00
FERTILIZER	$63.00	$58.48	$270.90	$151.60
CHEMICALS	$19.52	$9.46	$25.13	$28.32
CROP INSURANCE	$0.37	$0.00	$0.00	$0.00
OTHER PURCHASED INPUTS				
CANAL WATER				
FUEL, OIL & LUBRICANTS-EQUIPMENT	$50.11	$93.15	$203.07	$135.76
FUEL-IRRIGATION	$50.03	$46.69	$125.06	$113.39
REPAIRS	$27.16	$85.93	$44.73	$37.26
CUSTOM CHARGES	$34.72	$130.75	$1,063.33	$790.00
LAND TAXES	$2.57	$2.57	$2.57	$2.57
OTHER EXPENSES	$81.52	$82.14	$82.93	$82.70
TOTAL CASH EXPENSES	$344.76	$709.17	$1,969.73	$1,413.61
RETURN OVER CASH EXPENSES	$11.74	$188.27	$1,830.27	$2,086.39
FIXED EXPENSES	$52.32	$97.28	$87.66	$75.75
TOTAL EXPENSES	$397.08	$806.45	$2,057.39	$1,489.36
NET FARM INCOME	-$40.58	$90.99	$1,742.61	$2,010.64
LABOR AND MANAGEMENT COSTS	$83.12	$165.08	$266.00	$232.38
NET OPERATING PROFIT	-$123.70	-$74.09	$1,476.61	$1,778.25
CAPITAL COSTS				
INTEREST ON OPERATING CAPITAL	$5.88	$12.76	$25.45	$16.88
INTEREST ON EQUIPMENT INVESTMENT	$23.66	$45.38	$59.50	$48.04
TOTAL CAPITAL COSTS	$29.54	$58.14	$84.96	$64.92
RETURN TO LAND AND RISK	-$153.24	-$132.22	$1,391.65	$1,713.34

Appendix 5: Estimates of Grape Production Profitability, Kentucky, 2010

Table 1. Estimated Grape Producer Profitability Summary: Kentucky, 2010

Variety	Estimated Establishment Cost (Cash Outlays Until Positive Cash Flows Are Generated) -per acre-	Estimated Annual Return to Land, Labor, & Management (Full Production) -per acre-	Estimated Present Value of 10-Year Cumulative Return (7% Discount Rate) -per acre-	Estimated Payback Period (Land, Labor & Management) -per acre-
American & French-American Hybrids	$ 8,028	$1,850	$3,821	7 Years
Vinifera (European Hybrids)	$10,667	$3,042	$9,191	5 Years
Table Grape	$9,034	$3,277	$8,587	6 Years

Table 2. Estimated *Vinifera* Wine Grape Annual Return to Land, Capital & Management ($) Full ProductionYear Varying Price/Yield Combinations: Kentucky, 2010

	Price Per Ton							
Yield/A (Tons)	**$900**	**$1000**	**$1100**	**$1200**	**$1300**	**$1350**	**$1400**	**$1450**
2.0	-1,568	-1,369	-1,169	-969	-769	-669	-569	-469
3.0	-813	-513	-213	87	387	537	687	837
3.5	-435	-85	265	615	965	1,140	1,315	1,490
4.0	-58	342	742	1,142	1,542	1,742	1,942	2,142
4.5	320	771	1,220	1,670	2,120	2,345	2,570	2,795
5.0	698	1,198	1,698	2,198	2,698	2,948	3,198	3,448
6.0	1,453	2,053	2,653	3,253	3,853	4,153	4,453	4,753

Table 3. Estimated French-American Hybrid and American Varieties Annual Return to Land, Capital & Management, Full Production Year Varying Price/Yield Combinations: Kentucky, 2010

	Price Per Ton							
Yield/A (Tons)	**$750**	**$800**	**$850**	**$900**	**$950**	**$1000**	**$1050**	**$1100**
3.0	-1,263	-1,113	-963	-813	-663	-513	-363	-213
4.0	-658	-458	-258	-58	142	342	542	742
5.0	-52	198	448	698	948	1,198	1,448	1,698
5.5	251	526	801	1,076	1,351	1,626	1,901	2,176
6.0	553	853	1,153	1,453	1,753	2,053	2,353	2,653
6.5	856	1,181	1,506	1,831	2,156	2,481	2,806	3,131
7.0	1,159	1,509	1,859	2,209	2,559	2,909	3,259	3,609

Source: http://www.uky.edu/Ag/NewCrops/grapebudget10.pdf

Appendix 6: Establishment Costs for a Small Winery in Arkansas, 2009

	Plant size (annual fermenting capacity in thousand gallons)		
Expense Items	5	10	20
Receiving and Crushing	$11,639	$24,174	$76,828
Fermentation and Storage	$57,060	$103,780	$196,930
Cellar	$7,970	$43,810	$50,700
Bottling Line	$4,120	$13,095	$36,620
Total Equipment	$80,789	$184,859	$361,078
Building sq. ft.	2,400	4,400	8,400
cost	$120,000	$220,000	$420,000
Total Costs (excludes land)	$200,789	$404,859	$781,078
Equipment costs per gallon of capacity	$16.16	$18.49	$18.05
Total costs per gallon of capacity	$40.16	$40.49	$39.05

Source: http://arkansasagnews.uark.edu/983.pdf

Note: Grapes produce ~300 gallons of wine/acre/year. To establish a winery at $40/gallon capacity as above, this equates to $11,000-13,000/acre (after allowing 2% inflation per year since 2009). This is in addition to the $12,000/acre to establish the vineyard.

Appendix 7: Estimated Establishment Costs and Annual Costs and Revenue for a 50+ Acre Lavender Farm and Associated Oil Processing Facility

Category	**$/acre**	**Comments**
Establishment Costs		
Lavender plants	1600-2000	@ $0.65/plug @ 2400-3000 plants/acre
Machinery	1000-2000	$50-100,000
Contract planting	1000-1500	10 man-days/acre @ 100-150/day
Buildings	1000-2000	$50-100,000
Site preparation	200	
Other	500	
Total Establishment Costs	**5000-8000**	Could be a more costly than this, eg more sophisticated machinery could be used
Annual Revenue	**10-15,000**	@ 50 liters oil/acre/yr @ 200-300/liter
Annual Costs		
Labor	1500-3000	@ 1 employee/10-20 acres @ $30,000/yr each
Plant replacement	160-200	Assume 10% replaced/yr
Fertilizer, pesticides, etc	300	
Water	200	@ $100/acre-ft for AWSA water @ 24” irrigation
Fuel and electricity	300	
Maintenance	100	
Harvesting	N/A	Included in labor but may need additional help
Oil production	150	3 people for 4 weeks @ $600/wk each
Oil materials	200	Oil containers, labels, etc
Management and marketing	N/A	Included in owner’s profit
Total Annual Costs	**3000-5000**	
Annual Profit	**5000-12000**	