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Estimated Costs of Precision Grading Sugarcane Fields, 2017

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Introduction

Precision grading of agricultural crop land is an example of a land improvement practice that increases the value of agricultural land. In addition, precision grading is important when portions of the field have been disturbed by agricultural and non-agricultural activity, such as pipeline construction and maintenance activities. In these cases, it is important that the entire field be re-graded. The costs of precision grading represent a long term investment in the productive capacity and profitability of crop land. The main purpose of precision grading is to level the surface of the field and to grade the field to a specific slope that will improve drainage. This report presents cost estimates of precision grading sugarcane fields for which the sugarcane producer purchases the laser-leveling and dirt-moving equipment and performs the work with farm labor. Both variable and fixed costs associated with precision grading are estimated on a per hour of operation basis as well as costs per acre and per cubic yard of dirt moved.

The production of sugarcane in Louisiana requires well drained fields. Most sugarcane fields have quarter drain ditches as well as lateral main drainage ditches so as to remove standing water quickly. Quarter drain ditches run perpendicular to sugarcane rows and carry water from the row middles to the edge of the field. Lateral ditches run parallel to sugarcane rows and drain water away from the field. By improving drainage within the field, precision grading of sugarcane fields can reduce the number of lateral and quarter drain ditches required.

The number of ditches within a sugarcane field that may be eliminated by precision grading will depend upon the size of the field. In relatively large fields, precision grading may allow for an increase in the number of rows of sugarcane between lateral ditches. For example, in relatively large fields that are not precision graded, there may be approximately30 rows of sugarcane between two main lateral drainage ditches. After precision grading the field, the number of rows of sugarcane between the lateral ditches might expand to 42 rows. If a field has three quarter drain ditches running across the sugarcane rows, precision grading may allow for one or two of these quarter drains to be eliminated. An added advantage of precision grading sugarcane fields is that land previously taken up by drainage ditches can be returned to production. Therefore, investment in the costs of precision grading sugarcane fields can increase the percentage of a field's area that is engaged in actual sugar production (more production acreage from the same amount of land).

The amount of acreage that can be returned to sugarcane production by precision grading for a particular farming operation will depend upon the total acreage and topography of the fields to be leveled. It has been estimated that, on a whole farm basis, precision grading can increase the productive area of a farm's sugarcane acreage anywhere from between 5 percent to 8 percent. This implies that if 1,000 acres of sugarcane land were precision graded, 50 to 80 more acres of land would be in sugarcane production from the same amount of land. On a sugar per acre basis, if a farm averaged 7,000 pounds of sugar per acre before, precision grading could result in a 350- to 560-pound increase.

Precision grading of sugarcane fields provides several other advantages besides increasing land in sugar production. Eliminating a portion of the ditches required to drain a field reduces weed pressure in the field

along ditches. Ditch banks provide a suitable environment for the establishment of many types of weeds. Elimination of a ditch may not reduce the cost of weed control on the field, but it will remove areas where weeds could thrive. Because the effects of precision grading (in terms of land surface smoothness and slope) last for many years, the land-leveling operation on fallow ground can be eliminated, thereby reducing production costs. Other advantages include more uniform fields, elimination of odd rows and points in fields, easier cultivation, and more efficient harvest. Since precision grading is a long-term investment in the land, it will require several years of production to recover the costs invested. Therefore, land chosen for precision grading should be land that has a high probability of remaining in sugarcane production for several years. Examples include land that the producer owns, land with favorable rental arrangements, land with good sugarcane production potential, and land not subject to possible residential development.

Cost Considerations

In deciding whether or not to make the investment in precision grading of fields on a sugarcane farm, a couple of key cost considerations should be addressed. The first consideration involves whether the producer should purchase the laser-leveling and dirt-moving equipment and do the work himself or hire the work out to someone else on a custom-hired basis. The second cost consideration is determining how many years of sugarcane production will be required to recover the investment in precision grading costs. The total amount of acreage on the farm to be leveled is a critical component in this decision. If only a small amount of acreage is to be graded, e.g., 200 acres, the producer may choose to contract out the work rather than purchase the equipment for such a small amount of acreage. If, however, a large amount of acreage is to be graded over a multiyear period, for example 1,000 acres graded over a five-year period, it would probably be more economical for the producer to purchase the laser-leveling and dirt-moving equipment and perform the work themself. In terms of costs per cubic yard of dirt moved, the costs of a producer buying the equipment and performing the work themself are estimated to be in the range from between $0.59 to $0.97 per cubic yard. If precision land leveling operations were performed by someone other than the sugarcane producer, the cost per cubic year would be considerably higher. In addition, the current cost of diesel fuel at a specific point in time would also influence precision leveling costs, regardless as to whether the work was being performed by a grower with owned equipment or if it was done on a custom hired basis.

The determination of the number of years of sugarcane production required to recover investment in precision grading costs can be estimated by comparing the precision grading costs per acre with the increased net returns per acre resulting from increased production. An estimate of the number of years required to recover precision grading costs can be determined by dividing the precision grading costs per acre by the increased annual returns per acre.

Results

Estimated costs of precision land-grading equipment per hour of operation are presented in Table 2. Equipment required for precision grading land includes a tractor, a dirt bucket or scraper, and laser-leveling equipment consisting of a field transmitter with trailer as well as receiver and control boxes, which are mounted on the tractor, and dirt moving equipment. In the example in Table 2, costs are estimated for a 300 horsepower, 4-wheel drive tractor pulling a dirt scraper with an 18 cubic yard capacity.

Operating costs per hour for the tractor were an estimated $56.77 per hour, including fuel and repair costs. Fuel costs were estimated using a diesel price of $1.85 per gallon. Operating costs for the scraper and laser equipment include only repair costs, estimated at $10.44and $1.44 per hour, respectively. With an hourly wage rate of $15.30, total operating costs for the entire system were estimated to be $83.95 per hour, including labor. Fixed costs per hour were estimated based upon assumed years of expected life of the equipment as well as hours of annual use. In this example, hours of annual leveling use were based upon an average of 300 cubic yards of dirt moved per acre. Fixed costs for the entire precision grading

system were estimated to be $55.43 per hour of use. Total costs of this land-leveling system, including operating and fixed costs, were an estimated $139.38 per hour of operation.

These estimated costs per hour of operation were then used to calculate the costs per acre and costs per cubic yard of dirt moved for a specific precision grading example. In this example, it was assumed that 200 acres of land were being precision graded annually with an average of 300 cubic yards of dirt moved per acre. Time requirements per acre were estimated assuming that the grading equipment makes eight cycles of picking up and moving dirt per hour. Using a scraper with an 18 cubic yard capacity, it was estimated that the equipment in this example could move 144 cubic yards of dirt per hour. With an average of 300 cubic yards of dirt moved per acre, it was estimated that 2.1 hours of operation were required for each acre precision graded. Estimated costs of precision grading on a per acre and per cubic yard basis are presented for this example in Table 3. Operating costs, including fuel, repairs, and labor, were estimated to be $174.89 per acre. Fixed costs were an estimated $115.47 per acre, resulting in an estimate of total costs of $290.37 per acre to move 300 cubic yards of dirt. On a cost per unit of dirt moved basis, this total cost estimated translates to a total cost of $0.97 per cubic yard of dirt moved. Operating costs were estimated to be $0.58 per cubic yard and fixed costs to be $0.38 per cubic yard.

The total cost of $290.37 per acre represents a long term investment in the land. An estimation of the increased annual returns per acre resulting from precision grading is necessary to determine the number of years required to recover this investment. As an example, suppose the average sugar yield on this farm is 7,000 pounds of sugar per acre before precision grading. If precision grading of sugarcane fields results in a 5 percent increase in productive area, this is equivalent to a 350-pound increase in sugar yield per acre. With raw sugar valued at 25 cents per pound, the producer and landlord's share of this increased yield (61 percent or 213.5 pounds) is valued at $53.38 per acre. This represents the increase in net returns per acre annually from the graded fields. Dividing this increased return per year ($53.38 per acre) into the total precision leveling investment costs ($290.37 per acre) results in a payback period of approximately 5 and one half years for this example. Estimated number of production years necessary to recover total precision leveling investment costs are presented for Table 1 for a range of raw sugar prices and precision leveling costs per acre.

In summary, precision grading of sugarcane fields provides an opportunity to increase production from the same amount of acreage by reducing some of the ditches required to drain the field. A critical decision is whether to buy the laser-leveling and dirt-moving equipment and perform the work or hire it out on a custom basis. Total costs of performing the precision grading operations are estimated to be in the range of $0.58 to $0.97 per cubic yard of dirt moved, with approximately five and one half years of sugarcane production required to recover investment cost.

Table 1. Payback period calculation (in years) necessary to cover total investment cost.

Raw Sugar Price	Total Precision Leveling Investment Cost per Acre				
($/lb)	$250	$275	$300	$325	$350
$0.21	5.6	6.1	6.7	7.2	7.8
$0.22	5.3	5.9	6.4	6.9	7.5
$0.23	5.1	5.6	6.1	6.6	7.1
$0.24	4.9	5.4	5.9	6.3	6.8
$0.25	4.7	5.2	5.6	6.1	6.6
$0.26	4.5	5.0	5.4	5.9	6.3
$0.27	4.3	4.8	5.2	5.6	6.1
$0.28	4.2	4.6	5.0	5.4	5.9
$0.29	4.0	4.4	4.8	5.2	5.7
$0.30	3.9	4.3	4.7	5.1	5.5
$0.31	3.8	4.2	4.5	4..9	5.3

Increased returns to grower and landlord in this example are based on the following assumptions: (a) 5% increase in productive field area, (b) a 7,000 pound per acre sugar yield, and (c) 61% grower and landlord crop proceeds share (based on a 39% mill share).

Table 2. Estimated costs of precision grading per hour of operation, 2017.

Item Description	Tractor Large 4WD 300 HP	Scrapper 18 cu. Yd. Capacity	Laser Equipment	Labor Costs	Total Costs
Purchase Price ($)	$282,000	$98,880	$30,000	--	--
Expected Life (Yrs)	8	15	10	--	--
Salvage Value ($)	$98,700	$9,888	$3,000	--	--
Annual Use (Yrs)	1200	417	417	--	--
Land Leveling (Hrs)	417	417	417	--	--
Repair Costs (%)	96	66	20	--	--
Operating Costs per Hour					
Fuel Costs ($)	$28.57	--	--	--	$28.57
Repair Costs ($)	$28.20	$10.44	$1.44	--	$40.08
Labor Costs ($)	--	--	--	$15.30	$15.30
Total Operating Cost	$56.77	$10.44	$1.44	$15.30	$83.95
Fixed Cost per Hour					
Depreciation ($)	$19.09	$14.24	$6.48	--	$39.81
Interest ($)	$7.53	$6.20	$1.88	--	$15.62
Total Fixed Costs	$26.63	$20.44	$8.36	--	$55.43
Total Costs per Hour ($)	$83.40	$30.88	$9.80	$15.30	$139.38

Salvage value equals 35% of purchase price for tractor and 10% for scrapper and laser equipment. - Estimated grading hours based on 8 cycles per hour, 18 cubic yards moved per cycle, 300 cubic yards moved per acre, and 200 acre precision graded annually. - Total repair costs over equipment life as a percentage of the purchase price. - Fuel consumption is 15.4418 gallons of diesel per hour with diesel priced at $1.85 per gallon. Total estimated repair cost divided by the total hours of use over the useful life of the equipment. - Interest on average investment charged at an annual rate of 4.75 percent.

Table 3. Estimated cost of precision grading per acre and per cubic yard of soil moved, 2017.

Item Description	Tractor Large 4WD 300 HP	Scrapper 18 cu. Yd. Capacity	Laser Equipment	Labor Costs	Total Costs
Total Cost per acre ($)					
Operating Cost	$118.27	$21.75	$3.00	$31.88	$174.89
Fixed Costs	$55.48	$42.58	$17.42	--	$115.47
Total Costs	$173.74	$64.33	$20.42	$31.88	$290.37
Total Costs per Cubic Yard ($)					
Operating Costs	$0.39	$0.07	$0.01	$0.11	$0.58
Fixed Costs	$0.18	$0.14	$0.06	--	$0.38
Total Costs	$0.58	$0.21	$0.07	$0.11	$0.97

Estimated grading hours based on 8 cycles per hour, 18 cubic yards moved per cycle, 300 cubic yards moved per acre, and 200 acre precision graded annually.

References

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