



Analysis of Energy and Economic Efficiency of Irrigated Canola Production in Brazilian Central-West Region

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INTRODUCTION

Energy efficiency, defined as the ratio of energy produced to energy consumed, is a major tool to assess sustainability of agricultural activities. Although studies on energy efficiency in agriculture provide important tools for energy consumption, this study does not cover all aspects of sustainable agriculture. Hence, other areas such as economy and water use should be included. Thus, we developed a study to assess energy and economic efficiency of irrigated canola in the Central West region of Brazil.

METHODOLOGY

One experiment was carried out at the Faculty of Agricultural Sciences, Federal University of Grande Dourados from May to September 2012 and repeated May to September 2013 to evaluate the effect of different irrigation frequencies on grain yield of canola.

Economic analysis: Economic analysis was based on total operating cost (COT) and effective operating cost (COE), using the market quotes.

Total operating profit (LOT), was calculated by the difference between gross revenue (RB) and total operating cost (COT).

$COT = COE + DC$; $LOT = RB - COT$

Energy analysis: Analysis of energy efficiency was performed through evaluation of energy inputs corresponding to energy used, and energy outputs equivalent to the energy extracted from the agricultural production system. $EF = EE / EU$



RESULTS AND DISCUSSION

Table 1. Cost and operating profit of canola under different irrigation frequencies. 1 US\$ = 2.40 R\$ in 2014

Treatment	Yield (kg ha ⁻¹)	RB	COE	COT	LOE	LOT
		(R\$ ha ⁻¹)				
Two year-average						
I3S	2,982.86	2,207.3164a	1,107.15	1,471.17	1,100.16	736.15
IS	2,301.48	1,703.0952b	1,098.26	1,453.54	604.84	249.56
SI	709.93	525.3482c	829.97	1,083.57	-304.62	-558.22

Table 2. Energy used (EU), energy extracted (EE), net energy gain (GL), energy efficiency (EF), specific energy (ES) and EI / EU ratio of canola under irrigation depths (LI)

Treatment	EU (MJ ha ⁻¹)	EE (MJ ha ⁻¹)	GL (MJ ha ⁻¹)	EF	ES	EI / EU
Two year-average						
I3S	14,560.83	71,588.64a	57,027.81	4.92a	4.88b	0.58
IS	14,096.92	55,235.52b	41,138.60	3.92a	6.13b	0.60
SI	8,695.17	17,038.32c	8,343.15	1.96b	12.25a	0.97

CONCLUSION

1. Economically, absence of irrigation prevents offseason canola cultivation in the Central-West region of Brazil. 2. Irrigation promotes energy and economic viability with positive increases, depending on irrigation depths. 3. Irrigation performed more frequently, three times a week, promotes the best energy and economic results.