

Supplementary Materials: Assessing Jatropha Crop Production Alternatives in Abandoned Agricultural Arid Soils Using MCA and GIS

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The following supplementary material describes briefly the criteria and values that will be used during the impact assessment.

- Sapling purchase cost. After analyzing the price of seed at a national and international level, currently there is not a fixed market price for JCL seed in the Canary Islands. On the other hand, after interviewing some private producers of JCL on Fuerteventura, little importance is given to the cost of seeds, since they are not considered a significant cost in the phase of cultivation.

In the case at hand, and considering that the most common form of planting spacing is 2 m × 2 m [1–3], which involves 2500 plants per hectare and market prices for seedlings, the total cost for one hectare is €2500.

- Initial investment. Based on the experience in Pozo Negro, an initial investment in drip irrigation system is absolutely necessary, either underground or surface (including filters, pumps, and valves). Thus, pipeline cost (both for surface mounting and buried) and their installation process (renting of machinery and labor) were calculated. Similarly, other costs including head and the suction process were figured out. All this resulted in a cost of approximately €12,000 in the case of a plot of 1 ha with surface irrigation and €13,000 in the case of irrigation buried for an area of one hectare at market prices in the island.
- Water consumption. This criterion assesses the final water consumption levels involved in the production of JCL crops. Such consumption is particularly relevant in an arid environment where water resources are of great value and where water production is derived from industrial sources, either desalinated or regenerated. It is defined as the water needed for the production of JCL seeds in cubic meters per hectare and month (m³/ha per month). The dose of irrigation has been taken into account in the calculation. Thus, taking into account these four types of irrigation doses at 100% (buried and surface) and 75% (buried and surface), the time of irrigation, and the available drip in different micro-plots, we can estimate an annual consumption of 1400 m³/ha per month (100% irrigated) and 980 m³/ha per month (75% irrigated).
- Water cost. The desalinated water for agriculture usage is subsidized, with a final cost to the farmer of €0.60/m³, with a flat subscription fee of €3.01/month, so considering the water consumption previously calculated the total cost would be approximately €880/ha per month (100% irrigated) and €580/ha per month (75% irrigated). Regarding the regenerated water, the price for agricultural usage varies depending on the municipality, in a range between €0.30/m³ in Puerto del Rosario and €0.25/m³ in Antigua. Therefore, the costs range from €440/ha per month (100% irrigated) to €290/ha per month (75% irrigated).
- Direct labor cost. This criterion includes the cost per worker employed in activities directly related to the cultivation of JCL, such as planting, harvesting, pruning, crop maintenance, *etc.* The minimum official wage, social security contributions, taxes, *etc.* have been taken into account for calculating the final amount. All this would entail a monthly cost of nearly €1100.
- Indirect labor cost. Given the wage costs set out by Spanish legislation, casual and temporary workers whose services to a company do not exceed 120 days receive at least the amount of professional salaries, that is €30.57 by legal time in the activity. Calculating 10 days of monthly activity, this cost equals €300 per month.

- Phytosanitary and fertilizer cost. Fertilizers are used to improve the performance of the plant JCL and getting seed of better quality. The literature [4,5] shows that without water and fertilization processes the expected yields are extremely low.

Actual *Jatropha* yields show that irrigated and fertilized yields are able to achieve higher productions of seed per hectare. Although some experts do not consider it important to use pesticides in the cultivation of JCL, as it shows low susceptibility to diseases and pests, other authors, on the contrary, consider that in extensive monoculture conditions pests can present major problems [6].

In Pozo Negro, pesticides have not been used. In fact, in the four-year life of the JCL bush no pest or plant disease was detected in either plot. With respect to the fertilizer use during the stage of seed germination, a substrate—consisting of mixed-zone soil, peat, and fine lapilli—has been applied as described in Section 2. On the other hand, after each pruning the plots have been treated by adding 3 kg of agricultural gypsum to reduce the sodicity of the soil. Given these data, it is considered that for a hectare of land the total annual cost of plant treatment stands at around €340.

- Energy Consumption. The main source of energy consumption refers to both the energy applied in the production of water (desalinated and reclaimed) and the pumping for irrigation. In order to calculate such an amount, the actual data from Pozo Negro have been applied, resulting in the following values: (a) pump—451.122 kWh/m³ per month; (b) desalinated water—1780.53 kWh/m³ per month; and c) regenerated—743.49 kW/m³ per month.
- Energy Cost. The relevance of this criterion is evident since JCL plant cultivation is aimed at producing biofuels. These costs are mainly related to the costs of producing water, either desalinated or regenerated. Although this consideration is already included in the price of water, due to its importance it is analyzed independently to show the energy cost of the biofuel production from JCL seeds.

Given the current price of energy (€0.13866/kWh/month), the energy consumption data given previously indicate that the approximate consumption cost is approximately €62.55 kWh/month.

- Seed Production. Finally, the criterion representing the evolution of seeds produced per unit area (tons/ha) corresponds to the values already discussed in Section 3. The quantity of seed produced varies depending on the type of water, land, and annual crop.

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