Aserpiado in a vineyard (Wolfgang Duifhuizen)

Aserpiado (Spain)

Aserpiado or Alumbrado

DESCRIPTION

Aserpias are micro-depressions within a field along all or alternate inter vines rows, made by a tillage tool. The main objective of implementing Aserpiado is to let water infiltrate on-site, thereby increasing soil moisture and plant available water, decreasing runoff and associated losses of soil.

Aserpiado (also known as Alumbrado) is applied in vineyards in Southern Spain in lower and mid altitudes where the climate is characterized by relative high rainfall during winter, but almost none in summer. This requires adoptions in the water management like irrigation or on-site storage of water.
With the aserpiado technique, seasonal soil bunds are made every autumn in order to limit irrigation requirements and to protect the soil against erosion. These contour bunds in the allies remain in place the entire winter to make best use of precipitation that occurs mostly during this period.

The functioning of Aserpias was analysed in a vineyard within the Appellation of Origin Montilla-Moriles in Córdoba, the only previously existing documentation on this measure comes from vineyards in the Jerez wine region. Farmers use Aserpiado because it is the only way to get enough water without irrigation, as when irrigation is applied it cannot get the protected ‘Jerez-Sherry’ label.

The microbasins are made in the inter-row area by dragging a caterpillar tractor pulled (see picture Aserpiadora) hydraulic beam over the field which lifts leaving a heap of soil behind. The speed and interval of the beam are set in such a way that a bund is made every 1.5 meter. Some users sow barely directly in advance of making the aserpiado which results in a high plant cover of the bunds during winter. The main function of Aserpiado is to catch rainwater which otherwise would be lost runoff. With Aserpiado the runoff is close to zero this means more water should become available for the crops.

The required inputs for creating and maintaining aserpias depends upon whether the bunds are permanent or seasonal. If permanent the ridges should be checked regulary and maintained by hand. When the aserpiado is only present during the winter season regular tillage in summer is necessary to keep the soil workable so the 'aserpiadora' (specialized tillage tool) can create the aserpias in autumn which are removed in spring to ease field traffic. With a modern-day Aserpiadora a farmer can create 3 to 5 ha of aserpias a day (Narvaez, 1980). The impacts of establishing aserpias are less soil erosion, less runoff and more water storage in the soil. Land users like Aserpiado as it is a very effective way to increase soil moisture and reduce soil erosion, when used in combination with cover crops the soil quality also improves over time.

LOCATION

Location: Finca Cañada Navarro, Montilla, Andalucia, Cordoba Province, Spain

No. of Technology sites analysed: single site

Geo-reference of selected sites
- -4.5573, 37.54113

Spread of the Technology: applied at specific points/ concentrated on a small area

In a permanently protected area?:

Date of implementation: less than 10 years ago (recently)

Type of introduction
- ✓ through land users' innovation
- ✓ as part of a traditional system (> 50 years)
- during experiments/ research
- through projects/ external interventions

Aserpias; the soil bunds prevent runoff (Wolfgang Duifhuizen)

Some aserpias were filled with water for infiltration tests. (Gema Guzmán)

CLASSIFICATION OF THE TECHNOLOGY

Main purpose

- [x] improve production
- [x] reduce, prevent, restore land degradation
- [ ] conserve ecosystem
- [x] protect a watershed/ downstream areas – in combination with other Technologies
- [ ] preserve/ improve biodiversity
- [ ] reduce risk of disasters
- [x] adapt to climate change/ extremes and its impacts
- [ ] mitigate climate change and its impacts
- [x] create beneficial economic impact
- [ ] create beneficial social impact

Land use

Cropland

- Annual cropping: cereals - barley
- Perennial (non-woody) cropping
- Tree and shrub cropping: grapes

Number of growing seasons per year: 1

Water supply

- [x] rainfed
- [ ] mixed rainfed-irrigated
- [ ] full irrigation

Purpose related to land degradation

- [x] prevent land degradation
- [x] reduce land degradation
- [ ] restore/ rehabilitate severely degraded land
- [ ] adapt to land degradation
- [ ] not applicable

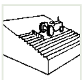
Degradation addressed

soil erosion by water - Wt: loss of topsoil/ surface erosion, Wg: gully erosion/ gullying

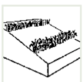
SLM group

- improved ground/ vegetation cover
- water harvesting
- irrigation management (incl. water supply, drainage)

SLM measures



agronomic measures - A1: Vegetation/ soil cover, A3: Soil surface treatment

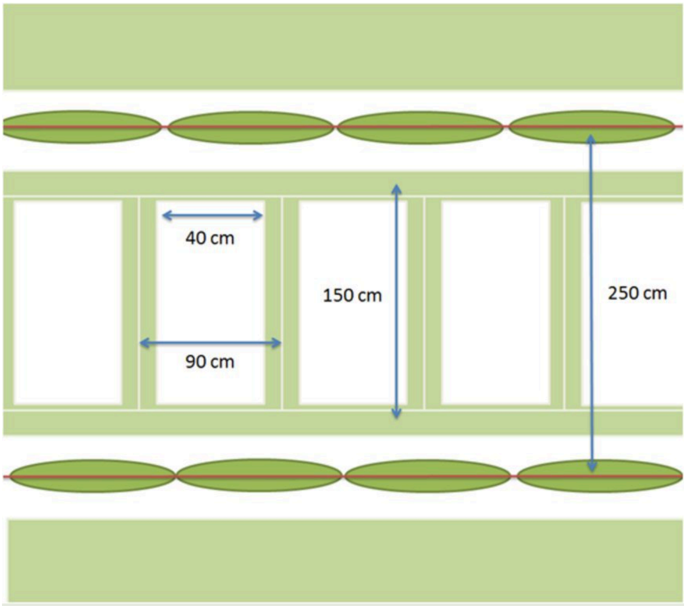


vegetative measures - V2: Grasses and perennial herbaceous plants

TECHNICAL DRAWING

Technical specifications

The bunds stretch over most of the inter-row alley, but in order not to expose superficial roots the bunds are 1.5 m wide so at each side there is about half a meter distance from the stems. Often the bunds are covered with barley and pruning residues. The bunds itself are 15 to 20 cm high and usually spaced 90 cm apart leaving 40 cm space at the base. At Cañada Navarro the Aserpia-bunds and sides are covered with barley as a cover crop during winter, in other sites where Aserpiado is applied the bunds remain bare.



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ESTABLISHMENT AND MAINTENANCE: ACTIVITIES, INPUTS AND COSTS

Calculation of inputs and costs

- Costs are calculated: per Technology area (size and area unit: **22 hectares**)
- Currency used for cost calculation: **Euros**
- Exchange rate (to USD): 1 USD = 0.94 Euros
- Average wage cost of hired labour per day: n.a

Most important factors affecting the costs

The cost of Aserpiado and sown tasks compared to conventional farming.

Establishment activities

1. (Timing/ frequency: None)
2. (Timing/ frequency: None)

Maintenance activities

1. Tillage with cultivator (15-20 cm deep) (Timing/ frequency: After harvest crop)
2. Sowing barley in allies (Timing/ frequency: Autumn)
3. Making aserpias in every other alley (Timing/ frequency: Soon after sowing barley)
4. Killing cover crop (Timing/ frequency: Early in march)
5. Tillage with cultivator (removing aserpias) (Timing/ frequency: After killing the cover crop)

Maintenance inputs and costs (per 22 hectares)

Specify input	Unit	Quantity	Costs per Unit (Euros)	Total costs per input (Euros)	% of costs borne by land users
Labour					
Tractor driver	h/ha	5.5	40.0	220.0	96.0
Equipment					
Scarifier	h/ha	1.5	40.0	60.0	100.0
Seeder	h/ha	2.25	40.0	90.0	100.0
Aserpiadora	h/ha	1.5	40.0	60.0	100.0
Cultivator	h/ha	1.5	40.0	60.0	100.0
Plant material					
Barley seed	kg/ha	80.0	0.2	16.0	
Fertilizers and biocides					
Herbicide**	l/ha	3.0	6.67	20.01	
Total costs for maintenance of the Technology				**526.01**	
Total costs for maintenance of the Technology in USD				*559.59*	

NATURAL ENVIRONMENT

Average annual rainfall
- [ ] < 250 mm
- [x] 251-500 mm
- [x] 501-750 mm
- [ ] 751-1,000 mm
- [ ] 1,001-1,500 mm
- [ ] 1,501-2,000 mm
- [ ] 2,001-3,000 mm
- [ ] 3,001-4,000 mm
- [ ] > 4,000 mm

Agro-climatic zone
- [ ] humid
- [ ] sub-humid
- [x] semi-arid
- [ ] arid

Specifications on climate
Average annual rainfall in mm: 600.0
High annual variability and erratic rainfall patterns, historical precipitation records show an annual variation between 300 and 1200 mm.
Name of the meteorological station: Santaella IFAPA station
The Montilla region characterized by hot and dry summers, chilly winters and very few days of rainfall.

Slope
- [ ] flat (0-2%)
- [ ] gentle (3-5%)
- [ ] moderate (6-10%)
- [ ] rolling (11-15%)
- [x] hilly (16-30%)
- [ ] steep (31-60%)
- [ ] very steep (>60%)

Landforms
- [ ] plateau/plains
- [ ] ridges
- [ ] mountain slopes
- [x] hill slopes
- [ ] footslopes
- [ ] valley floors

Altitude
- [ ] 0-100 m a.s.l.
- [x] 101-500 m a.s.l.
- [ ] 501-1,000 m a.s.l.
- [ ] 1,001-1,500 m a.s.l.
- [ ] 1,501-2,000 m a.s.l.
- [ ] 2,001-2,500 m a.s.l.
- [ ] 2,501-3,000 m a.s.l.
- [ ] 3,001-4,000 m a.s.l.
- [ ] > 4,000 m a.s.l.

Technology is applied in
- [ ] convex situations
- [ ] concave situations
- [x] not relevant

Soil depth
- [ ] very shallow (0-20 cm)
- [ ] shallow (21-50 cm)
- [x] moderately deep (51-80 cm)
- [ ] deep (81-120 cm)
- [ ] very deep (> 120 cm)

Soil texture (topsoil)
- [ ] coarse/ light (sandy)
- [x] medium (loamy, silty)
- [ ] fine/ heavy (clay)

Soil texture (> 20 cm below surface)
- [ ] coarse/ light (sandy)
- [x] medium (loamy, silty)
- [ ] fine/ heavy (clay)

Topsoil organic matter content
- [ ] high (>3%)
- [x] medium (1-3%)
- [ ] low (<1%)

Groundwater table
- [ ] on surface
- [ ] < 5 m
- [x] 5-50 m
- [ ] > 50 m

Availability of surface water
- [ ] excess
- [ ] good
- [x] medium
- [ ] poor/ none

Water quality (untreated)
- [ ] good drinking water
- [ ] poor drinking water (treatment required)
- [ ] for agricultural use only (irrigation)
- [ ] unusable

Water quality refers to:

Is salinity a problem?
- [ ] Yes
- [x] No

Occurrence of flooding
- [ ] Yes
- [x] No

Species diversity
- [ ] high
- [x] medium
- [ ] low

Habitat diversity
- [ ] high
- [x] medium
- [ ] low

CHARACTERISTICS OF LAND USERS APPLYING THE TECHNOLOGY

Market orientation
- [ ] subsistence (self-supply)
- [ ] mixed (subsistence/ commercial)
- [x] commercial/ market

Off-farm income
- [ ] less than 10% of all income
- [ ] 10-50% of all income
- [ ] > 50% of all income

Relative level of wealth
- [ ] very poor
- [ ] poor
- [x] average
- [ ] rich
- [ ] very rich

Level of mechanization
- [ ] manual work
- [ ] animal traction
- [x] mechanized/ motorized

Sedentary or nomadic
- [x] Sedentary
- [ ] Semi-nomadic
- [ ] Nomadic

Individuals or groups
- [x] individual/ household
- [ ] groups/ community
- [x] cooperative
- [ ] employee (company, government)

Gender
- [ ] women
- [ ] men

Age
- [ ] children
- [ ] youth
- [ ] middle-aged
- [ ] elderly

Area used per household
- [ ] < 0.5 ha
- [ ] 0.5-1 ha
- [ ] 1-2 ha
- [ ] 2-5 ha
- [ ] 5-15 ha
- [ ] 15-50 ha
- [ ] 50-100 ha
- [x] 100-500 ha
- [ ] 500-1,000 ha
- [ ] 1,000-10,000 ha
- [ ] > 10,000 ha

Scale
- [ ] small-scale
- [ ] medium-scale
- [x] large-scale

Land ownership
- [ ] state
- [x] company
- [ ] communal/ village
- [ ] group
- [ ] individual, not titled
- [x] individual, titled

Land use rights
- [ ] open access (unorganized)
- [ ] communal (organized)
- [ ] leased
- [x] individual

Water use rights
- [ ] open access (unorganized)
- [ ] communal (organized)
- [ ] leased
- [ ] individual

Access to services and infrastructure

	poor				good
health	poor			✓	good
education	poor			✓	good
technical assistance	poor			✓	good
employment (e.g. off-farm)	poor		✓		good
markets	poor				good

		☐☐☑	
energy	poor	☐☐☑	good
roads and transport	poor	☐☐☑	good
drinking water and sanitation	poor	☐☐☑	good
financial services	poor	☐☑☐	good

IMPACTS

Socio-economic impacts

demand for irrigation water	increased	☐☐☐☐☐☑☐	decreased	

Socio-cultural impacts

Ecological impacts

harvesting/ collection of water (runoff, dew, snow, etc)	reduced	☐☐☐☐☐☐☑	improved	
surface runoff	increased	☐☐☐☐☐☐☑	decreased	
groundwater table/ aquifer	lowered	☐☐☐☐☑☐☐	recharge	Water balance modelling on aserpiado fields indicate a high percolation rate
soil moisture	decreased	☐☐☐☐☑☐☐	increased	
soil loss	increased	☐☐☐☐☐☐☑	decreased	

Off-site impacts

COST-BENEFIT ANALYSIS

Benefits compared with establishment costs

Short-term returns	very negative	☐☐☐☐☐☐☑	very positive
Long-term returns	very negative	☐☐☐☐☐☐☑	very positive

Benefits compared with maintenance costs

Short-term returns	very negative	☐☐☐☑☐☐☐	very positive
Long-term returns	very negative	☐☐☐☑☐☐☐	very positive

CLIMATE CHANGE

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ADOPTION AND ADAPTATION

Percentage of land users in the area who have adopted the Technology

- ☑ single cases/ experimental
- ☐ 1-10%
- ☐ 11-50%
- ☐ > 50%

Of all those who have adopted the Technology, how many have done so without receiving material incentives?

- ☐ 0-10%
- ☐ 11-50%
- ☐ 51-90%
- ☑ 91-100%

Number of households and/ or area covered

120 ha (in Montilla-Moriles region)

Has the Technology been modified recently to adapt to changing conditions?

- ☐ Yes
- ☑ No

To which changing conditions?

- ☐ climatic change/ extremes
- ☐ changing markets
- ☐ labour availability (e.g. due to migration)

CONCLUSIONS AND LESSONS LEARNT

Strengths: land user's view

- 1. Storage of water from winter rainfalls.
  2. Control of soil erosion.
  3. Benefits associated to the cover crops.

Strengths: compiler’s or other key resource person’s view

- Control of erosion
  Increasing infiltration

Weaknesses/ disadvantages/ risks: land user's viewhow to overcome

- No significant disadvantages or higher cost have been noticed compared to a cover crop farm.

Weaknesses/ disadvantages/ risks: compiler’s or other key resource person’s viewhow to overcome

- If the aserpiado fails, concentration of runoff in rills will easily occur. To make aserpiado large enough to not be overtopped by regular rainstorms, also bunds need to be checked for stability.

REFERENCES

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Full description in the WOCAT database
https://qcat.wocat.net/en/wocat/technologies/view/technologies_907/

Linked SLM data
n.a.

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Project
- n.a.

Links to relevant information which is available online
- El Alumbrado para acumalacion del agua en cultivos leñosos de secano, Revilla Narvaez (in Spanish): http://www.mapama.gob.es/ministerio/pags/biblioteca/hojas/hd_1980_19.pdf
- APROVECHAMIENTO DE LAS LLUVIAS EN VIÑEDOS SITUADOS EN LADERAS Y PENDIENTES MEDIANTE “ASERPIADO”, José Mª González Moreno, 2011: None
- Los viticultores del Marco de Jerez apuestan por la Producción Integrada: http://www.mapama.gob.es/ministerio/pags/biblioteca/revistas/pdf_vrural/Vrural_1999_87_54_55.pdf