Olive and wild asparagus agroforestry system: asparagus performance and its best positioning in the olive orchard

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Why growing wild asparagus under olives?
Additional crop, additional income (Agroforestry!)

New crop, but existing market

Interesting price (10-30 €/kg)

Recently studied

Grows naturally under olives
Traditional orchard

Asparagus planted only along the tree rows
Super High Density or Hedgerow System

Asparagus planted only along the tree rows
Open Field Control

Asparagus planted in rows corresponding to tree rows
Objectives

What is the light availability at different distance from the tree rows?

What is the best positioning of the asparagus plant? (modelling approach)

Precision agroforestry
Methods

Minute by minute light at different distance from the tree rows
Photosensor (Diode)
Light (PAR) measured every minute in every position (0.5 m increments) from March to September.
Daily pattern of incident radiation above the canopy and at different positions under the canopy.

- Above canopy
- Below canopy between rows
- Hedgerow system
Daily pattern of incident radiation above the canopy and at different positions under the canopy.
Daily pattern of incident radiation above the canopy and at different positions under the canopy.

Above canopy

Below canopy along rows

Hedgerow system
Daily pattern of incident radiation above the canopy and at different positions under the canopy.

- Above canopy
- Below canopy
- EAST of row
- Hedgerow system
Daily pattern of incident radiation above the canopy and at different positions under the canopy

Above canopy

Hedgerow system

Below canopy

WEST of row
Traditional system

Above canopy

Below canopy between rows
Daily pattern of incident radiation above the canopy and at different positions under the canopy.

Above canopy

Below canopy between rows

Traditional system
Daily pattern of incident radiation above the canopy and at different positions under the canopy.
Daily pattern of incident radiation above the canopy and at different positions under the canopy.
For each position light was integrated over the day, and the season (March to September)
Total PAR March-September (%)
Converting light into photosynthesis

Above canopy

Hedgerow system

Below canopy along rows

Day Time (Minutes from Dawn)
Carboxylation
Photosynthesis

$\text{CO}_2$

Light

Leaf Photosynthesis

Light (PAR)
Converted minute-by-minute light into photosynthesis integrated photosynthesis over the season
Relative to a plant in full sun (control)
Light (Photosynthesis)

Total CO₂ Assimilation and PAR (%)

Greater RUE
Traditional Olive System

Total CO₂ Assimilation and PAR (%)
The photosynthesis at the different positions was converted into grams of plant matter and compared to the actual plant biomass (for the positions where actual asparagus plants were placed)
Asparagus in open field Control

Traditional System (asparagus below tree)

Hedgerow System (asparagus below tree)
Traditional System (asparagus below tree)

Asparagus in open field Control

Hedgerow System (asparagus below tree)

$y = 2.8147x$

$R^2 = 0.9088$
Asparagus in open field Control

Traditional System (asparagus below tree)

Hedgerow System (asparagus below tree)
Asparagus in open field Control

60-68% of Control

Traditional System (asparagus below tree)

Hedgerow System (asparagus below tree)

Estimated Biomass increment per plant (g DW)

Measured Biomass increment per plant (g DW)

\[ y = 2.8147x \]

\[ R^2 = 0.9088 \]
Asparagus in open field Control

60-68% of Control

Traditional System (asparagus below tree)

48-78% of Control

Hedgerow System (asparagus below tree)
Conclusions
Traditional orchard

Light varied little with distance from row (35-44%)

Biomass (yield) varied from 60 to 68% of control
Hedgerow orchard

Light varied 3-fold with distance from row (22-60%)

Biomass (yield) varied from 48 to 78% of control

Placing the asparagus in the right position, matters!!!
We have data on spear quantity and quality under different light conditions, but...

Next time!
Placing the crop in the right position, matters!!!

Thanks