Crop selection in Agri-PV: international review based strategic decision-making model

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Selecting crops to grow with solar panels in an agrivoltaic system could involve considering factors such as:

- Shading – could be beneficial (e.g. reducing evapotranspiration) may reduce yields
- Shelter – from e.g. wind, rain or frost could reduce crop damage
- Soil moisture – research has demonstrated that soil moisture can be higher under solar panels in agrivoltaic systems due to lower evapotranspiration from crops
- Technology – for example combining agrivoltaic and irrigation systems
- Economic – if shading to crops is increased by agrivoltaic systems, could more shade tolerant crops with higher value / economic potential be grown?

Research on the impact of agrivoltaics on a range of crops has been undertaken globally, and this was brought together in a review article (Mehta and Zörner, 2025) which aimed to develop a model to support decision making in selecting crops to grow in agrivoltaic systems.

The model focuses on four key elements related to crops:

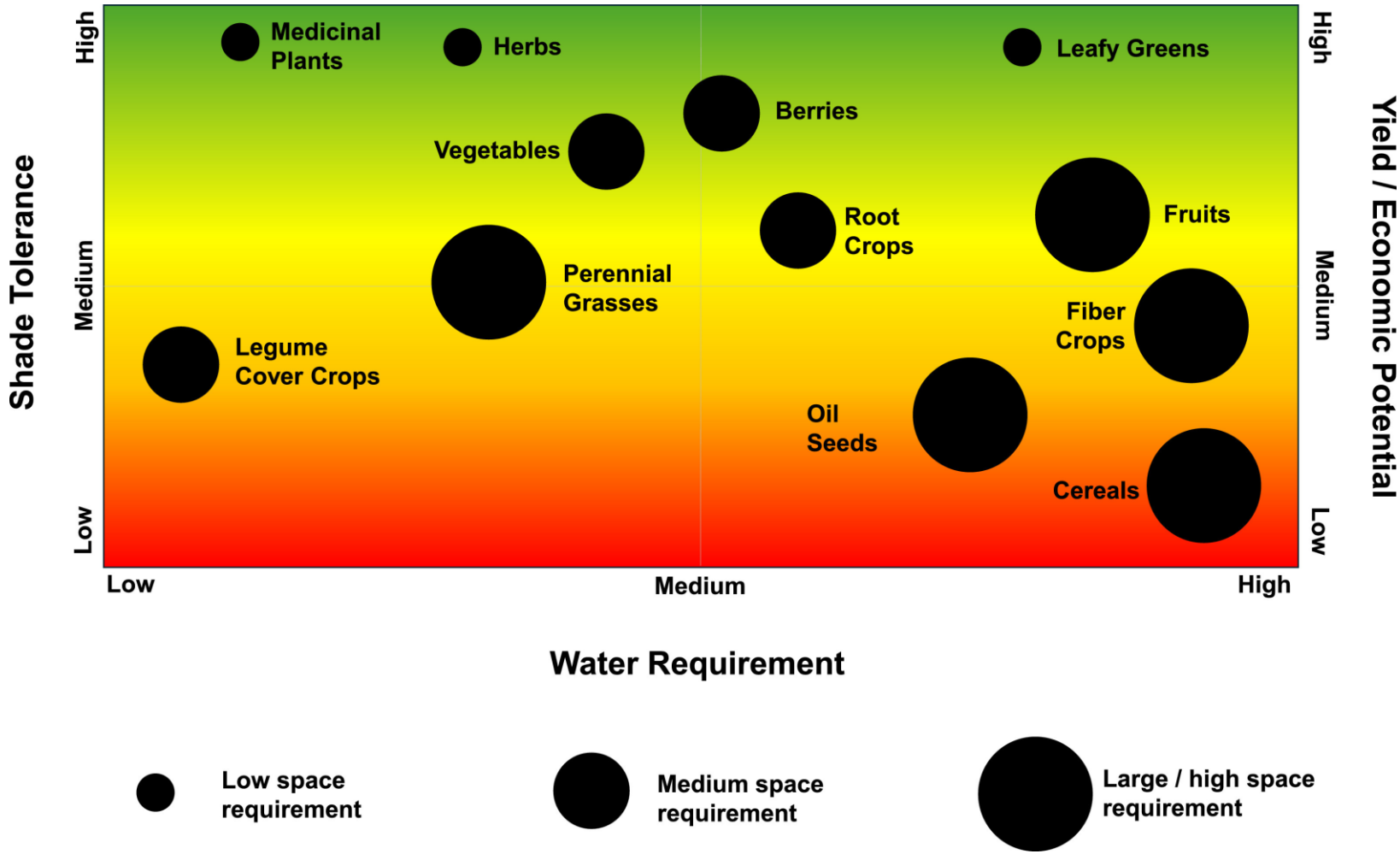
- Water use
- Shading adaptability
- Crop yields and economic potential
- Space requirements

They also explored how crop selection had to take account of both regional climate conditions and the design of the agrivoltaic system. For example, a high value crop that needed less space could fit well with a small-scale agrivoltaic system.

The matrix and associated table are shown below and could support you in thinking about what crops might both grow well in an agrivoltaic system on your farm and benefit your farm business.

Reference (open access and free to read):

Kedar Mehta, Wilfried Zörner (2025) Crop selection in Agri-PV: international review based strategic decision-making model, Solar Compass, Volume 16, *https://doi.org/10.1016/j.solcom.2025.100143*.



How to interpret this matrix

Axes show you crop Shade Tolerance (left side), Yield / Economic Potential (right side) and Water Needs (base), the size of the spot on the matrix represents the crop space needs:

- Leafy green crops have high shade tolerance, high water requirement, high yield/ economic potential and low space requirement.
- Perennial grasses have medium shade tolerance, medium-low water requirement, medium yield / economic potential and medium space requirement.

Mehta and Zorner (2025) also present the data they gathered in the form of a table, with information about where studies took place and highlighting the average changes in crop yields. An adapted version of the table is shown below, with this table you need to consider:

- The agrivoltaic systems and configurations may be different in the different studies included, for example one may use static panels, another tracking, this could impact on yields
- The locations given are country specific, however, climate conditions (e.g. rainfall, sunlight, temperatures) can vary substantially across a region and country
- Different crop varieties may respond slightly differently to the agrivoltaic systems and the changes they cause
- This is a "snapshot" of current research into the impact of agrivoltaics on crop yields

Crop type	Crop	Location	Space needs	Adaptability to Shading	Water needs	Effect on yield	Average yield change
Cereals	**Rice**	Japan South Korea Vietnam Bangladesh China	High	Low	High	↓	- 10 %
	Wheat	Belgium France China USA Italy	High	Low	High	↓	- 25 %
	Maize	USA Japan Ethiopia	High	Low	Medium- High	↓	- 22 %

	Barley	Sweden Uzbekistan	High	Low	High	=	+ / - 10 %
	Durum wheat	Italy	High	Low	High	↓	- 30 %
Root crops 	**Sugar beet**	Belgium Russia Turkey	Medium	Medium	Medium	=	NA
	Radishes	Peru	Medium	Medium	Medium	=	NA
	Potato	Germany UK	Medium	Medium	Medium	=	+ / - 20 %
Fibre crops 	**Cotton**	Uzbekistan China	High	Low	High	=	+ / - 10 %
Fruits 	**Kiwi**	China South Africa	High	Low	High	↑	+ 20 %
	Grape	South Korea India France	High	Medium	High	=	+ / - 25 %
	Pear	Belgium	High	Low	High	↓	- 15 %

	Apple	USA Italy France	High	Low	High	=	+ / - 10 %
	Peppers	USA	Medium	Medium	High	↑	+20 %
Berries 	**Black berries**	USA Chile	Medium	Medium	High	=	+ / - 25 %
	Goji berries	China	Medium	Medium	High	↑	+ 20 %
	Blue berries, Raspberries	Germany Netherlands Switzerland	Medium	Medium	High	↑	N/A
	Strawberries	China	Medium	Medium	High	↑	+ / - 10 %
Vegetables 	**Tomatoes**	USA Italy UK India	Medium	Medium	High	=	+ / - 20 %
	Cherry tomato	USA	Medium	Medium	High	↑	+ 90 %
	Broccoli	South Korea	Medium - High	Medium	High	↑	N/A

Leafy Greens 	**Lettuce**	USA Chile France	Low	High	Medium	‖	+ / - 10 %
	Escarole / Spinach	Italy Tanzania	Low	High	Medium	↑	+ / - 10 %
Herbs 	**Basil**	N/A	Low	High	Medium	↑	+ 2.5 %
	Mint	N/A	Low	High	Medium	↑	N/A
Perennial Grasses 	**Clover Grass**	Germany USA	Medium	Low	High	‖	+ / - 10 %
Oil seeds 	**Sunflower**	Argentina	High	Medium	Low	‖	NA
	Oleiferous	Argentina	High	Medium	Low	‖	NA

Medicinal Plants 	**Turmeric**	India	Low-Medium	High	Medium	↑	NA
	Ginger	China	Low-Medium	High	Medium	↑	+ 20 %
Legume Cover Crops 	**Alfalfa**	New Zealand	Medium	Medium	Medium	↓	−20 %

This document is part of the Value4Farm Decision Support Tool (DST) aimed at farmers and their advisors to explore whether there is potential to integrate food and energy on their farm, particularly through agrivoltaics and biogas. Find out more at *https://value4farm.eu/decision-support-platform/*

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