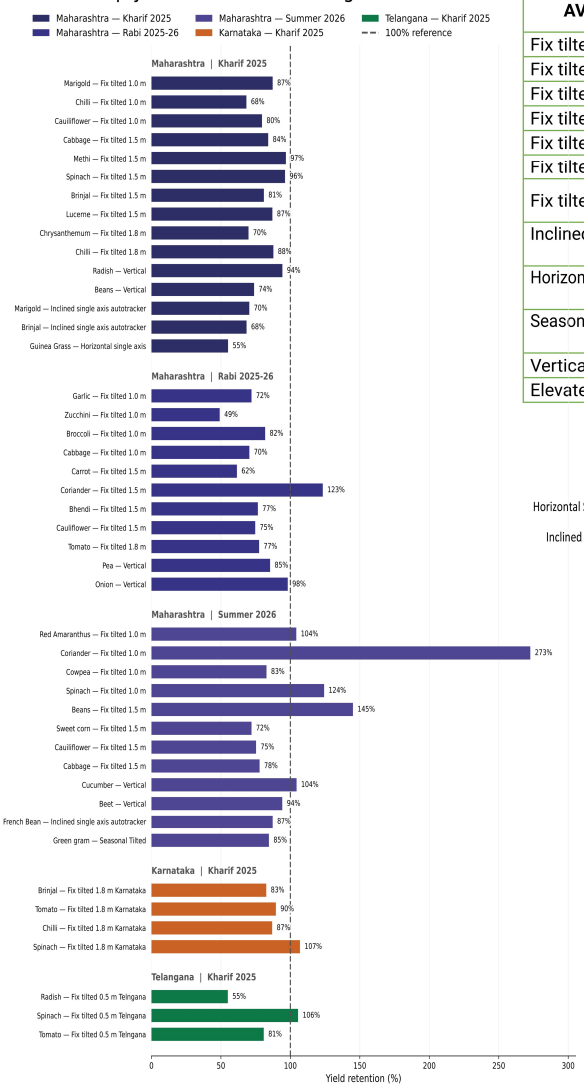
Performance of Crops and Energy Generation in Multimodel Agrivoltaics in Three States of India

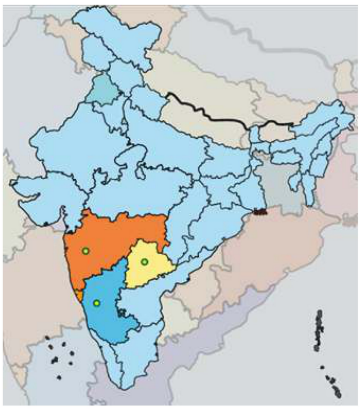
Abstract

India faces growing challenges in food security due to climate change and population growth, while targeting net-zero emissions by 2070. **Agrivoltaics (AV)** integrates solar energy generation with agricultural production, enabling simultaneous food and clean energy production. BAIF established **17 AV models with 13 unique structural designs** across Maharashtra, Karnataka, and Telangana, with a total capacity of 1,233 kW. Thirty crops were evaluated under different shading conditions. Results showed 82–89% crop productivity compared with control, 81% to 92% performance ratio for energy generation, and **1.64–1.71 overall land productivity,** depending on crop, shading, and system design.

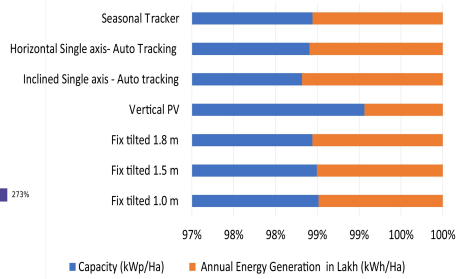
Crop yield retention under agrivoltaics



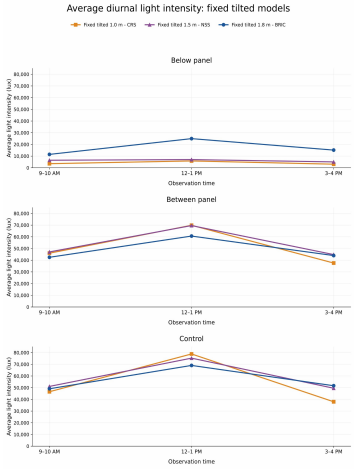
AV - Models	Capacity (kWp)	Pitch (m)	Location
Fix tilted 1.0 m	200	8.5	Pune, Maharashtra
Fix tilted 1.5 m	300	8.5	
Fix tilted 1.8 m	40	9.5	
Fix tilted 1.5 m	90	9.5 -10.5	Tumkuru, Karnatka
Fix tilted 2.0 m	46	8.5-11.5	
Fix tilted 4.0 m	37	5.0-7.0	
Fix tilted 1.0 m	250	9.5	Karimnagar, Telangana
Inclined tracker 1.0 m	65	9.5	Pune, Maharashtra
Horizontal tracker 1.0 m	26	9.5	
Seasonal tracker 1.0 m	65	9.5	
Vertical model	20	4.0	
Elevated Flat 3.5 m	24	4.0	



Model Capacity and Power Generation



Average diurnal light intensity: fixed tilted models



Crop Yield Performance under Agrivoltaics

Yield Retention (%)	Performance Category	Crops
≥ 100%	Equal or Higher Yield	Summer coriander, spinach, beans, cucumber; Rabi coriander
80–99%	High Yield Retention	Kharif methi, spinach, brinjal, lucerne, tomato, chilli
60–79%	Moderate Yield Retention	Kharif chilli, cauliflower; Rabi garlic, cabbage, cauliflower; summer cabbage, cauliflower
Below 60%	Low Yield Retention	Kharif radish, Rabi zucchini

Crop Yield Performance under Agrivoltaics









Key Outcomes :

- Crop yield retention under agrivoltaics varies by states and seasons ranging from 79% to 92% in Kharif and Rabi seasons, peaking at 110% in Summer.
- Selected crops like Coriander, Beans and Spinach achieved excellent yield gains.
- Observed average LER of 1.60 in fix tilted model
- Fixed-tilt model at 1.5 m height showed the highest annual energy generation (11.46 lakh kWh/ha), closely followed by seasonal tracking (11.42 lakh kWh/ha).
- Fixed-tilt and seasonal tracking designs appear promising for balancing solar energy generation with agricultural production.

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