

observed in paprika pepper, where fruit number and dry fruit weight per plant declined as population increased, while yield per hectare rose because fruit number per unit area increased. This confirms that density-driven yield formation depends less on maximizing the performance of each plant than on increasing the number of productive units occupying a given area.

Experimental framework: Planting density gradient of sweet pepper (*Capsicum annuum* L.) across production systems

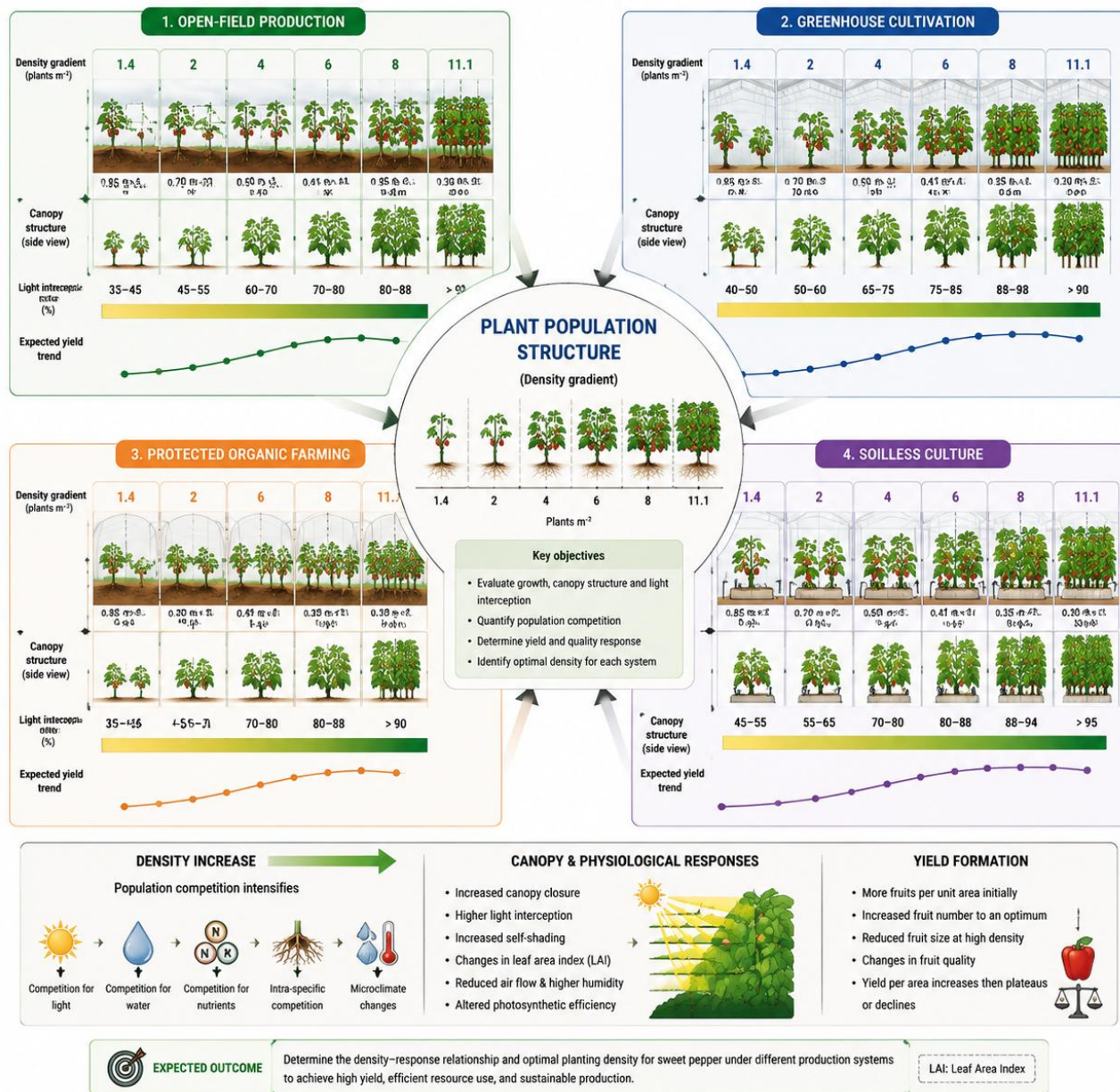


Figure 2 Conceptual framework of pepper density experiments across different production systems

Not all responses are linear, and several case studies identify clear biological limits to crowding. In chili pepper, raising density from 20,000 to 30,000 plants/ha increased total fruit yield by 52.58%, but increasing to 40,000 plants ha⁻¹ caused yield to decline by 34.09%, showing that excessive competition can reverse the yield advantage of denser planting (Setiawati et al., 2022). Greenhouse bell pepper supports the same interpretation at the reproductive level: marketable yield increased linearly with density, but fruit set per plant decreased linearly as density increased, indicating that total yield gains arise from stand-level compensation rather than improved reproductive success of individual plants.