

## Competition and facilitation processes between sweet pepper (SP) and associated crops in additive intercropping system

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### Introduction

French organic vegetable farms - O Crops divers O High-yields



Additive row intercropping: promising practice to reach these purposes by introducing a secondary crop into a main crop without drastically modifying other practice.

→ References needs on design / performances / processes to design efficient intercropping systems and optimize their management

# Which compromises between competition and facilitation for resources in these systems ?

 Objectives:
 (i) investigate the effect of intercropping sweet

 pepper (SP) with different secondary crops on yields and growth of SP
 (ii) reveal competition and facilitation processes at

 work with regards to soil resources and organisms
 (iii) reveal compatibility

### **Materials & Methods**

• INRAE experimental station, south of France (Alenya - 2021)

Randomized complete block design (3 blocks; each one in a tunnel)

• Organic farming

SP in sole crop (control)
 SP + French bean

• 4 treatments • SP + onion



Similar conditions: SP density (1,5 plant. m<sup>-2</sup>), amounts of water, organic fertilizers and pesticides, pruning & trellising methods

Month	January	February	Marc	h	April		Мау			June	July			August			September			
Week number	1 2 3 4	5 6 7 8	9 10 11	12 13	14 15 16 17	1	8 19 20 21	22	23	24 25 26	27	28 29	30	31	32 3	3 34	4 35	36	37	38 39
LEGEND					Sweet pepp	er		н	н	н	н	н	н	н	ΗH	н	н	н	н	нн
Nursery					French bear	n	ннн	н												
Tunnel					Onion					н	н	нн								
H Harvest(s)					Parsley H		н			Н				н				н		н
Figure 1. Crop calendar.																				

#### Measurements & observations:

- Marketable yields (SP + secondary crops )
- o SP stem diameter at full growth
- o Colonization by arbuscular mycorrhizal fungi (AMF) and necrosis in SP roots at uprooting
- o Monitoring nitrate concentration and water tension in soil

#### Results

- The three secondary crops produced consistent marketable yield with low waste rates.
- Intercropping : SP stem diameter >> 7 to 12% & marketable yield of SP >> 21 to 28%.
- Intercropping with onion and parsley rolonization by AMF & arbuscules abundance than in sole crop.



→ FACILITATION ?

• Root of SP were highly impacted by necrosis (*Pyrenochaeta lycopersici*) independently of the treatment.

Table 1. production of secondary crops and sweet pepper yield, growth, AMF colonization in roots and root necrosis index.

	Secondary crop	Sweet	pepper												
	Marketable	Waste	Marketable		St	F		N	1	A		Root			
Treatments	yield (kg.m <sup>-2</sup> )	rate (%)	yield (l	kg.m⁻²)	diameter (mm)		(%)		(%)		(%)		Necrosis index		
French bean	0,95	1	3.23	А	18.7	а	100	а	22.1	ab	10.9	ab	2.9	а	
Onion	2,25	10	3.47	А	19.1	а	100	а	32.3	b	18.7	b	3.1	а	
Parsley	2,26	12	3.54	А	18.2	а	100	а	26.6	b	13.9	b	2.9	а	
Sole crop	-	-	4.49	b	20.6	b	91.7	а	5.8	а	2.5	а	3.3	а	

Values are the means of three replicates and different letters indicate significant differences for the Tukey HSD test ( $P \le 0.05$ ).

F%: Frequency of AMF in root system, M%: AMF colonization rates in root system, A%: Arbuscule abundance in root system.

Root necrosis index is related to the proportion of the root surface affected by necrosis (0: 0 %; 1: 1-10 %; 2: 11-20 %; etc. 10: 91-100 %).

 Soil water tension in the French bean and onion treatment was significantly higher than in sole crop at different periods = higher consumption of water putting SP under water stress condition for SP (>35kPa)

**Higher N uptake** during the 22 first days **in intercropping treatments than in the sol crop** 

WATER = Limiting resource at specific periods

- → N = Not limiting resource
- ➔ Specific N requirement of secondary crops just after planting







#### Figure 3. Soil nitrate concentration over time.



Sole cro