



Relay-cropping of soybean cultivars into wheat for ecological intensification of agriculture

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Background & Aims

As an example of ecological intensification, **relay-cropping (RC)** allows to harvest two crops within the same year thereby increasing land use efficiency (Lamichhane *et al.*, 2023). Compared to sequential double cropping, sowing **soybean (SB)** into standing **wheat (W)** allows for earlier SB establishment in the growing season thus escaping summer drought (Wallace *et al.*, 1992 ; Duncan *et al.*, 1997). The purpose of this study was to compare the response of a range of commercial SB cultivars in RC to identify and propose the ideotype of a soybean variety adapted for W-SB relay cropping.

Materials & Methods

Auzeville, SW France (43.53°N, 1.48°E)

21 soybean cultivars (MGs 000 to II) – 3 replicates

9	8	7	6	5	4	3	2	1	Y
RGT SIGMA	RGT SPHINXA	RGT SULTANA	RGT SIGMA	RGT SPHINXA	RGT SULTANA	RGT SIGMA	RGT SPHINXA	RGT SULTANA	7
RGT SANTANA	RGT SYMBALA	ES INVENTOR	RGT SANTANA	RGT SYMBALA	ES INVENTOR	RGT SANTANA	RGT SYMBALA	ES INVENTOR	6
RGT SAKUSA	RGT STUMPA	ES MENTOR	RGT SAKUSA	RGT STUMPA	ES MENTOR	RGT SAKUSA	RGT STUMPA	ES MENTOR	5
ANGELICA	RGT SPEEDA	RGT STABELLA	ANGELICA	RGT SPEEDA	RGT STABELLA	ANGELICA	RGT SPEEDA	RGT STABELLA	4
ANGELICA	RGT SPEEDA	RGT STABELLA	ANGELICA	RGT SPEEDA	RGT STABELLA	ANGELICA	RGT SPEEDA	RGT STABELLA	3
ES TRIBOR	WENDY PZO	RGT SINEMA	ES TRIBOR	WENDY PZO	RGT SINEMA	ES TRIBOR	WENDY PZO	RGT SINEMA	2
RGT SINFONIA	RGT STOCATA	RGT STRAVIATA	RGT SINFONIA	RGT STOCATA	RGT STRAVIATA	RGT SINFONIA	RGT STOCATA	RGT STRAVIATA	1
ES MEDIATOR	ES ISIDOR	ES PALLADOR	ES MEDIATOR	ES ISIDOR	ES PALLADOR	ES MEDIATOR	ES ISIDOR	ES PALLADOR	0

Number of rows 1SB: 2 WW (17 cm between rows)
+ 4 SB varieties grown as sole crops (reference)

SB sowing
into W
06/05/21Winter W
harvest
06/07/21

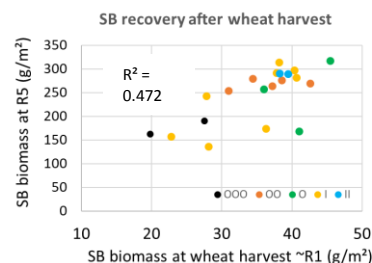
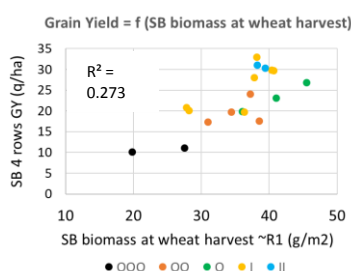
- SB biomass at R1 (W harvest), R5 and R8 stages
- Plant area index (PAI) measured with a LICOR 2000 from R3 to R5
- FCOVER (fraction of green vegetation cover) determined with a Phenomobile from R3 to R5 (visible spectrum)



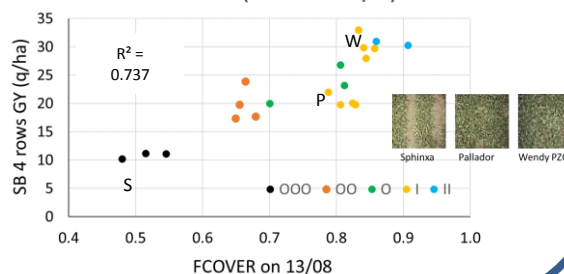
SB harvest : 29/09/21 (00-000) - 12/10/21 (0 to II)

Results

- Relay-cropping decreased biomass at R1 (-84 %) and R5 (-63 %), leaf area index at R1 (-74 %) and R5 (-49 %) and grain yield at R8 (-55 %).
- Grain yield of SB in RC ranged from 1.1 t/ha (MG 000) to 3.1 t/ha (MG II), consistently with the SB biomass at wheat harvest and R5.
- The best adapted cultivars to RC exhibited a faster recovery capacity, resulting in a higher shoot biomass and leaf area index at the end of vegetative growth.



Grain Yield = f(FCOVER on 13/08)



PAI 3.1	PAI 3.4	PAI 3.7	PAI 3.8	PAI 4.0
RGT SPHINXA (000)	RGT STUMPA (00)	ES TRIBOR (0)	RGT STOCATA (I)	WENDY PZO (II)
GY 10.2 q/ha	17.7 q/ha	26.8 q/ha	29.9 q/ha	33.0 q/ha
Height 26 cm	35 cm	56 cm	57 cm	61 cm

Conclusion

- In SW France, late-maturing groups (0, I, II) are better adapted to relay-cropping (as in conventional sole crop)
- Relatively less time in competition with the cereal and higher recovery capacity
- Longer cycle duration (an advantage with irrigation)
- Pronounced indeterminate growth with larger canopy cover and higher radiation interception
- Higher competitiveness with weeds

Centre
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References

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Lamichhane JR *et al.*, 2023. *Field Crops Res.* **291**: 108795
Wallace SU *et al.*, 1992. *Agron. J.* **84**: 968



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