HERBICIDE-FREE SYSTEMS BASED ON UNDER-THE-ROW GRASS COVER IN FRENCH VINEYARDS

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Abstract:

Context and purpose of the study - In a context of reducing herbicide use, the most part of French vineyards are developing permanent grass cover crops on inter-rows alleys, while under the row chemical weeding remains the general case. The setting up of a controlled grass cover crop under the vine row could be a complementary alternative to mechanical weeding – which one is very restrictive – interesting from a technical and economical point of view. The present study aimed at assessing agronomic impacts of grass cover crop under the row in different climatic conditions and production objectives.

Material and methods - Two soil management treatments – under-the-row grass cover and chemical weeding, i.e. bare soil – were compared on two experimental plots in South-west and Mediterranean regions of France. Maximum percentage of grass cover per plot was 100% on South-west site and 30% on Mediterranean site. Experiments were implemented since 2007 on Malbec grape variety within AOP Cahors and since 2010 on Syrah within IGP Vin de Pays d'Oc. Each treatment was replicated three times in a complete randomized block design. Experimental monitoring was carried out over the medium to long term (six to nine years). Data were annually collected on grapevine production – yield, vigour – and water and nitrogen status (water potentials dynamics, leaf chlorophyll index, must assimilable nitrogen).

Results -On Mediterranean site, introduction of under-the-row grass cover has not resulted in a significant decrease in yield or vigour. On South-west site, yield was reduced for this treatment in comparison to bare soil most of the years of monitoring, with variation according to climate. AOP production objective was nevertheless achieved for more than 50% of the vintages studied. Regarding vigour, over the first four years of study, an increasing rise of the relative difference between under-the-row grass cover treatment and bare soil was registered, until it reaches -45%. Proportion of grass coverage per plot seems to be a more important factor than climatic context to explain the impact of under-the-row grass cover on the vine. Monitoring of water and nitrogen status indicators highlighted that competition from under-the-row grass cover focuses on nitrogen rather than water. In South-west region, foliar nitrogen fertilisation was applied after four years of grass cover under the row. A strong reduction of the relative difference between under-the-row grass cover treatment and bare soil was then observed in terms of vigour and leaf nitrogen. The setting up of a grass cover under the row of vines appeared to be a viticultural practice compatible with different sets of constraints and objectives pertaining to the adaptation of production system such as management of the proportion of grass coverage and adaptation of the fertilisation practices.

Keywords:grapevine, under-the-row grass cover, mediterranean and oceanic climates.

1. Introduction.

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In a context of reducing herbicide use, the most part of French vineyards are developing permanent grass cover crops on inter-rows alleys, while under the row chemical weeding remains the general case. The setting up of a controlled grass cover crop under the vine row could be a complementary alternative to mechanical weeding – which is very restrictive – interesting from a technical and economical point of view. **The present study aimed at assessing agronomic impacts of grass cover crop under the row in different climatic conditions and production objectives.**

MATERIAL AND METHODS

Two soil management treatments – **Under-the-Row Grass Cover (URGC) and chemical weeding, i.e. bare soil (BS)** – were compared on two experimental plots in South-west and Mediterranean regions of France.
Experimental sites characteristics are described in table 1. Each treatment was replicated three times in a complete randomized block design. Data were annually collected on **grapevine production** – yield, vigour – and **water and nitrogen status** (water potentials dynamics, leaf chlorophyll index, must assimilable nitrogen).

Table 1. Description of the experimental sites characteristics

Location	South-west region		Mediterranean region	
Variety & Vineyard	Malbec – AOP Cahors		Syrah – IGP Pays d'Oc	
Production objective	8 t/ha		12-15t/ha	
Climate	Oceanic		Mediterranean	
Soil type	Loam - deep		Loam - shallow	
Monitoring period	2007 - 2015		2010 - 2015	
Treatments	**URGC**	**BS**	**URGC**	**BS**
Row management	**Sown grass cover: *Koeleria, Festuca ovina***	**Chemical weeding**	**Sown grass cover: *Festuca rubra***	**Chemical weeding**
Inter-row management	Sown grass cover: *Festuca rubra*		Chemical or mechanical weeding	
Percentage of grass cover	100%	60%	30%	0%
Water and nitrogen supply	No irrigation, foliar fertilization from 2011 (20 U N/an)		No irrigation, no fertilization	

Figure 1. illustrations of the systems studied

South-west site | Mediterranean site

DISCUSSION & CONCLUSION

Incidence of grass cover crop was more important in the South-West region than on the Mediterranean site, despite a more humid climate during spring and summer. This is in contradiction with literature (Tesic et al., 2007; Le Goff-Guillou et al, 2000). We thus hypothesize that grass coverage per plot seems to be a more important factor than climatic context to explain the impact of under-the-row grass cover. Furthermore, in the South-west, the introduction of N foliar spraying seems to limit the depreciative effect of total grass cover on vigour.

The setting up of a grass cover under the row of vines appeared to be a viticultural practice compatible with different sets of constraints and objectives pertaining to the adaptation of production system such as management of grass coverage proportion and adaptation of the fertilisation practices.

References
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Tesic, D., M. Keller, and R. J. Hutton. 2007. Influence of vineyard floor management practices on grapevine vegetative growth, yield, and fruit composition. American Journal of Enology and Viticulture 58:1-11.

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RESULTS

Agronomic performances

On **Mediterranean site**, introduction of URGC has not resulted in a significant decrease in yield or vigour.
On **South-west site**, yield was reduced for this treatment in comparison to bare soil most of the years of monitoring, with variation according to climate. AOP production objective was nevertheless achieved for 5 of the 7 years monitored. Regarding vigour, over the first four years of study, an increasing rise of the relative difference between URGC treatment and bare soil was registered, until - 45%. We did not observe any adaptation of the vine to competition from grass cover. From 2011, start of N fertilization, difference of vigour between treatments stabilized before reduced.

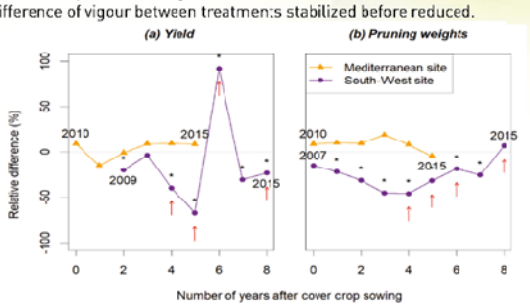

Figure 2. Dynamics of relative differences between URGC and BS of grapevine yields (a) and of pruning weights (b), since the year of cover crop implantation.
* refer to year with significant differences between URGC and BS. Red arrows indicate years with foliar fertilization

Water and Nitrogen status

Monitoring of water and nitrogen status indicators highlighted that competition from URGC focuses on **nitrogen rather than water**. In South-west region, after start of N fertilization, a strong reduction of the relative difference between URGC treatment and bare soil was observed in terms of leaf nitrogen.

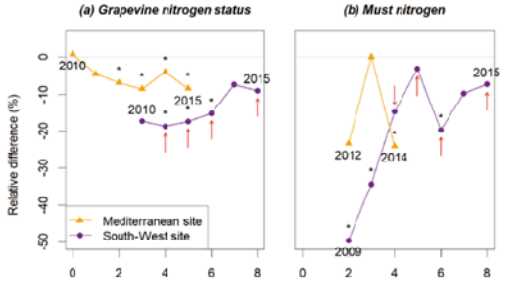

Figure 3. Dynamics of relative differences between URGC and BS of grapevine nitrogen status, since the year of cover crop implantation: (a) leaf nitrogen (N-Tester in Mediterranean site and Dualex® in South-West), and (b) must nitrogen.
* refer to years where differences between modalities were found different. Red arrows indicate years with foliar fertilization.