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Are sown flower strips an efficient tool to limit aphid colonization and viral epidemics in melon crops?



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The melon aphid *Aphis gossypii* is a serious pest on melon crops causing leaf-curling, stunting and even plant death when colonization is intense. It is also an efficient vector of viruses frequently observed on melon crops in France: *Cucurbit aphid-borne yellows virus* (CABYV, persistent), *Cucumber mosaic virus* (CMV, non-persistent) and *Watermelon mosaic virus* (WMV, non-persistent).

The management of aphids and viruses is all the more challenging that the evolution of the regulation (plan Ecophyto 2018) imposes a progressive reduction of the usage of the phytosanitary products. Innovative strategies are needed to control these bioagressors.

The bibliography suggests that the management of field margins could contribute to regulate the populations of aphids and/or their viral load (1,2). Indeed, flower strips can participate in aphid biological control by favouring natural enemies and strips of non-host plants can protect crops from non-persistently aphid-transmitted viruses by allowing aphids to probe on healthy plants and thus to lose their virus load before reaching the crops.

The objective was to evaluate the potential role of sown flower strips to reduce the risk of aphid colonization and the risk of viral epidemics in melon crops.

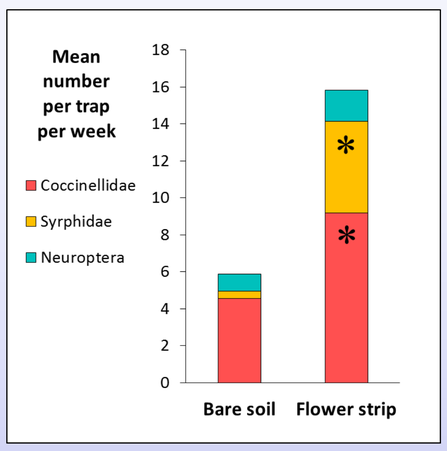


Aphis gossypii infestation on melon



WMV infection on melon

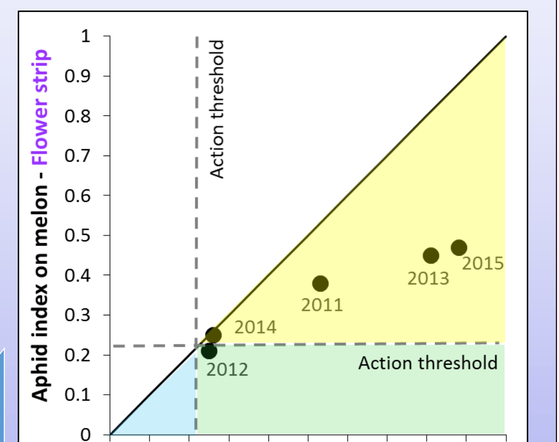
RESULTS

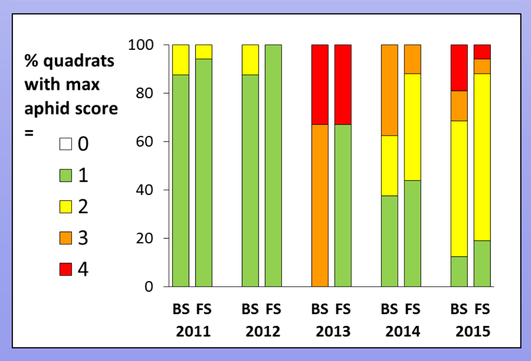


Entomofauna was highly stimulated by flower strips. In particular, aphid predators such as Coccinellidae and Syrphidae were significantly more abundant near flower strips.

Aphid colonization was consistently reduced (up to 47%) in melon crops with flower strips; still the aphid index remained above the action threshold in 4/5 trials.

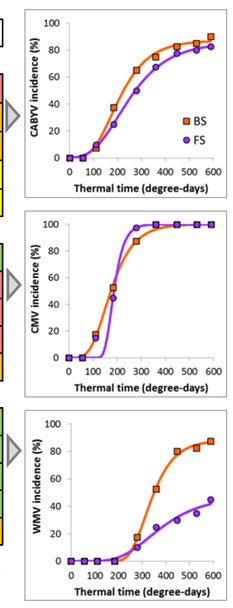
Indeed, except in 2012 where no quadrat reached score 2 in FS modality, the management of the field margins wouldn't have avoided an insecticide treatment « in real life ».





Mean incidence (%) with		Bare soil	Flower strips
CABYV	2011	66.8	64.5
	2012	49.2	43.3
	2013	36.4	42.8
	2014	29.6	25.2
	2015	51.4	25.2
CMV	2011	4.2	14.9
	2012	63.3	63.3
	2013	54.3	69.8
	2014	62	64.8
	2015	58.9	44.5
WMV	2011	10.3	18.6
	2012	33.3	14.7
	2013	21	11.5
	2014	43.4	13.9
	2015	45.7	51.7

Mild [0-20%]
Intermediate [21-40%]
Severe[41-60%]
Extreme [61-100%]

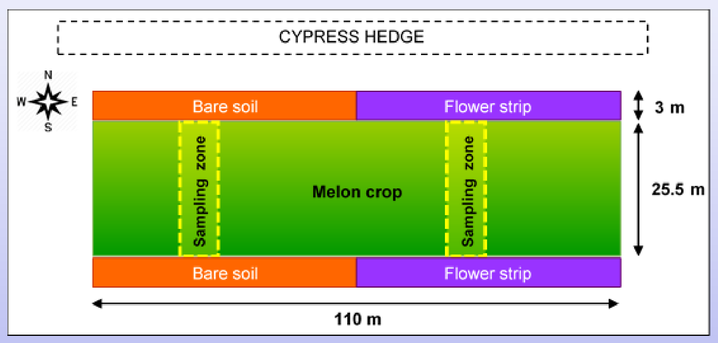


The impact of flower strips varied according to the virus: mainly neutral on CABYV, sometimes deleterous on CMV, usually favourable on WMV. Underlying mechanisms remain to be elucidated.

Sown flower strips alone are not sufficient to control aphids and viruses in melon crops but could positively complement the efficiency of a genetic resistance in an IPM programme (3).

METHODS

- Five field experiments conducted in Avignon (2011-2015).
- Experimental design with two modalities of field margins: bare soil (BS) and flower strip (FS) sown with an ad hoc mix (40% sainfoin, 30% grass pea, 20% salad burnet, 5% cornflower, 5% marjoram) two months before melon planting.





- Flying insects sampled with tent traps placed near field margins (2014-2015).
- Aphid colonization assessed with a 0-4 rating scale (3-5 dates per trial)
  → Aphid Index = area under the pest progress curve standardized by the duration of the monitoring
- Virus detection by double antibody sandwich enzyme-linked immunosorbent assay (DAS-ELISA) with specific polyclonal antisera (7-9 dates per trial)
  → Mean incidence over the epidemic = area under the disease progress curve standardized by the duration of the monitoring

SCORE	DESCRIPTION
0	No aphids
1	Less than 10 isolated aphids
2	Small colonies (<50 aphids)
3	Large colonies + honeydew
4	Very large colonies (>500 aphids)

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