EVOLUTION OF MANAGEMENT FOR THE CONTROL OF PROTAPION TRIFOLII IN RED CLOVER (TRIFOLIUM PRATENSE L.) SEEDS CROPS IN FRANCE

Agathe JOFFRE – French National Seed Growers Association (FNAMS)
FNAMS – Research in Seed Growing

FNAMS is the French seed growers association - created in 1955
42 permanent employees – 8 experimentation farms

2 missions:

Union of seed growers
Political Economics

Technical services
Trials and studies on Forage seeds, Vegetable seeds, Cereals and Protein crops seeds, Sugar beet seeds
Communication of the trials results to all partners of the seed sector
Experimental program: around 2.5 M€ - 200 different trials/year

60% of the program is dedicated to crop protection (and more than 50% of these 60% are dedicated to test PPP in order to get new authorization for seed productions, mainly for vegetables, forage and sugar beet seeds)

Other research themes: pollination, irrigation, fertilization, physiology, yield, harvest...
## Context – Red clover seed productions in Europe & France

<table>
<thead>
<tr>
<th>Country</th>
<th>Seed production (in hectares)</th>
</tr>
</thead>
<tbody>
<tr>
<td>FRANCE</td>
<td>7481</td>
</tr>
<tr>
<td>CZECH R.</td>
<td>5655</td>
</tr>
<tr>
<td>POLAND</td>
<td>3628</td>
</tr>
<tr>
<td>SWEDEN</td>
<td>3065</td>
</tr>
<tr>
<td>GERMANY</td>
<td>2613</td>
</tr>
<tr>
<td>LITHUANIA</td>
<td>2072</td>
</tr>
</tbody>
</table>

*Source: ESCAA  
Source: GNIS*
Red clover seed crops
10 033 ha
Source: GNIS

France
(2017)
Swathing red clover with Marshall Plan equipment... in the Center of France

Source: A. JOFFRE
Context – The red clover seed weevils and its damages

2 major species coexisting on red clover

<table>
<thead>
<tr>
<th>Order</th>
<th>Coleoptera</th>
</tr>
</thead>
<tbody>
<tr>
<td>Family</td>
<td>Apionidae</td>
</tr>
<tr>
<td>Genus</td>
<td>Protapion</td>
</tr>
<tr>
<td>Common name</td>
<td>Red clover weevil</td>
</tr>
</tbody>
</table>

Adult feeding on clover foliage (and other leguminous): Negligible damages

Larvae feeding with seeds:
Up to 40% seed yield losses or even more

2 major species coexisting on red clover:
- Protapion trifolii
- Protapion apricans

Photos: J.COMPTE, Natura Mediterraneo, LABOSEM
Context – Red clover seed weevils life cycle

(1 generation per year)

Migration to the surrounding for hibernation

Spring

Blossoming flowerheads

Oviposition (3 months)

Larvae development

Adult emergence

Summer

Reproduction

Acquisition of sexual maturity

Autumn

Colonising red clover fields
Context – Two main preoccupations for French red clover seed producers

Lack of persistence of insecticides (in some areas)

Persistence of insecticides (days)
- Low (<7 d.)
- Medium (7-15 d.)
- High (>15 d.)

Restricted panel of effective active ingredients

- acetamiprid
- spinosad
- thiacloprid + deltamethrine

2017 - 2018
Characterization of red clover weevil species 2015

10 fields (red clover seed productions)

4 500 red clover weevils
Observed individually for specie characterization

Repartition in species of the red clover weevil captured (%)

99

Protapion trifolii 0,5
Protapion apricans 0,5
Ischnopterapion virens
Resistance test to insecticides

**Method**

2016

Adaptation of the methodology "Adult-Vial-Test for neonicotinoids" (method IRAC n°21)

6 fields (red clover seed productions)

200 red clover weevils

Per field for sensitivity resistance

2 insecticides tested

- Acetamiprid
- Deltamethrin + thiacloprid

Tested at different rates

(\( n = \) reference of authorized for field use)

- 0.2 \( n \)
- 1 \( n \)
- 2 \( n \)

Two repetitions / insecticide / field

Efficacy is observed 24h later
Resistance test to insecticides - Results

Mean results of the 6 fields (no significative difference between the areas of production)

**Deltamethrin + thiacloprid**  
( n = 6.25g a.i./ha + 62.5g a.i./ha)

**Acetamiprid**  
( n = 50g a.i./ha)

**Control**  
(untreated)

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<thead>
<tr>
<th></th>
<th>2n</th>
<th>n</th>
<th>0.20n</th>
<th>2n</th>
<th>n</th>
<th>0.20n</th>
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</thead>
<tbody>
<tr>
<td>% dead red clover weevils</td>
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<td>% dying red clover weevils</td>
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Number of red clover weevils
Efficacy trials with new active ingredient

Control untreated

Reference (thiacloprid 50g a.i./ha + deltamethrin 5g a.i./ha)

Cyantraniliprole 75g a.i./ha (+ 2.5L/ha oil adjuvant)

Number of adult Protapion trifolii captured (mean of 2 x 25 semicircles of butterfly net)

2014

2015

11/06/15 16/03/15 15/06/15 17/06/15 19/06/15 21/06/15 23/06/15 25/06/15 27/06/15 29/06/15

02-06-14 04-06-14 06-06-14 08-06-14 10-06-14 12-06-14 14-06-14 16-06-14 18-06-14 20-06-14

0 50 100 150 200 250 300 350


0 50 100 150 200 250 300 350
Effect of cyantraniliprole on red clover seed yield, compared to the reference thiacloprid + deltamethrin

Trials 2016 - Bourges (18)

Seed yield (q/ha)

- Untreated control
- Reference (thiacloprid 50q a.i./ha + deltamethrin 5g a.i./ha)
- Cyantraniliprole (75g a.i./ha + 2,5L/ha oil adjuvant)
- Cyantraniliprole applied 10 days later (75g a.i./ha + 2,5L/ha oil adjuvant)

2016
Effect of cyantraniliprole on red clover seed yield, associated or not with spinosad program
Trials 2017 - Bourges (18)

Seed yield (q/ha)

- Untreated control
- Reference (thiacloprid 50q a.i./ha + deltamethrin 5g a.i./ha, then 10-15 days later acetamipride 50 g a.i./ha)
- Spinosad (96 g a.i./ha), then 10-15 days later Cyantraniliprole (75g a.i./ha + 2,5L/ha oil adjuvant)
- Cyantraniliprole applied 10-15 days later (75g a.i./ha + 2,5L/ha oil adjuvant)

Legend:
- 2017
- a
- b
Red clover / white clover pests management... exploration of new ways?

Odor-mediated host choice
Leave and/or bud, flower volatiles

Can we disturb the critical step
(female oviposition)?
Odor disturbance?
Physical Disturbance?

Protapion trifolii
RED CLOVER

A. Fulvipes
WHITE CLOVER

Essentials oils?
(Mint, clove)

Clays?
Oils?
The difficulty to control those pests in some areas might not due to a lack of efficiency of the pesticides acetamiprid or deltamethrin + thiacloprid (results have to be confirmed).

The active substance cyantraniliprole showed interesting efficiency results to manage the red clover weevils.

The effect of other parameters responsible of the apparition of difficulties to manage clover weevil has to be explored such as proximity to the red clover field, environment, climate, abundance of red clover larval parasitoid.