Exploiting the *supermale x environment* interactions for breeding early all-male asparagus varieties

Adélaïde Salvado, Planasa France

asalvado@planasa.com

14th International Asparagus Symposium 2017
**Family owned business since 1887**: Darbonne family 5th generation

**Activities and Missions:**
1/ **Breeding**: Research & Development of new varieties
2/ **Nursery**: Production of nursery stock & seeds
3/ **Fresh Produce**: Grower, Packer & Shipper

**Planasa varieties in the world represents**
- 7,500 ha of Berries production
- **6,000 ha of Asparagus production**
- 20,000 ha of Garlic production
- 2,500 ha of Stone fruit production

**Planasa grows in the world**
- 423,000,000 Berries plants (700 ha of nursery)
- **15,000,000 Asparagus crowns**
- 2,000,000 kg of Garlic seeds (150 ha of production)
- 750 ha of Fresh produce crops

*Committed to*

*The farmer’s needs*
&
*The consumer’s taste*
Economic challenge for growers = better price

Improvement of earliness allowed by all-male effect and breeding progress

→ Do supermale lines permit to improve earliness of their descendancy?
Earliness = ability to produce early on the year and to have the majority of the production early.

Faedi index

$$\frac{\sum n_i g_i}{g_{tot}}$$

ni : quantil date of the day of picking i
gi : yield (gross weight per hectare) of the day of picking i
gtot : total yield (gross weight per hectare)
### Asparagus trial

Randomized complete blockers – 3 replicates

<table>
<thead>
<tr>
<th>2010 trial</th>
<th>2013 trial</th>
</tr>
</thead>
<tbody>
<tr>
<td>30 crowns/ block</td>
<td>32 crowns/ block</td>
</tr>
<tr>
<td>19 230 crowns/ha</td>
<td>22 800 crowns/ha</td>
</tr>
<tr>
<td>21 F1-hybrids</td>
<td>24 F1-hybrids</td>
</tr>
</tbody>
</table>

9 supermale lines
Weather data

DORMANCY STAGE
Chilling period
> 11°C and > 5°C

VEGETATIVE STAGE
> 28°C and > 11°C

Cut of vegetation
15th of November

Hilling
> 11°C

Start of picking = bud break

End of picking

Forcing PERIOD
> 11°C

Period of picking

FAEDI INDEX earliness

Data for each stage:
- Degree-day
- Relative moisture
- RG: global radiation
- ETP: evapotranspiration

Weather data
Weather effect on hybrid earliness

Significant local variation of weather each year of picking (p<<0.05)

Spearman’s correlation

<table>
<thead>
<tr>
<th>Vegetative stage</th>
<th>Dormancy stage</th>
<th>Forcing stage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Degree -day 28°C</td>
<td>ETP veg</td>
<td>Degree -day 11°C</td>
</tr>
<tr>
<td>Index Faedi</td>
<td>0.77</td>
<td>-0.57</td>
</tr>
<tr>
<td>Yield</td>
<td>-0.32</td>
<td>0.54</td>
</tr>
</tbody>
</table>

Vegetative stage
→ Indirect effect on earliness (by direct effect on yield)

Dormancy stage
→ Annual weather variation might be too low to show an impact on earliness (multi-local trials more adapted)

Forcing stage
→ Forcing stage seems to be a key stage for earliness: early variety = fast answer to favorable forcing
Weather effect on hybrid earliness

Bud breaking = combinaison of the effects of weather at both asparagus key stages
Weather effect on hybrid earliness

Modalities of trials = weather and supermale

<table>
<thead>
<tr>
<th>Analysis of variances</th>
<th>Sum Square</th>
<th>Degrees of freedom</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supermale</td>
<td>688.9</td>
<td>8**</td>
</tr>
<tr>
<td>Year of picking</td>
<td>865.6</td>
<td>3***</td>
</tr>
<tr>
<td>Supermale x year of picking</td>
<td>548.8</td>
<td>24</td>
</tr>
<tr>
<td>residuals</td>
<td>1450.5</td>
<td>52</td>
</tr>
</tbody>
</table>

** p<0.01 ***p<<0 (F-test)

→ Independance of the effects of the year (=weather) and supermale

Genetic a good way to improve asparagus earliness
**Genetic progress: standard heterosis**

**Darlise** : earliest variety

= check variety

Standard heterosis (%) = \( \frac{F_1 \text{ hybrid} - \text{Check variety}}{\text{Check variety}} \times 100 \)

(Nuruzzaman et al., 2002)

→ **Negative Standard heterosis** = F1 hybrid earlier than Darlise
Standard heterosis of earliness

Check variety = DARLISE

→ Our parental lines permit to improve earliness
Standard heterosis of earliness

Average of standard heterosis of supermale check variety = DARLISE

Supermale line favorable to earliness as others favorable to late production = large genetic pool
Conclusion

G x E interactions very important
Local trial permit to study the impact of E and G independently

FURTHER → breeding variety of agronomical interest (yield, quality, earliness, resistances)
- evaluation of the combining abilities
- CLIMA x Genotypes interactions (multi local trials)

To breed variety of high performances and fitness
Darvador: New very early all male variety

A very early variety of high quality spears

- Darvador
- Darlise
- Darzilla

And others varieties is coming soon!!
Thank you for your attention