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Flower stimulation in seed orchards – now a standard procedure in Sweden?

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Seed orchards

- are the most cost-efficient way to increase future forest production
- of many tree species have a more or less abundant fructification
- one exception is Norway spruce, *Picea abies*
- the amount of seed production is very vital for the economy of the whole operation

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Flower initiation in Norway spruce

- Next year’s bud is formed after the shoot elongation in mid-June to mid-July
- Depending on the weather during this period, the tree decides if the bud should be vegetative or generative
- Dry and hot weather → generative bud
- Wet and cool weather → vegetative bud
- Normally the weather is favorable for flower bud formation 1 year out of 5-7 years

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Can flower bud formation be enhanced?

- Yes, and no!
  - Yes, because stress can induce flowering
  - No, if climatic prerequisites are missing, it's difficult/impossible

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Flower stimulation with $GA_{4/7}$

- First reports in mid 1970-ies
- Gives effect in most conifer species, e.g.

- Pinus sylvestris	*- Picea abies*
- Pinus contorta	*- Picea mariana*
- Pinus radiata	*- Pseudotsuga menziesii*

- Generally more effective in stimulation of female flowering than male flowering
- The effect of $GA_{4/7}$ treatment often increases if combined with cultivation techniques (e.g. heat, drought, girdling)

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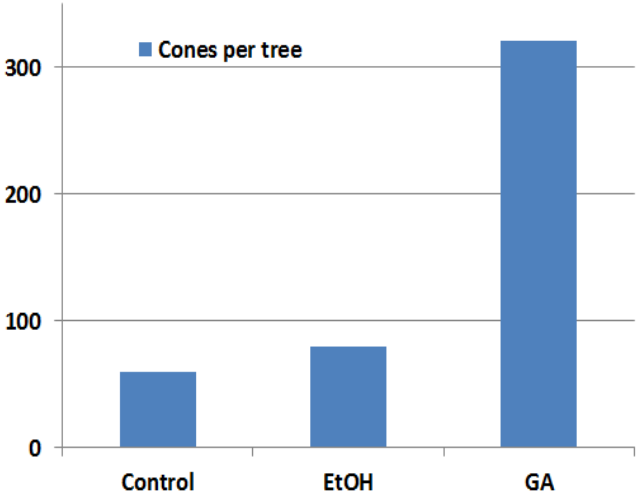
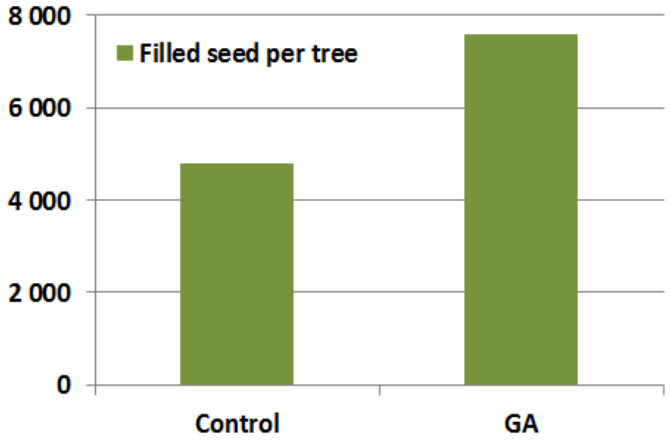
Flower stimulation with $GA_{4/7}$

Picea mariana



Bockerhoff & Ho, 1997

Pinus sylvestris



Eriksson et al. 1998

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Use of $GA_{4/7}$ in forestry

- $GA_{4/7}$ is used today in most breeding programmes as a routine practise
- But in seed orchards, the use has been limited to research activitites

Reason is

No registered and approved product for use in seed orchards

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Problem solved in Sweden

Globachem

- The Swedish Chemical Agency has now approved Gibb Plus Forest for commercial use in conifer seed orchards until 2019
- Gibb Plus Forest is the same product as Gibb Plus which is used for
  - Promoting fruit set in apples and pears
  - Reducing russetting in apples

Equipment used for application

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ArborSystems™
The No-Drill Injection Solution

Wedgle® Direct-Inject™

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Injection technique

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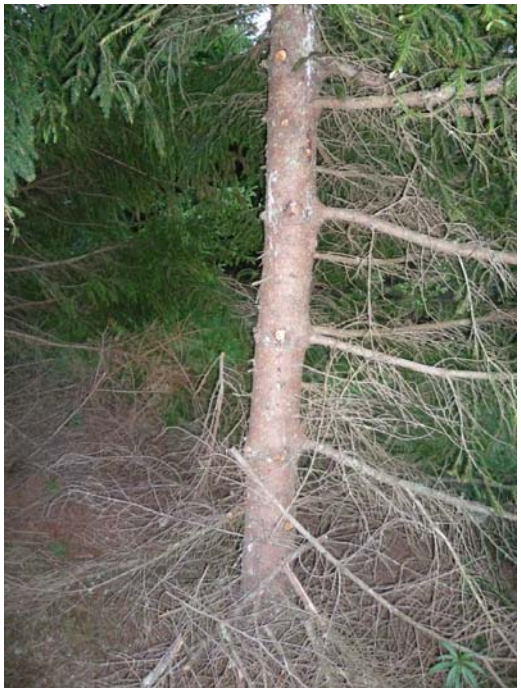
Preparation before application



- Assessment of tree diameter
  - For calculation of amount Gibb Plus Forest
- Pruning of branches for efficient $GA_{4/7}$ application
  - Performance ≈1 hectare/worker, day
  - Cost ≈ 165 €/hectare

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Gibb Plus Forest dosage and cost

Globachem

Cost 230 €/liter

Tree diameter, cm	Dosage, ml	Cost/tree, €
7-15	2	0,46
15-20	4	0,92
20-25	6	1,38
25-30	8	1,84
etc	etc	etc

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Organizing the application work

- Experience from 2011 and 2012
  - Two persons in a team
  - One applies tips and removes them
  - One inject Gibb Forest Plus, 2 ml/tip
  - One team treats 50-60 trees/hour
- Suggestion for 2013
  - Three persons in a team
  - One applies tips
  - One injects Gibb Forest Plus, 2 ml/tip
  - One removes tips
  - Each team needs two tip setters
  - Performance is expected to be 1 hectare/team,day (90 trees/hour)

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Economic calculations

Activity	Trees/ha	Unit/tree	Cost/unit, €	Total cost/ha,€
Branch pruning, initial cost				*165*
Gibb Plus Forest	490	5,2 ml	0,23	586
3-man team				494
Total cost				**1080 €**
Extra production	Based on results from S.o. 504 Ålbrunna			22 kg seed/ha
Cost for extra production				**49 €/kg seed**

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Economic calculations

Success rate	Cost for extra production
Every time	49 €/kg
1 out of 3	147 €/kg
1 out of 5	245 €/kg
1 out of 7	343 €/kg

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Conclusion

- The cost for flower stimulation with Gibb Plus Forest is limited, even if the success rate is not so high
- Training of the teams June 12
- In 2013 we will have 15 different 3-man teams working in 145 hectares Norway spruce seed orchards, during June 24-July 5
- The result will be evaluated. If OK, this will be a standard procedure in future seed orchard management


Thank you for your attention