Effect of different cultivation practices on the survival and growth of Icelandic Christmas trees in the early growth stage on agricultural fields

MSc project 2013

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Else Möller

Christmas tree research in Iceland

Long-term project started in 2009 in the forest department at the Agricultural University of Iceland: **"Fast growing Christmas trees in agricultural fields"**

The aim was to:

1. get more information about growing Christmas trees in agricultural fields

2. collect information about the existing experience of Christmas tree growing in Iceland from the very beginning and to publish the information in Icelandic

BSc (2010): Fast growing Christmas trees in agricultural fields
Survival of young plants and the effect of different fertilizer regimes

Experiment: Randomized complete block design (7 blocks)

Three species:
- Norway spruce (*Picea abies*)
- Engelmann spruce (*Picea engelmannii*)
- Lodgepole pine (*Pinus contorta*)
  (total 1890 trees)

Three fertilizer regimes:
- No fertilizer (control)
- 12 g fertilizer/plant
- 24 g /plant annually in the spring
  (Fertilizer: NPK 27-6-6)

MSc (2013): Fast growing Christmas trees in agricultural fields

Effect of different cultivation practices on the survival and growth of Icelandic Christmas trees in the early growth stage on agricultural fields

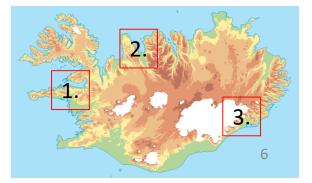The same experimental setup as in the BSc project

The aim of the project

1. To gain more knowledge about how to efficiently produce Christmas tree in agricultural fields under Icelandic conditions

   - Which species

   - What fertilizer regime

   - What herbicide regime

2. To establish a Christmas tree project together with two forest farmers in different parts of Iceland (north and south)

3. To follow the survival rate and growth over time

Methods

- Randomized complete blocks design (5 blocks 6 treatments)

- Soil preparation (Spraying, plowing, harving)

- Species: NS (BØ), ES (Rio Grande) and LP (Skagway).

  - Total 1350 plants

- Fertilizer: control, 12g and 24g (NPK 27-6-6)

- Three different herbicide regimes (Glyphosate/Roundup)

  1. Spray x 1 summer 2. Spray x 2 summer and autumn 3. Spray over the trees

- The effect of shelter: Distance from the shelter

- 3 different locations

  1. Hvanneyri - West Iceland
  2. Skagafjordur – North Iceland
  3. Kirkjubæjarklaustur – South Iceland

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MSc: Fast growing Christmas trees in agricultural fields
Results - Spices

1. The Lodgepole pine had the best survival rate in all locations

2. Engelmann spruce had a good survival rate but problems with top necrosis due to frost damage

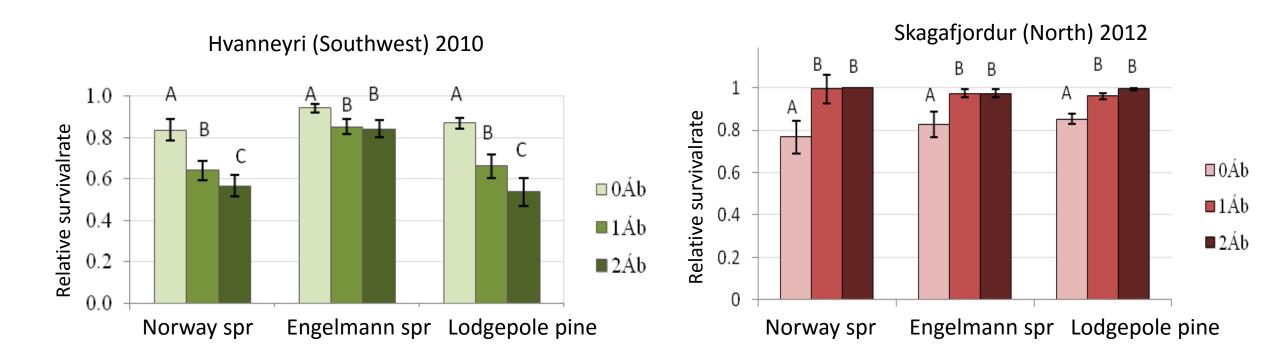3. Norway spruce had a very low survival rate in all locations, especial in the south.

MSc: Fast growing Christmas trees in agricultural fields
Results - Fertilizer

- Low survival rate when fertilizer was applied right after planting, especially at LP. (Results from Hvanneyri 2010)
- Increasing survival rate when fertilizer was applied one year after planting
- No positive effect on the growth rate the first two years after planting
- No effect of different fertilizer regime after two years (chemical analyses of needles)
- Different fertilizer regime had huge effects on weeds and grasses

MSc: Fast growing Christmas trees in agricultural fields
Results – Fertilizer (results from Kritholt – Skagafirði)

Hvanneyri (Southwest) 2010

Skagafjordur (North) 2012

0 Áb = control, 1 Áb = 12 g, 2 Áb = 24 g fertilizer (NPK 27-6-6-)

MSc: Fast growing Christmas trees in agricultural fields
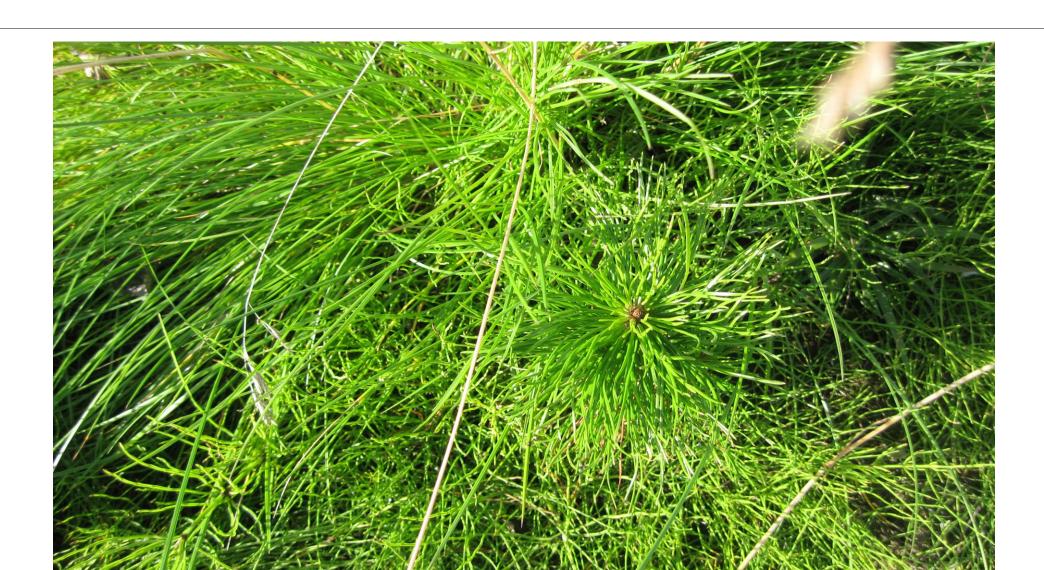## **Results** - Herbicide

None of the herbicide regimes had any effect on survival or growth rate the first year after planting but had a positive effect on weeds and grasses

In the plots which were sprayed all over, horsetail (*Equistenum arvense*) became very dense

After two years the plants in these plots started to show signs of damage from the herbicide (short yellow needles)

After two years it was obvious that none of the herbicide regimes was sufficient to reduce the weed and grass growth

Horsetail (*Equistenum arvense*)
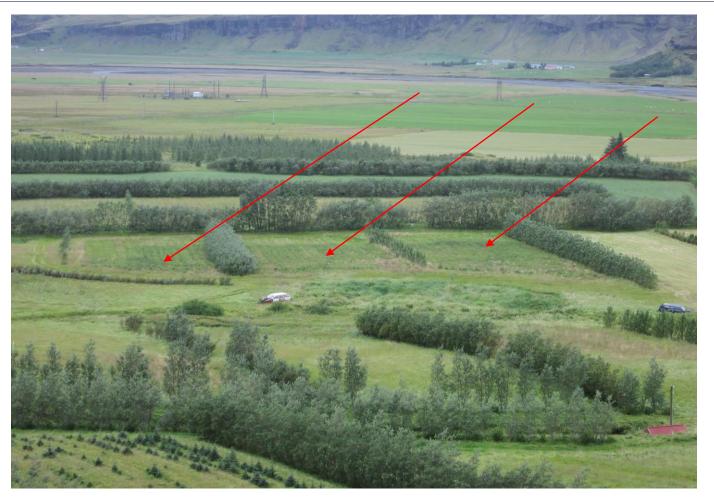
Damage from herbicides – yellow, short needles

MSc: Fast growing Christmas trees in agricultural fields
Results – Shelter (Skagafjordur)

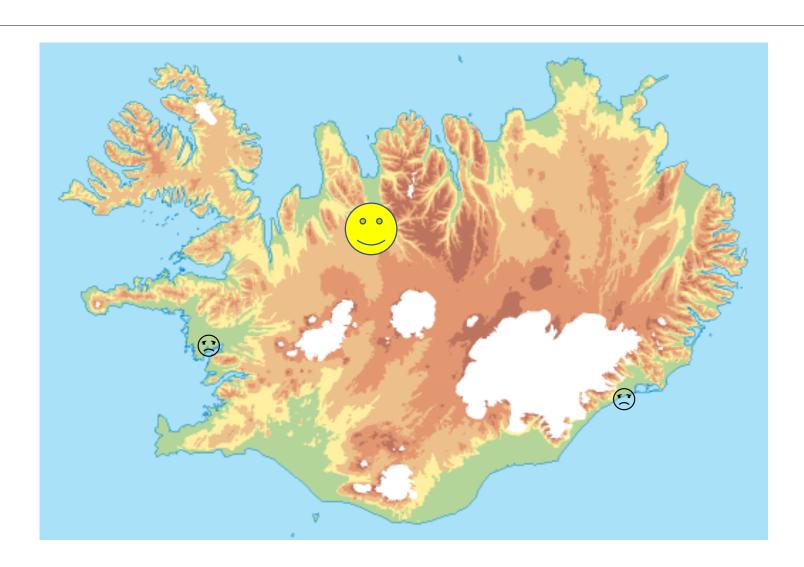The survival rate and growth rate increased for the little plants near the shelter

MSc: Fast growing Christmas trees in agricultural fields
Results – Shelter (Kirkjubæjarklaustur)

Lowest survival rate in the area with less shelter and cold wind from the highland or salty wind from the sea

MSc: Fast growing Christmas trees in agricultural fields
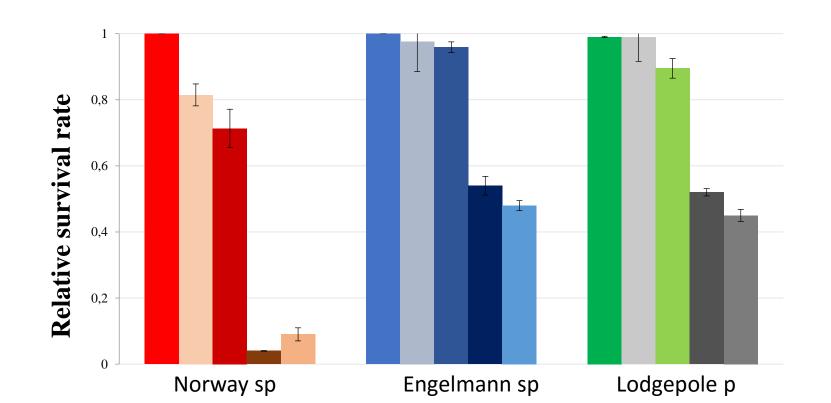## **Results** - Location

MSc: Fast growing Christmas trees in agricultural fields
Conclusion

- **Species:** Choose the right species and right proveniences for the right location

- **Fertilizer**: No fertilizer in agricultural fields the first two years

- **Herbicide**: Important! X 2 spray - not enough! All over spraying – damaged the young plants, but just Gluphosate was not enough (eg. MCPA)

- **Shelter:** Very important - more than just a thin shelterbelt

- **Location:** As far from the sea as possible and avoid flat areas

Fast growing Christmas trees in agricultural fields
Destany of the long-term project

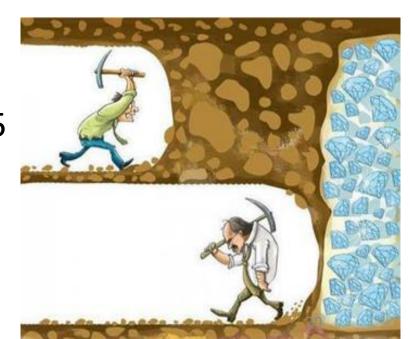## The survival rate decreased from 2012-2015 to < 50%

Fast growing Christmas trees in agricultural fields
Destany of the long-term project

➢The farmers did not want to use herbicides

➢The mortality was fair to high

➢We did not have the right equipment or machinery

➢We did not have the right growing sites

➢We do not have the knowledge or experience to perform
  this production

The long-term project was officially closed down 2015

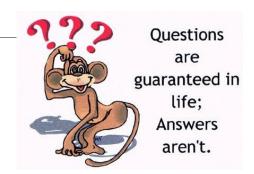… but we have other possibilities in Iceland!

Fast growing Christmas trees in agricultural fields
Challenges for the future Christmas tree production

The big questions:

- Should we increase the Christmas tree production?
- If "yes!" - How can we increase the production?
- Who shall "lead the wagon"?
- Do the Icelandic growers have the right mentality for this niche production?
- Is the market big enough for a domestic production?

Questions are guaranteed in life; Answers aren't.

Fast growing Christmas trees in agricultural fields
Challenges for the future Christmas tree production

… Or should we stick to the artificial Christmas tree?

- 84% of Icelandic families use Christmas tree for Christmas (350.000 inhabitants / 120.000 households)
- 53% of Icelandic families use artificial Christmas tree (2016 Gallup)

Fast growing Christmas trees in agricultural fields
Thank you to:

My four mentors:

- Bjarni Diðrik Sigurðsson, Professor, Agricultural University of Iceland
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- Björn B. Jónsson, Forester
- Claus Jerram Christensen, Forester (MSc), Danish Christmas Tree

- *The Agriculture University of Iceland*
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Fast growing Christmas trees in agricultural fields

Thank you!