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The effect of organic fertilizers and thinning methods on quality parameters and the yield on apple cultivars 'Aroma' and 'Discovery' in Norway

A. Koort & E. Vangdal

- Hardanger is a region in Norway which is the one of the most important sources of fruit production, where ca. 40% of the fruit is produced.
- Experiment was carried out in 2015-2016 in Ullensvang municipality, where most of the inhabitants live in narrow coastal mountainsides and valleys along Hardangerfjord.

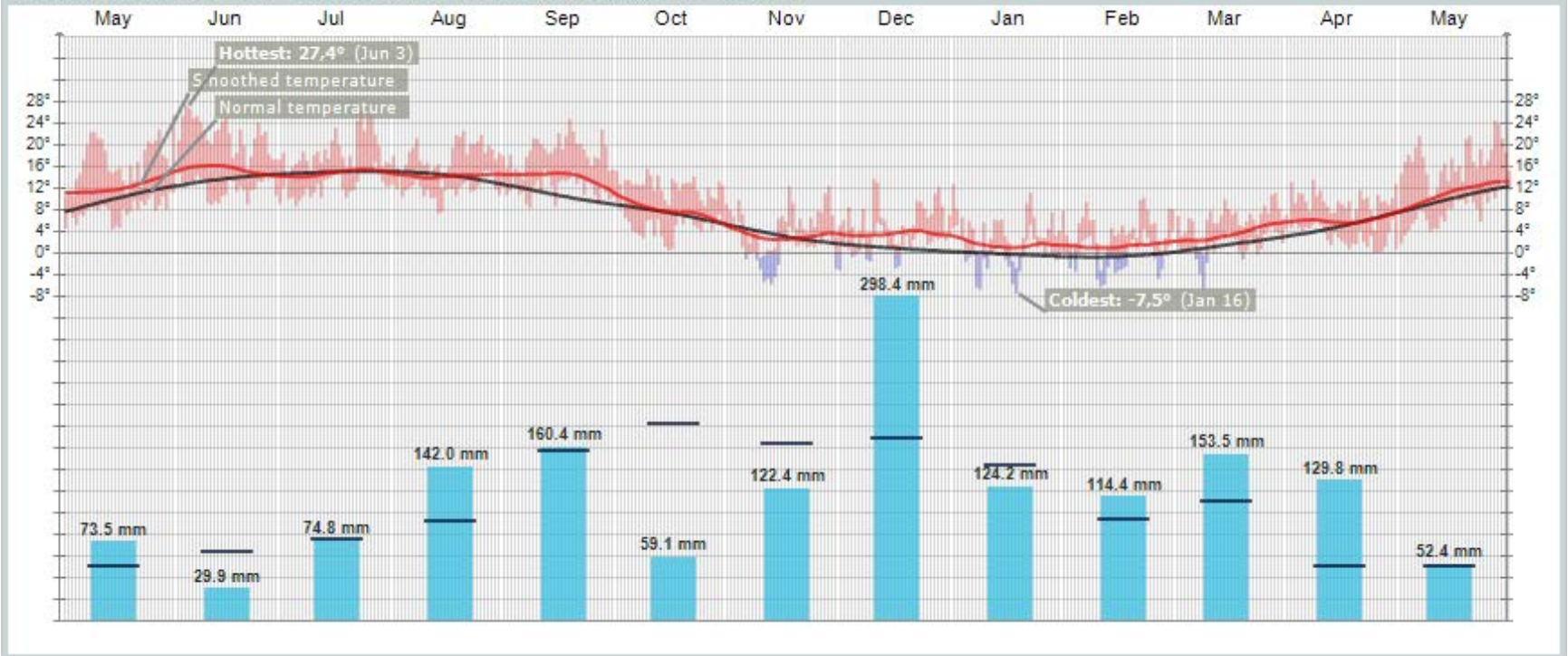


Photo: NIBIO

NIBIO Ullensvang



Weather statistics for Ullensvang Forsøksgard May 2016 – May 2017



<https://www.yr.no/place/Norway/Hordaland/Ullensvang/Lofthus/statistics.html>

Implications

- Does different organic fertilizers and the thinning methods influence the apple size, quality parameters and the yield of cv. 'Discovery' and 'Aroma'.
- Organic fertilizers tend to have slow nitrogen release in the beginning of the season, while synthetic fertilizers can provide optimal levels of nutrients. Therefore, there is a need to find out organic fertilizers suitable for intensive apple growing.
- High quality and more stable fruit set can provide higher price for local growers and they are interested in more stable yield.

Background and objectives

- Apple growers in Norway are focusing in medium sized apples suitable for 6-pack consumer packages.
- *'Aroma' can have an excessive and uneven fruit set, reduced fruit size is desired.*
- *'Discovery' is small-fruited cultivar, more even and bigger fruit size is required for 6-pack.*

'Aroma'



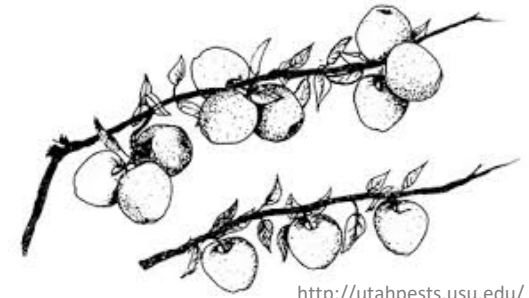
http://www.gartner.no/globalassets/gartner/produkter/frukt/epler/rod-aroma/buskerud/gartner_lokal_rod_aroma_lier_900g.jpg?width=274&height=274&quality=90

'Discovery'



http://www.gartner.no/globalassets/gartner/produkter/frukt/epler/discovery/sogn-ogfjordane/gartner_lokal_discovery_nordfjord_900g.jpg?width=586&quality=60

Background and objectives



<http://utahpests.usu.edu/>

Fertilizers used in trial were:

- Organic pelleted fertilizer Marihøne Pluss 8–4–5 (chicken manure, meat bone meal and vinasse)
- Organic liquid fertilizer Pioner Hi Fruit 4–1–5 (organic plant material, natural minerals, extracts of sugarcane and potato)

Two different thinning methods:

- Strong thinning 15 cm between fruit
- Weak thinning followed 1–2–1 system, 15 cm between 1 fruit, followed 15 cm after two fruit.

“ Our hypothesis was that organic fertilizers provide optimal nutrient ranges during the growing season to cultivars ‘Aroma’ and the ‘Discovery’ and have a positive effect on the yield and quality parameters.

Weak thinning reduce the fruit size of ‘Aroma and strong thinning increase the apple size of ‘Discovery’ “

Key results and discussion

- Preliminary results didn't show clear trends in both orchards, but the thinning effect influenced more size and fertilizer had stronger effect on the quality.
- IAD (chlorophyll absorbance index) was highest with Pioner Hi Fruit 60 kg N/ha with both thinning types when compared to the control weak in 'Aroma' orchard.



http://www.italiafruit.net/27937/Packaging_e_Tecnologie/Da-Meter_prezioso_alleato_per_l'ortofrutta_australiana

Key results of 'Aroma' orchard 2016

- There was significant effect on weight with the strong thinning method in the 'Aroma' orchard rather than fertigation type in 2016.
- Pelleted fertilizer Marihøne Pluss 60 kg N/ha with strong thinning gave heavier apples compared to the control.

'Aroma' orchard 2016

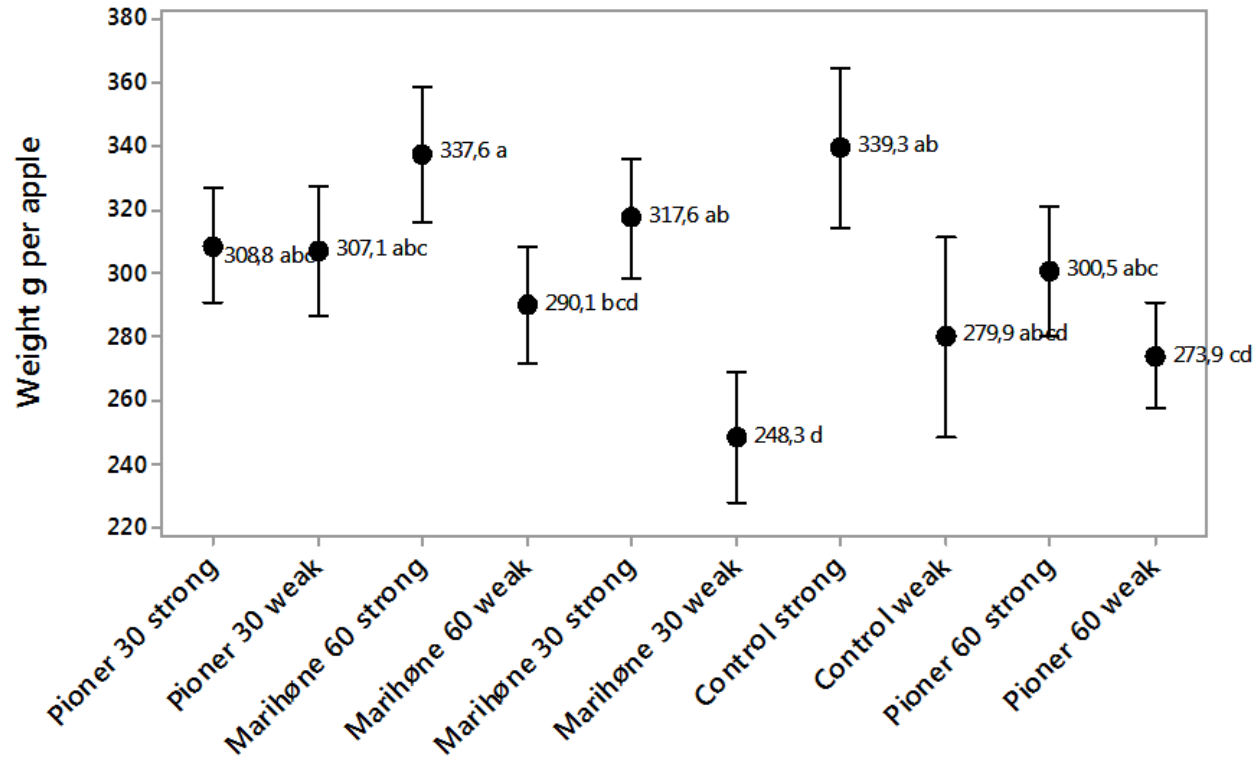


Figure 1. The effect of different fertilizers and the thinning method to fruit weight in 'Aroma' orchard in 2016

Table 1. Effect of different fertigation types and thinning methods on cultivar 'Aroma' quality parameters (2016).

	I _{AD} index	Starch (1-9 scale)	Firmness (kg.cm ²)	SSC (% °Brix)	TA (%)
Control weak	1.00 bc	7.20 bcd	6.15 ab	12.93 a	0.94 ab
Control strong	0.90 c	8.05 abcd	5.55 b	12.63 a	0.82 b
Marihøne 30 weak	1.05 bc	7.58 abcd	6.21 a	12.83 a	0.94 ab
Marihøne 30 strong	1.03 bc	7.35 cd	5.87 ab	13.25 a	0.91 ab
Marihøne 60 weak	1.12 b	8.05 abcd	5.88 ab	12.56 a	0.88 ab
Marihøne 60 strong	1.17 ab	7.26 d	5.89 ab	13.08 a	1.02 a
Pioner 30 weak	1.14 ab	8.13 abcd	5.86 ab	12.98 a	0.92 ab
Pioner 30 strong	1.12 b	8.20 abc	5.67 b	12.38 a	0.93 ab
Pioner 60 weak	1.27 a	8.36 ab	5.86 ab	12.70 a	0.99 ab
Pioner 60 strong	1.28 a	8.49 a	5.84 ab	12.42 a	0.90 ab

'Discovery' orchard 2016

- Most of the strong thinning replications had heavier apples compared to weak thinning.
- Highest weight in 'Discovery' orchard was with Marihøne Pluss 30 kg with strong thinning compared to weak thinning.
- No obvious trend were observed in quality parameters in 2015-2016, maybe clearer results in 2017.

Table 2. Effect of different fertigation types and thinning methods on cultivar 'Discovery' on apple weight (g)(2016).

	Weight g per apple
Control weak	139,0 bcd
Control strong	144,5 ab
Marihøne 30 weak	135,4 bcd
Marihøne 30 strong	152,4 a
Marihøne 60 weak	126,0 d
Marihøne 60 strong	139 bcd
Pioner 30 weak	139,3 bcd
Pioner 30 strong	142 abc
Pioner 60 weak	130,6 cd
Pioner 60 strong	139,4 bc

Table 3. Effect of different fertigation types and thinning methods on cultivar 'Discovery' on apple weight (2015).

Diameter	Control		Marihøne 30		Marihøne 15		Pioner 30		Pioner 15		
	Strong	Weak	Strong	Weak	Strong	Weak	Strong	Weak	Strong	Weak	
<55					3,13 %						
55-105	10,00 %	5,00 %	6,67 %	3,33 %	21,88 %			16,67 %	15,38 %		
105-155	62,50 %	65,00 %	83,33 %	90,00 %	53,13 %	82,50 %	58,33 %	76,67 %	69,23 %	90,00 %	
155-205	25,00 %	30,00 %	10,00 %	6,67 %	21,88 %	17,50 %	41,67 %	6,67 %	15,38 %	10,00 %	
205-255	2,50 %										

How work was carried out?

- ‘Aroma’/M9 planted in 2010, planting space 4,5x1. Pollinizer ‘Kobenza’
- ‘Discovery’/M9 orchard planted 2011, planting space 3,5x0,9 m.
- Fertigation: twice a week two weeks before blooming.
- Ground fertilizer Marihøne Pluss 8–4–5 30 kg N/ha.
- In 2015 two different rates: 15 kg N/ha and 30 kg N/ha with both fertilizers.
- In 2016: 30 and 60 kg N/ha.
- Control did not have any additional fertigation.

How work was carried out?

- Firmness was determined by penetrometer on opposite sides of each fruit .
- Chlorophyll absorbance index (absorption difference between 670 and 720 nm) indicating chlorophyll content I_{AD} was measured by DA-meter.
- Soluble solid content was measured by a refractometer and were expressed as °Brix.
- Titratable acid was analyzed by titration.
- Starch score was expressed in 1–9 scale, where 1=full staining, 9=free of starch

Thank you for your attention!

