Results from Söderfjärden experimental field

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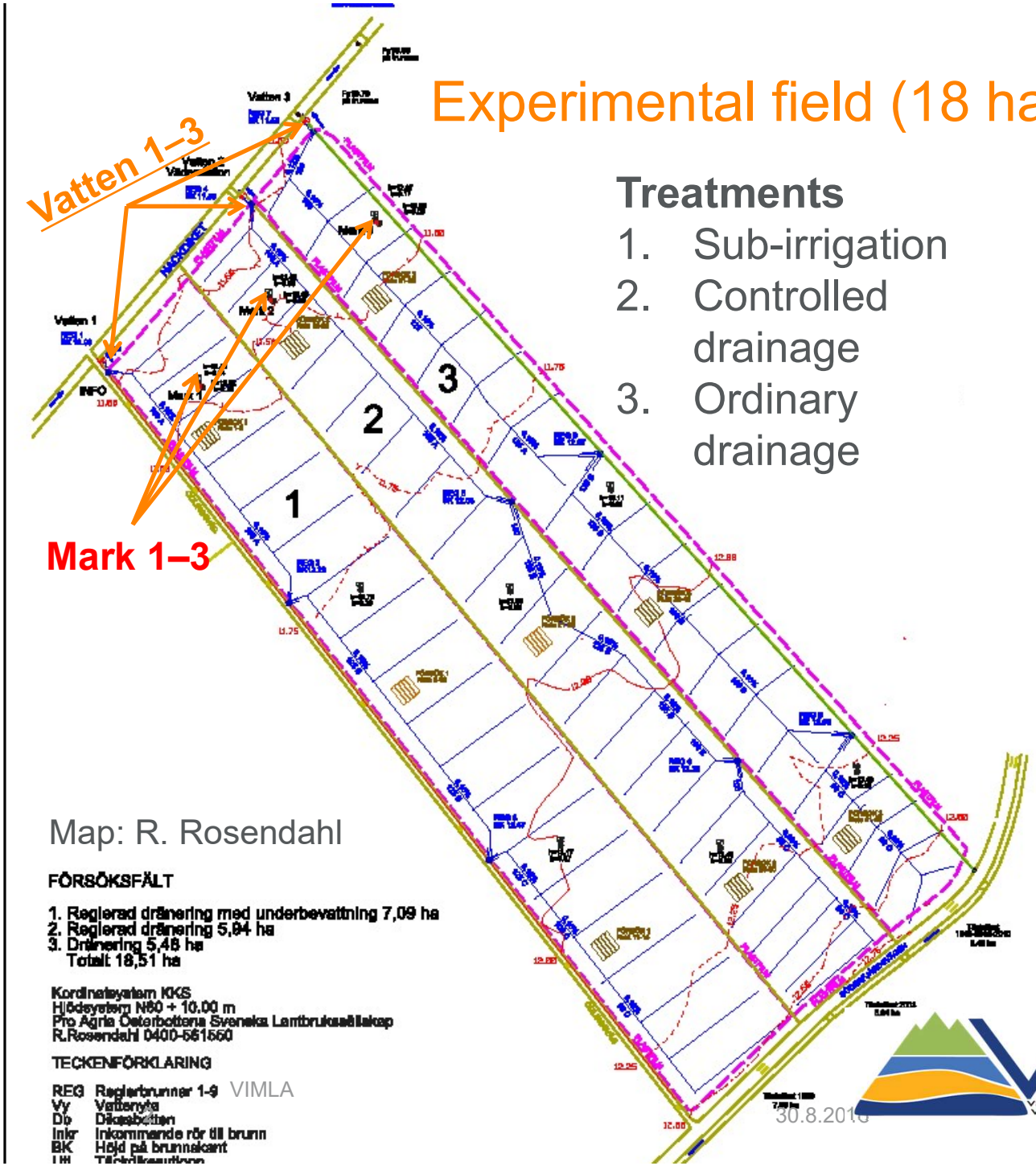
Experimental field (18 ha)



Map: R. Rosendahl

Treatments

1. Sub-irrigation
2. Controlled drainage
3. Ordinary drainage

Soil Taxonomy:

Sulfic Cryaquept,

Thionic Gleysol

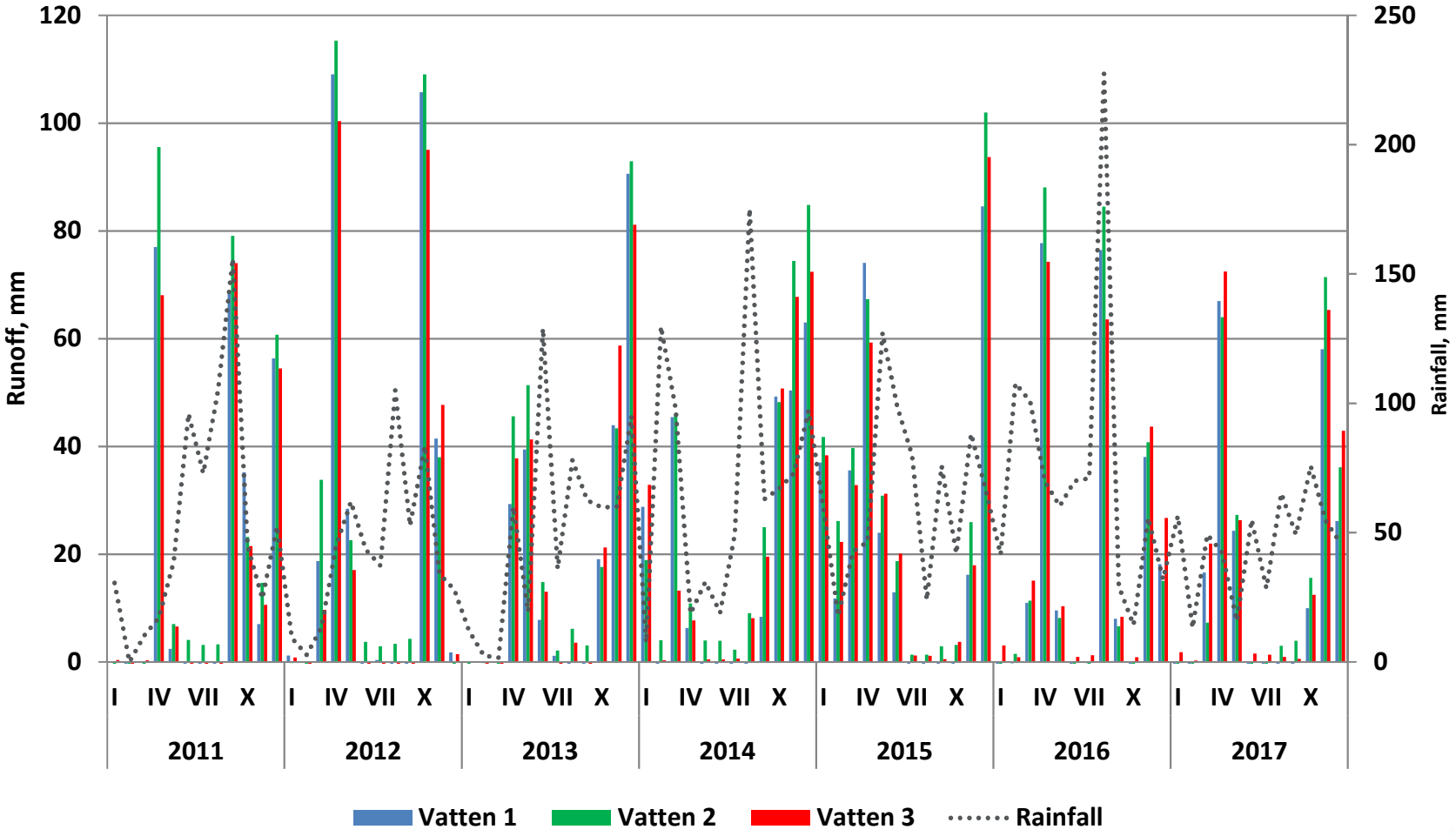
Continuous sampling

- **Vatten 1–3** (water flow, EC, pH)
- **Mark 1–3** (depth of groundwater)

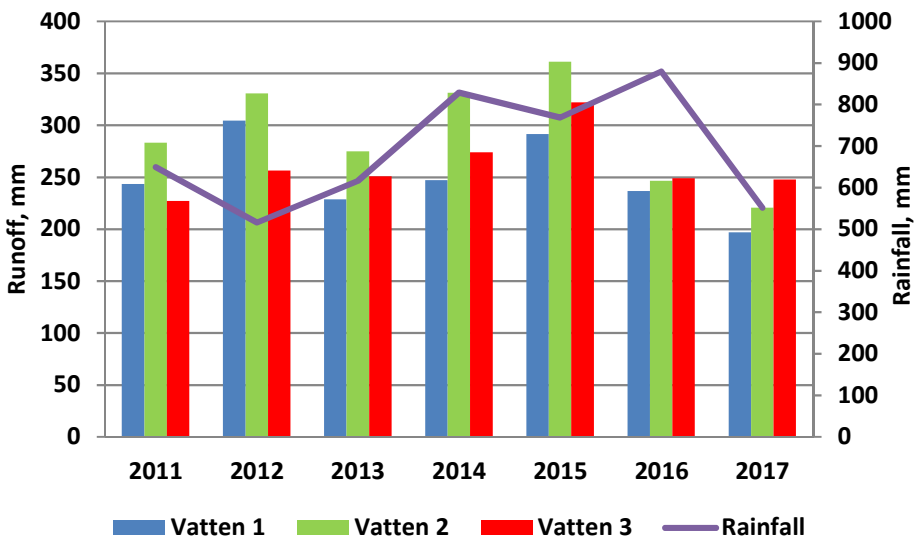
Previous experiments

- CATERMASS 2010–2012
- BEFCASS 2013–2015
- VIMLA 2015/11–2018

Monthly runoff and rainfall 2011-2017

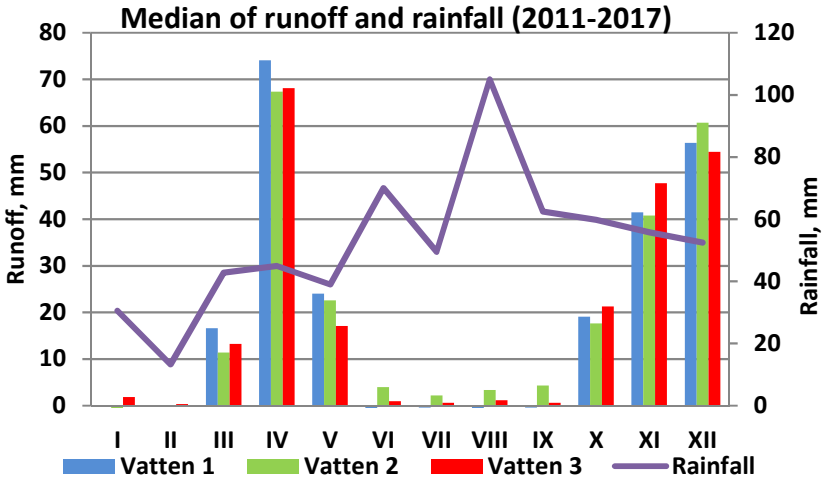


Runoff and rainfall



Annual rainfall and runoff

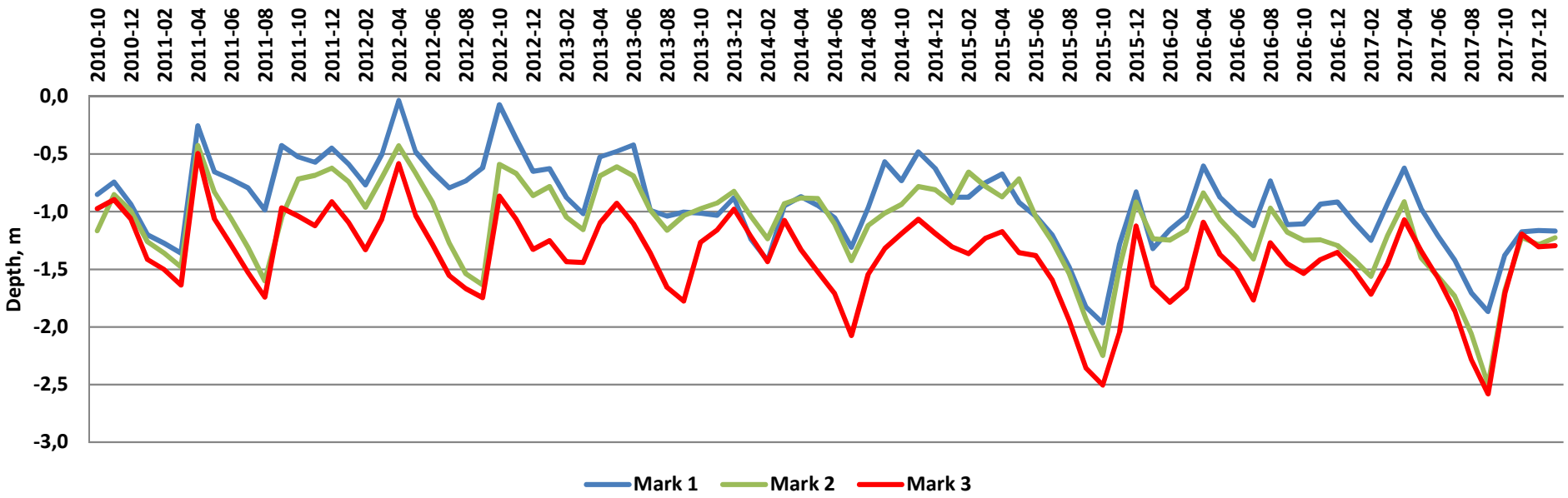
Vatten 1 = Sub-irrigation,
Vatten 2 = Controlled drainage
Vatten 3 = Ordinary drainage system



Median of monthly rainfall and runoff

- Highest rainfall during growing season
- High evaporation during growing season->negligible runoff
- Highest runoff during spring and autumn
- No diffreneces in runoff amounts among drainage systems

Monthly depth of shallow groundwater (2011-2017)

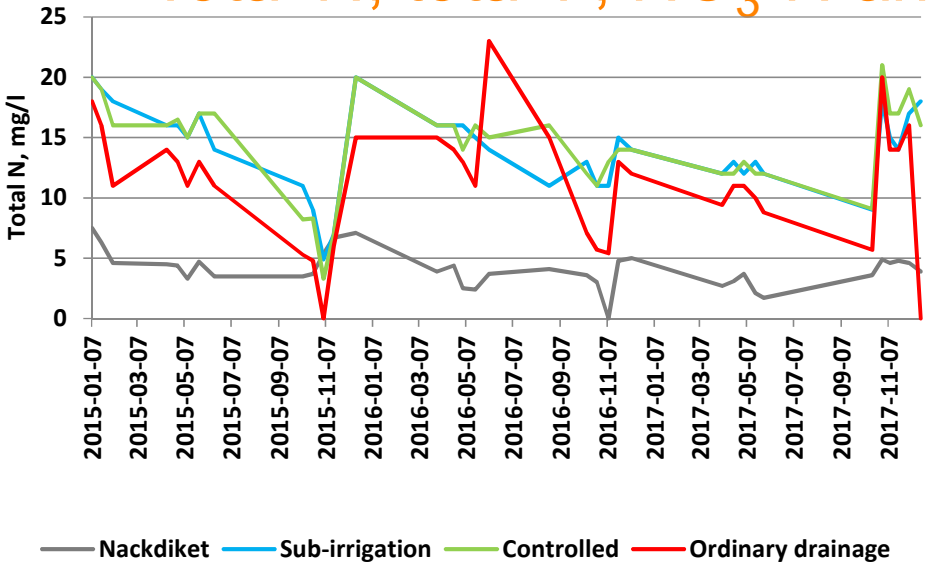


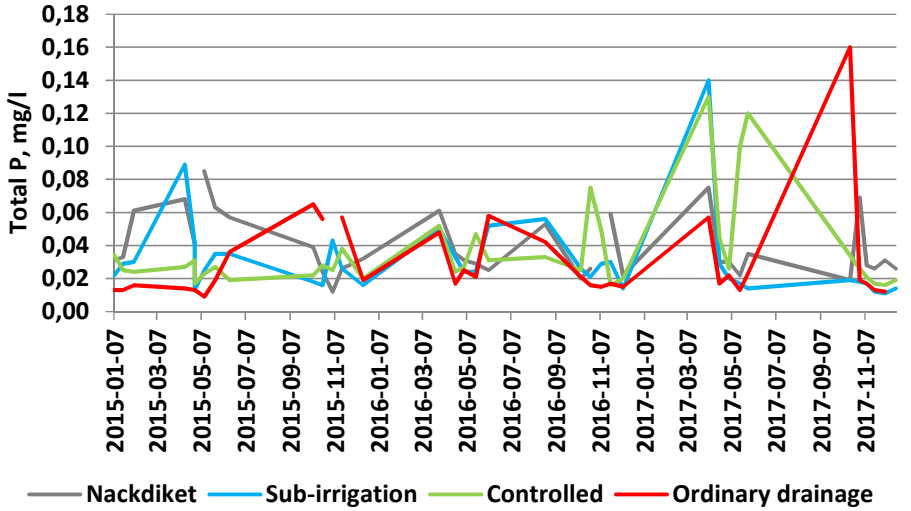
Lowest depth in Mark 3 (Ordinary drainage sytem), highest in Mark 1 (Sub-irrigation due to added water) and intermediate in Mark 2 (Controlled drainage).

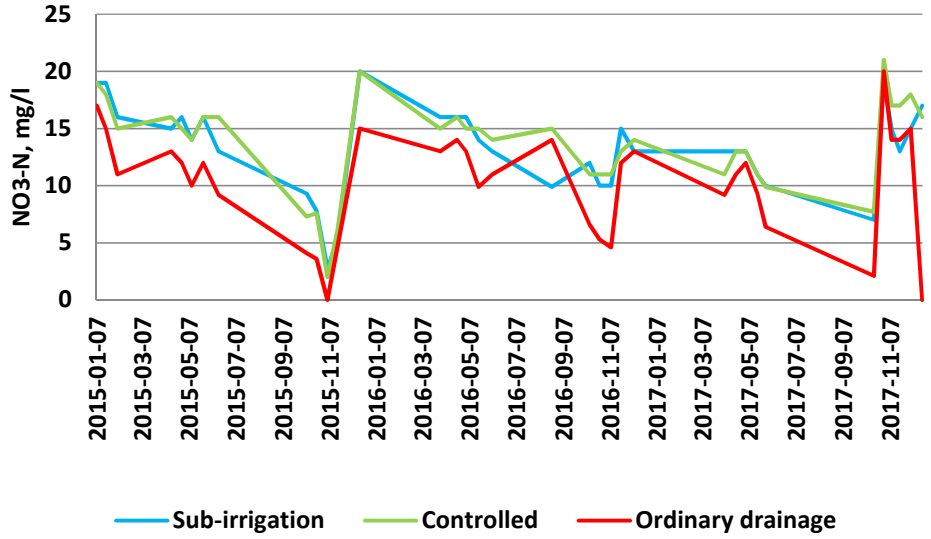
Low depth usually in August-October, high depth in spring and late autumn

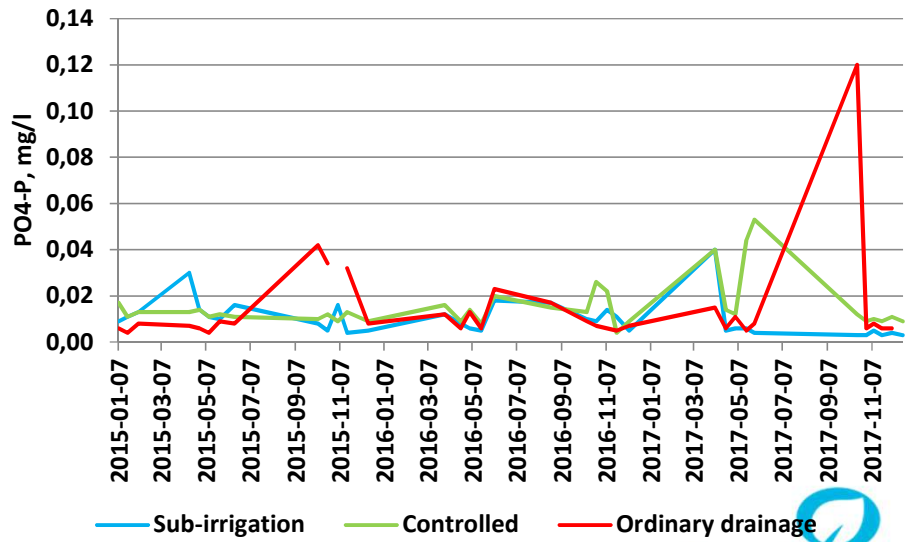
Data downloaded from EHP Environment (https://ehp-data.com/loggers)

Total N, total P, NO_3-N and PO_4-P in runoff









Data from the regional ELY Centre.

Estimated total nitrogen loads in drainage discharge

		Total N (kg/ha)		
Year	Season	Sub-irrigation	Controlled drainage	Ordinary drainage
2015	Spring	31	37	27
	Summer	0	1	1
	Autumn	15	19	13
	Total	46	57	41
2016	Spring	16	17	15
	Summer	10	13	11
	Autumn	8	8	8
	Total	34	38	34
2017	Spring	14	12	13
	Summer	2	3	2
	Autumn	13	19	17
	Total	29	34	32

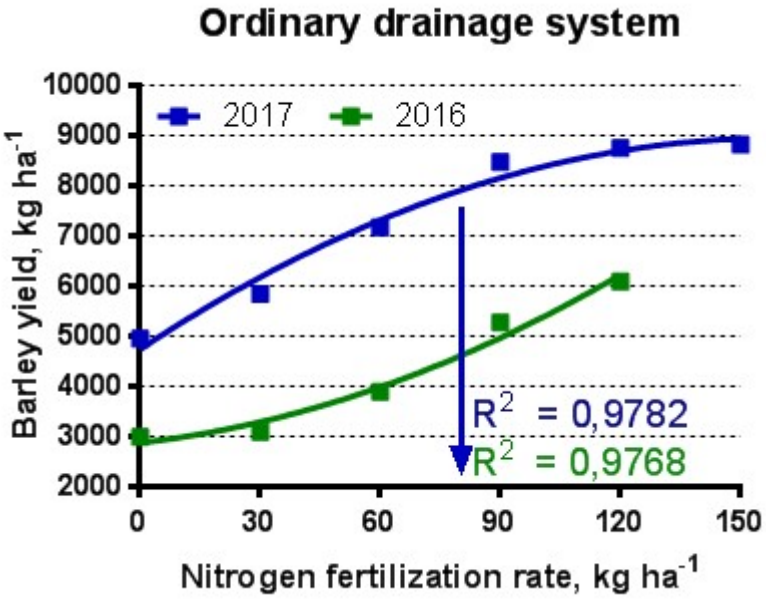
- Total N losses were high (30–60 kg/ha/yr), and most of it was in the form of NO_3-N.
- Highest losses in spring and autumn
- No clear differences among treatments
- (The losses were estimated via continuous water flow measurements and grab sampling.)

Field trials in Söderfjärden in 2016-17

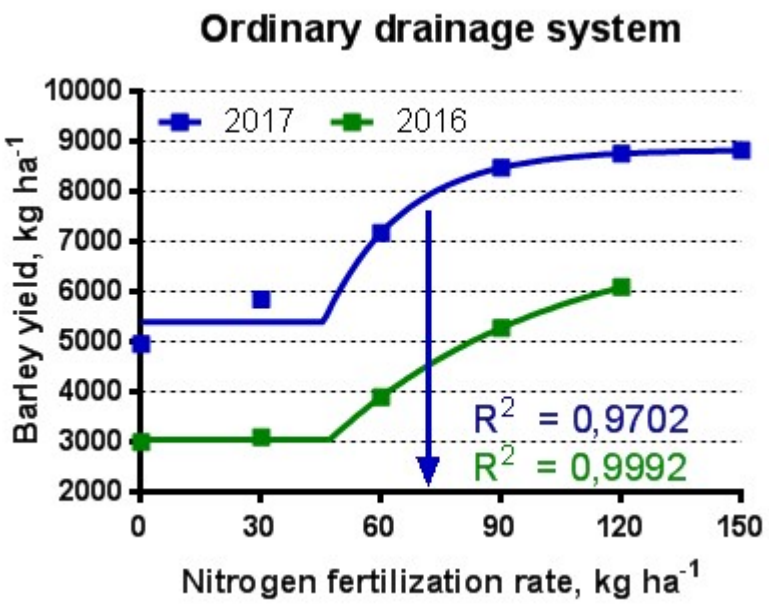
- Barley was grown in field trials in both years and planted by the farmers
- Nitrogen application rates were 0, 30, 60, 90, 120 ja 150 kg/ha (Highest N application rate only in 2017)
- Total harvested area from each plot was 1,5 m * 8 m

Barley yields in 2016-17

- Yield response curves were drawn by using two different types of equations
- Results indicate that yield responses were small at low nitrogen application rate



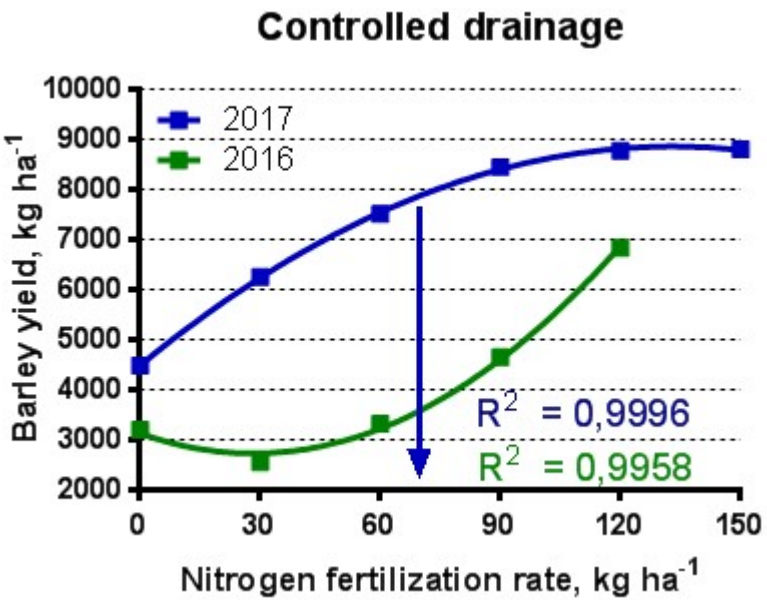
90 % of the maximum yield was reached with **80** kg N ha^{-1}. Maximum was not reached in 2016

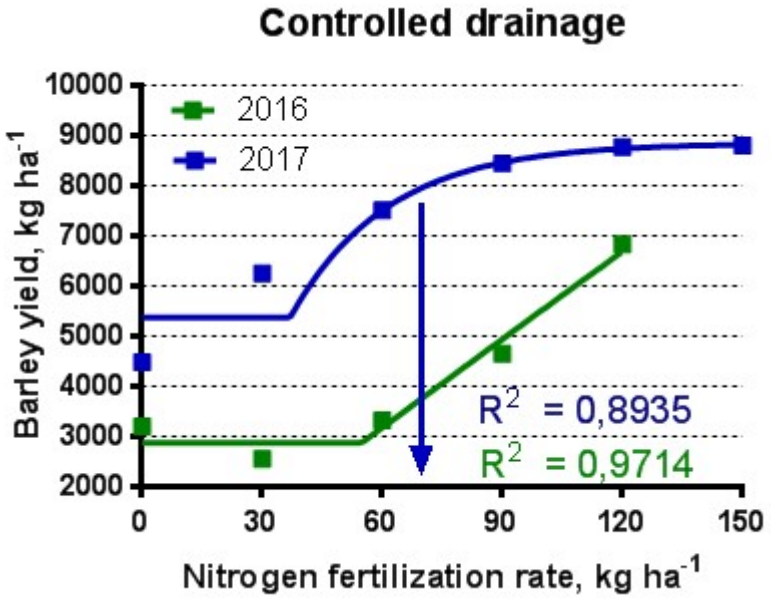


90 % of the maximum yield was reached with **72** kg N ha^{-1}. Maximum was not reached in 2016

Barley yields in 2016-17

- Yield response curves were drawn by using two different types of equations
- Results indicate that yield responses were small at low nitrogen application rate

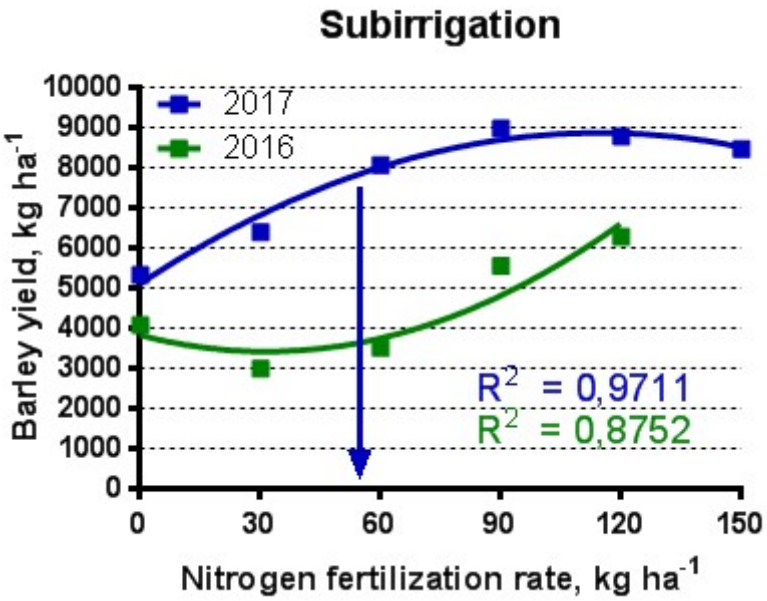




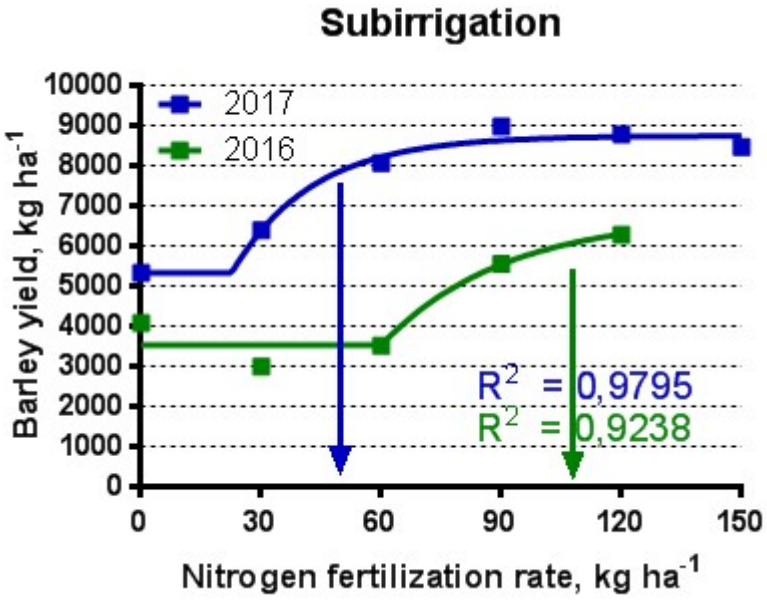
90 % of the maximum yield was reached with **70** kg N ha^{-1} (according to both yield response curves)

Barley yields in 2016-17

- Yield response curves were drawn by using two different types of equations
- Results indicate that yield responses were small at low nitrogen application rate



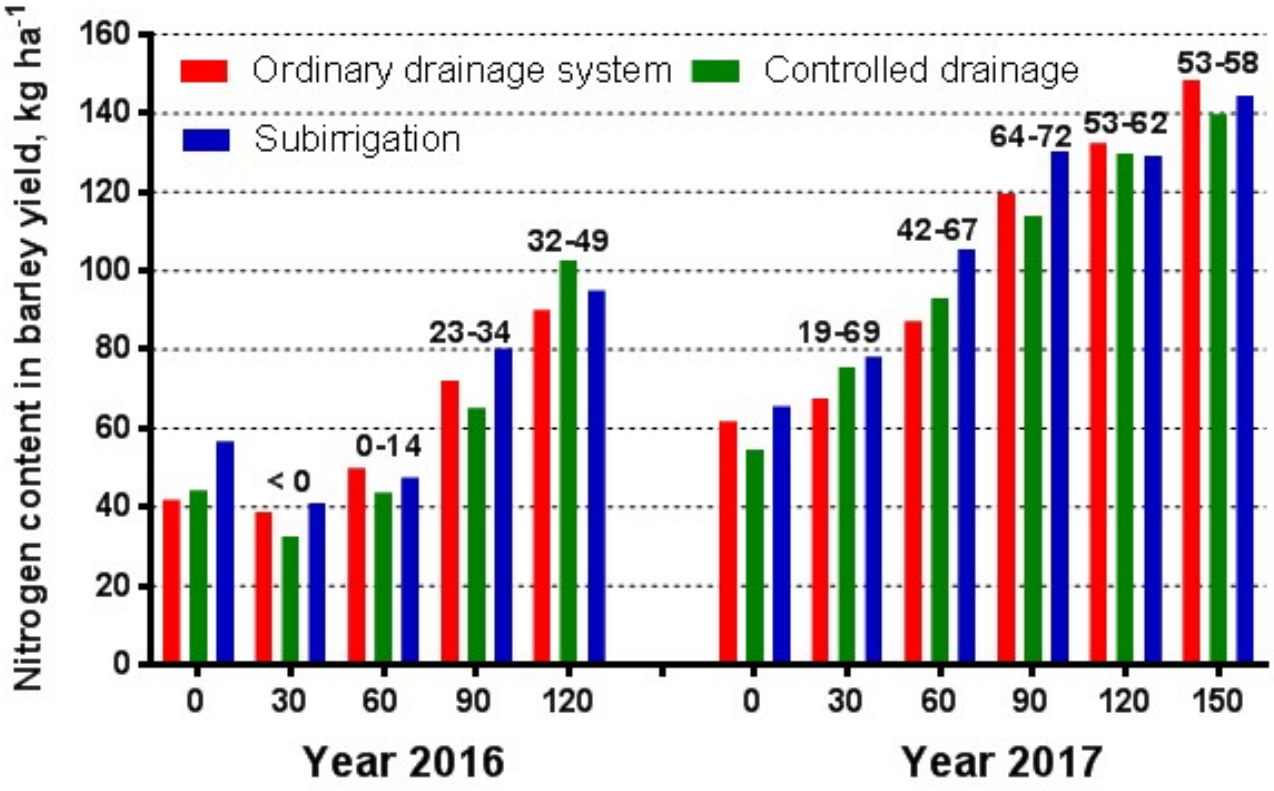
90 % of the maximum yield was reached with **55** kg N ha^{-1}.
Maximum was not reached in 2016



90 % of the maximum yield was reached with **50** and **108** kg N ha^{-1}

Apparent nitrogen utilization rate in 2016-17

- Nitrogen content in yields increased together with yields
- Apparent nitrogen utilization rate was up to about 70 % of the applied nitrogen fertilizer (see the figure below)



Conclusions of the field trials

- Acid sulfate soils (AAS) have a high yield potential and it shows as a high yields even without nitrogen fertilizers.

- High soluble nitrogen content in AAS probably improved crop growth especially when nitrogen fertilization rate is low.

- Maximum yields were comparable between different drainage methods but the optimum yield was obtained with a lower nitrogen application rate in field with subirrigation drainage system (year 2017).

- Agricultural Environmental Scheme allows nitrogen fertilization rate of 150 kg ha^{-1} for barley when expected yield is 6500 kg ha^{-1}. Especially in good growing conditions it is too much for plant requirement to reach optimum yield.

- More measurements are needed to evaluate the optimal nitrogen fertilization rate in AAS with high soluble nitrogen content.

- Annual total nitrogen load in drainage discharge was high (30–60 kg/ha) in each drainage system.