

Organic fertilization of the raspberry 'Glen Ample' in polytunnel at 61°, 65° and 68°N in Norway.

Rolf Nestby

Fruit yields and cane development are influenced by fertilization and site.

The solid fertilizers Agromarin™ (Agromarin, Norway) and Marihøne Pluss (Naturgjødning AS, Norway) used alone or together with Oase™ 8-2-10 (Nordisk Miljøteknologi, Norway) were tested in Poly tunnel trials at three different locations along the Norwegian Atlantic coast, and they gave satisfactory fruit yield at all latitudes. However, the recommendation of fertilization would depend on site. Cane diameter at node 20, generative development on node 20 lateral and freezing injury of buds differed between latitudes.

Effects on yield At 61°N

The yield did not increase as an average of two years by increasing solid fertilizer (SF) above an amount equivalent to 9 kg N per 1000 m of hedge, and the two fertilizer types gave equal yields. However, there was a tendency that increased fertilization by fertigation equivalent to 6 kg N per 1000 m of hedge, reduced the yield (Tab. 1).

Table 1. Fertilization of the raspberry 'Glen Ample' by two solid fertilizers in combinations with fertigated Oase at 61°N

Fertigation	Solid fertilizers	
	Agromarin	Marihøne Pluss
6 kg N	5436	5552
Water	6107	5776
Mean	5772	5664
Se	213 ^{ns}	213 ^{ns}

*, **, ***, ^{ns} indicate significant level of 5%, 1%, 0.1% and not significant. Se=Standard error. Used in all tables.

Effects on yield at 65°N

There was a significant interaction between type of solid fertilizer and fertigation as an average of three years (Fig. 1). Marihøne Pluss (MP) of 9 kg N per 1000 m hedge together with Oase of 4 kg N per 1000 m hedge, gave the highest yield as an average of three years, followed by Agromarin without fertigation giving 9 kg N per 1000 m of hedge. Higher levels of N did not increase yields significantly

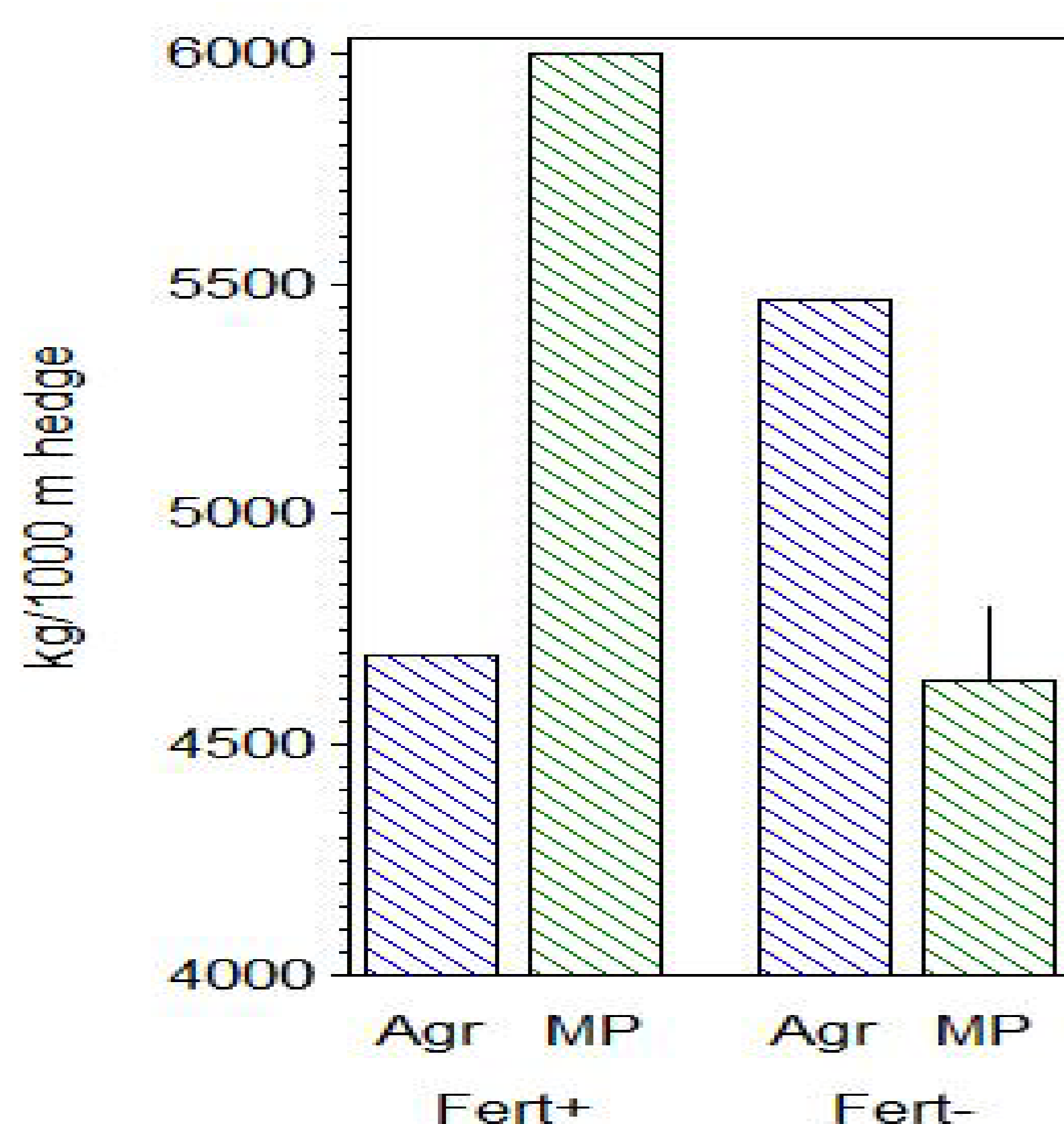


Figure 1. Effect on fruit yield at 65°N in Norway by using the solid fertilizers Agromarin (Agr) and Marihøne Pluss (MP) in combinations with Oase 8-2-10. With and without Oase is respectively Fert+ and Fert-. Bar=Se for all comparisons.

Effects on yield at 68°N

The field did not yield a significant amount of fruit in 2008 due to a heavy attack of European water vole (*Arvicola amphibius*). The yield potential was very high in 2009, but some yield was not harvested since the tunnels blew down in early June and were not replaced before August 2010. An extremely harsh winter 2009/2010 gave severe winter injury and the yield was very low. The results from 2009 showed that the yield was higher using MP instead of Agromarin as an average. However, fertigation with Oase combined with Agromarin induced a strong increase in yield (Tab. 2). Since the field suffered of K (potassium)-deficiency, this increase is probably caused by the high level of K in Oase (Fig. 2). SF alone gave less fruit in classification 1 than SF combined with Oase.

Table 2. Effect of fertilization the raspberry 'Glen Ample' with solid fertilizer types in combination with fertigated Oase at 68°N.

Solid Fertilizers	Fertigation					
	4 kg N		Water		Mean	
	Class 1 %	Yield	Class 1 %	Yield	Class 1	Yield
Agromarin	74	4511	63	3562	69*	4037*
MP	72	4908	67	4432	70*	4670 ^{ns}
Mean	73	4710	65	3997	70**	4354*
Se	2.3 ^{ns}	222 ^{ns}	2.3 ^{ns}	222*	1.6	157*



Figure 2. Potassium deficiency symptoms in leaves of raspberry 'Glen Ample' at 68°N in Norway.

Effects of site on growth, generative development and freezing injury.

There were large temperature differences between the sites. However, the polytunnels reduced the differences in growing season.

Cane diameter and # of flowers at node 20 reckoned from cane basis increased from south to North, and freezing injury became more severe (Tab.3). There were a strong interaction for all parameters between year and site (not tabulated).

Table 3. Site effects on cane diameter in mm (Cd) and number of flowers (Fln) at node 20, and freezing injury (Fi) as an average of two years.

Site	Cd	Fln	Fi
61°N	6.7	14.0	8.5
65°N	7.5	16.2	8.3
68°N	9.6	24.2 ¹ (node 12 in 2010)	6.5
Mean	7.9	18.1	7.8
Se	0.2***	1.2***	0.2***