Starter fertilisers:
Do they influence rhizobial populations in vining pea fields?

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Introduction

Pea yields have reached a plateau in many areas of the UK over recent years. One option to increase yields is the application of starter fertilisers which is not currently practiced in the UK. Phosphorus promotes root growth and is essential for root nodulation to occur whereas nitrogen is potentially damaging to rhizobial populations thereby not only reducing nitrogen fixation in the pea crop but also leaving reduced levels of soil nitrogen for the subsequent crop. The aim of this project was to test the influence of starter fertilisers with and without nitrogen on vining pea yields and rhizobial populations in soils.

Methods

Three field trials using early, mid and late-sown commercial vining pea varieties were established in 2014 and 2015. The early sowing period was between 28 and 31 March, the mid sowing period was between 9 and 10 April and the late sowing period was between 4 and 7 May. Three rates of two starter fertilisers (Primary P®, Microstar®) were applied to each crop at each sowing (Table 1) and an unfertilised control was maintained. Each field plot was approximately two hectares in size and was treated, other than the application of starter fertiliser, as a commercial crop.

Table 1: Application rates and compositions of applied starter fertilisers Primary P® and Microstar®.

Fertiliser	Application rate	Composition
Primary P	7.5 kg/ha; 10 kg/ha; 12.5 kg/ha	40% phosphorus, 11% sulphur oxide 10% nitrogen, 2% manganese, 2% zinc
Microstar	7.5 kg/ha; 10 kg/ha; 12.5 kg/ha	45% phosphorus pentoxide, 3% magnesium oxide, 0.5% copper, 0.5% manganese

Four replicated soil samples were taken from the rhizosphere of each plot, when peas had reached the stage of first flower formation, to assess rhizobial population sizes. These soils were used to inoculate pea plants grown under glasshouse conditions and five weeks later nodules per plant were counted. All glasshouse tests were replicated three times. Field plots were harvested un-replicated and yields calculated.

Picture 1: Early sown vining pea crop, 2014.

Results

Numbers of nodules per plant were greater in mid and late sown crops than in early sown ones (Figure 1) but the application of any of the starter fertilisers at any rate did not significantly influence rhizobial populations (Figure 2).

Yield tended to be higher in mid and late sown crops in both years (Figure 3) and higher rates of 12.5 kg/ha starter fertiliser appeared to increase yield, especially when Microstar® was applied (Figure 4).

Figure 1:
Numbers of nodules per plant as a measure for rhizobial population sizes when inoculated with soils sampled from early, mid and late sown pea crops. The early sowing period was between 28 and 31 March, the mid sowing period was between 9 and 10 April and the late sowing period was between 4 and 7 May. Mid and late sown crops had significantly higher numbers of nodules than early sown crops ($p<0.001$). Data show mean values and standard error of means.

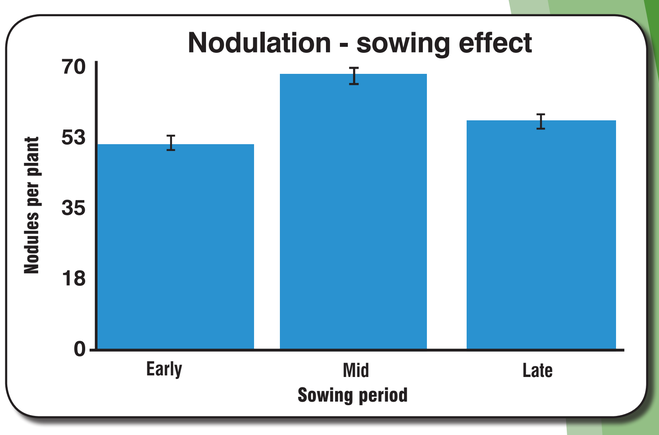


Figure 2:
Numbers of nodules per plant when inoculated with soils fertilised with 7.5 kg/ha, 10 kg/ha or 12.5 kg/ha of either Primary P® or Microstar®. The application of starter fertilisers did not influence rhizobial population sizes in soils. Data show mean values and standard error of means.

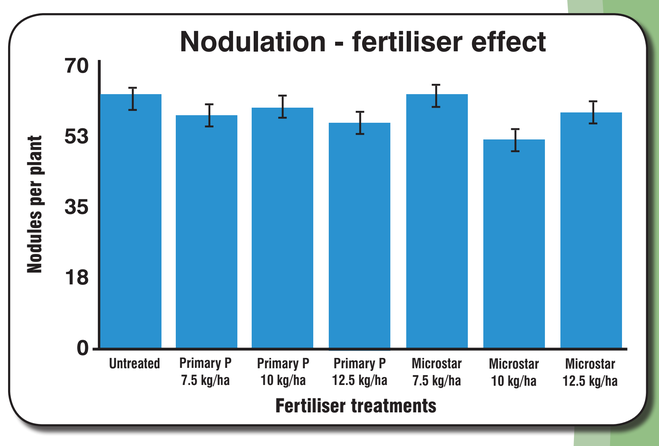


Figure 3:
Vining pea yield from fields sown with early, mid and late maturing crops. The early sowing period was between 28 and 31 March, the mid sowing period was between 9 and 10 April and the late sowing period was between 4 and 7 May. Yields tended to be higher in later sown fields. Data show mean values and standard deviation of two subsequent years.

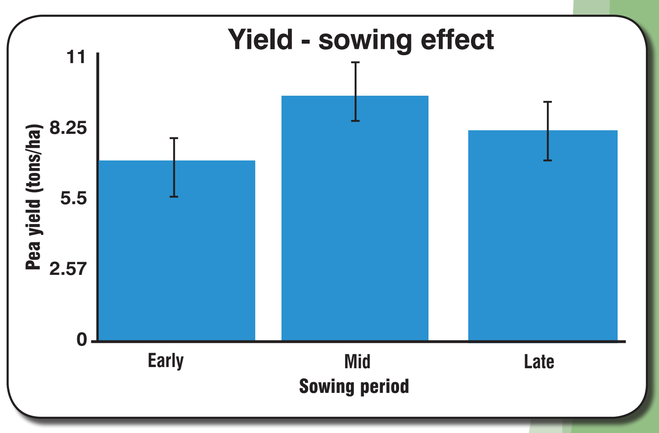
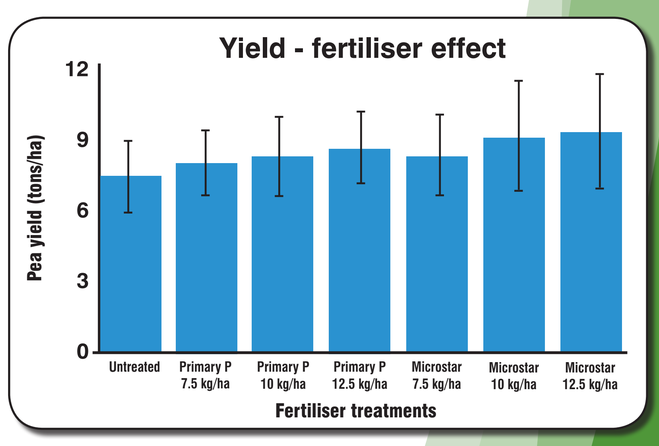


Figure 3:
Vining pea yield from field plots fertilised with 7.5 kg/ha, 10 kg/ha or 12.5 kg/ha of either Primary P® or Microstar®. Higher fertilisation rates of both fertiliser types tended to increase vining pea yields. Data show mean values and standard deviation of two subsequent years.



Conclusions

- The size of rhizobial populations was not influenced by the application of starter fertilisers - phosphorus did not stimulate rhizobial numbers and nitrogen did not supress them
- Higher rates of starter fertilisers both with and without nitrogen tended to improve yields - starter fertilisers are not very costly and a pea yield increase of greater than 73 kg/ha will result in an economic benefit for pea growers
- Later sown crops had greater numbers of rhizobia in soil and higher yields than early sown crops – growing conditions were better later in the season in both years

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