Rhizobia and starter fertiliser

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N applications essential

Agricultural artificial N requirements

- Haber Process
- 450 million tonnes
- 3-5% of the worlds natural gas
- 2% worlds annual energy supply
- Without N from 1900 to 2000 would need 4x more land.
- Cultivated land would need to claim approx. 50% of all ice free continents

What is “Nitrogen Fixation”

- ***Biological***: The conversion by certain soil microorganisms, such as *Rhizobium spp*, of atmospheric nitrogen into compounds that plants and other organisms can assimilate.

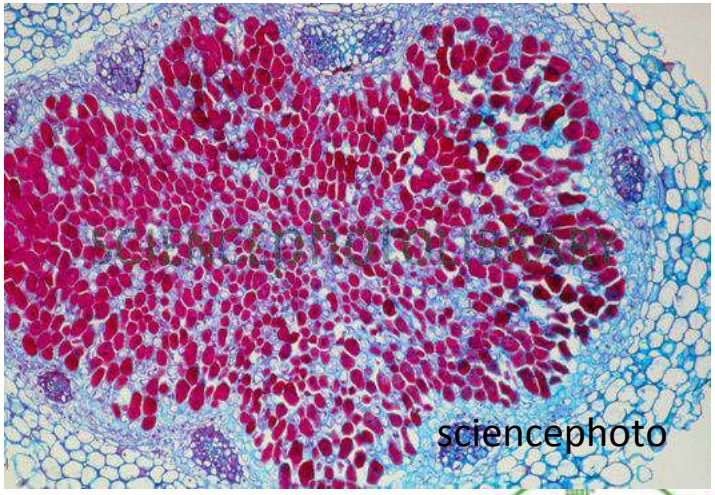
- ***Chemical***: application of ammonia

Rhizobia

UK peas and beans have no artificial N requirement.

Nodules on bean roots

Biological nitrogen fixation – most efficient way to supply nitrogen to legumes



Inside a nodule - leghaemoglobin

- Pea yields have reached a plateau in many areas over recent years.
- Are there other opportunities to boost yields?
- Don’t need N BUT…phosphorus very important.
- Starter fertilisers? Inoculate?

Some factors affecting rhizobial success.

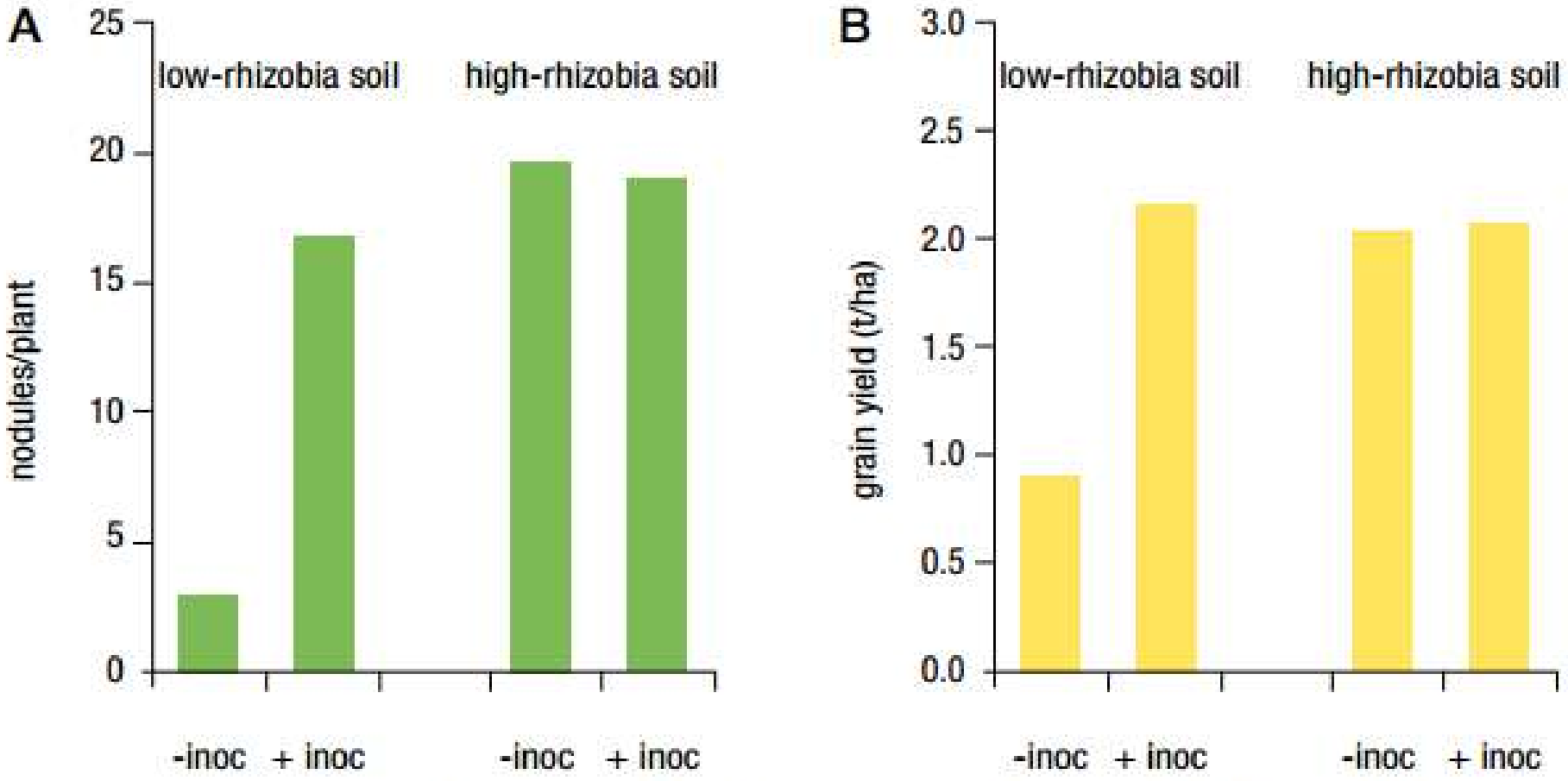
- French work has shown that about ⅓ of the R. leguminosarum strains recovered from some soils were ‘fixminus’.
- Some are unable to nodulate and can outnumber symbiotic strains.
- Genotype specific!
- Rhizobia can produce phages and toxins.
- Predatory protozoa

Benefit from inoculation when…..

(i) efficient rhizobia are absent

(ii) if superior inoculant strains are used which are able to outcompete the indigenous strains.

FIGURE 1 **Effects of inoculation on (A) nodulation and (B) grain yield of faba bean in low-rhizobia and high-rhizobia soils.**



Note: Data aggregated from 18 experiments in the National Rhizobium Program (NRP) across WA, Victoria and NSW during 1997–2003

Benefit from inoculation when…..

(i) efficient rhizobia are absent

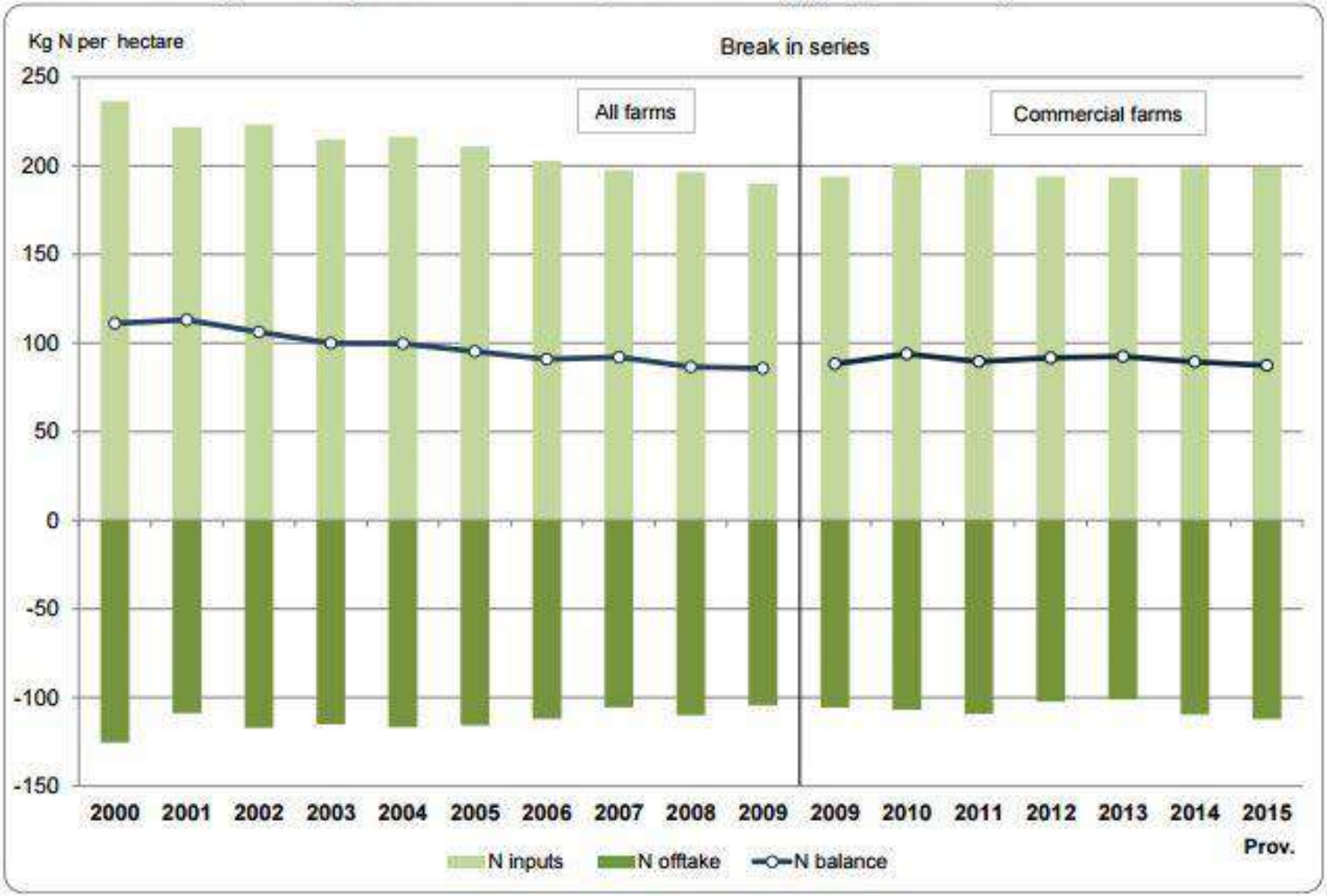
(ii) if superior inoculant strains are used which are able to outcompete the indigenous strains.

Is there a role for starter N?

- Use of low levels of N to overcome any limitations during early growth.

- If >20-30kg/ha N, seldom see a response.

Chart 1: Summary of nitrogen balance for UK, 2000 to 2015 (kg N per hectare)



Soil Nutrient Balances, DEFRA 21st July 2016.

Is there a role for starter N?

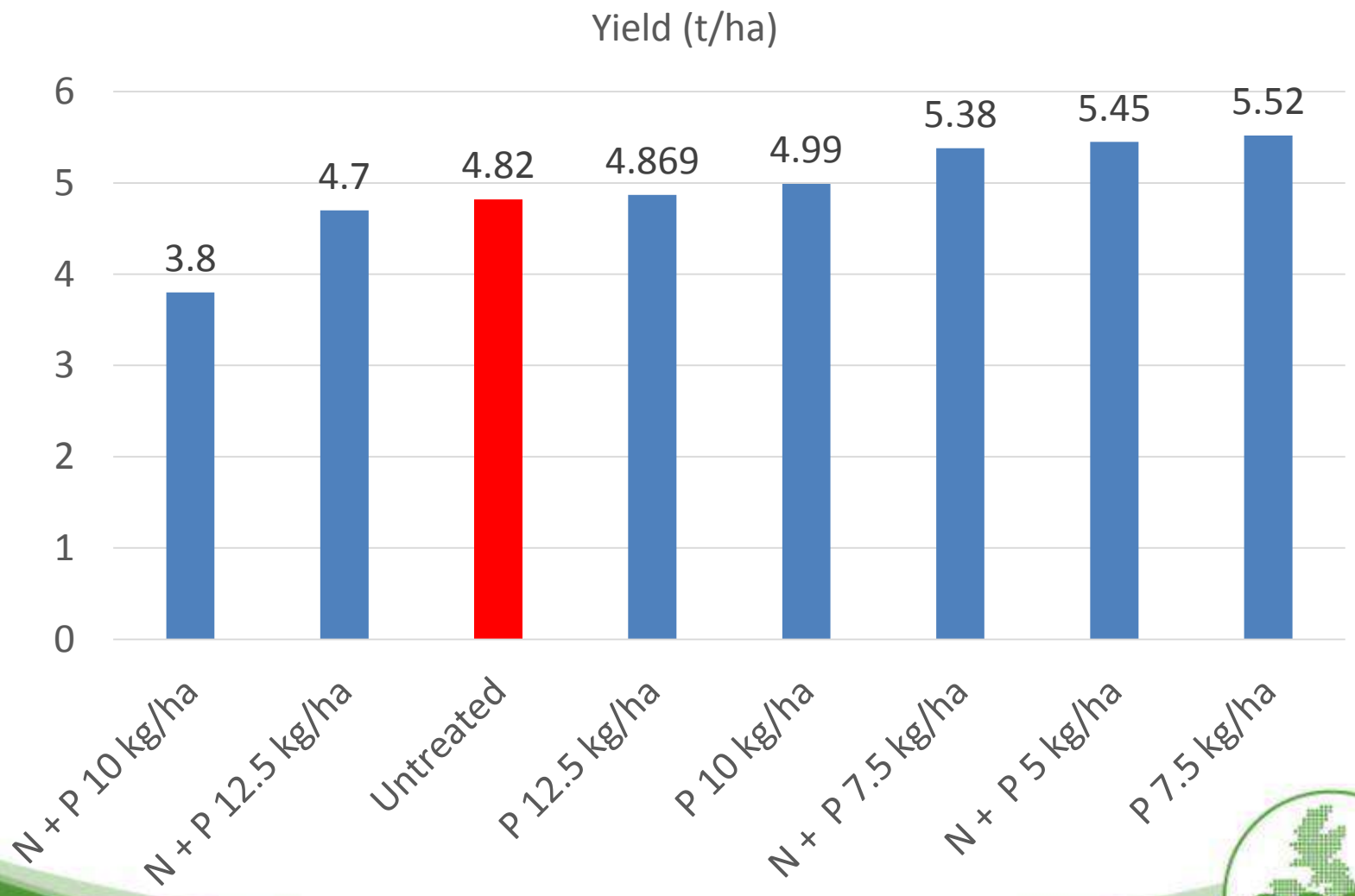
- Use of low levels of N to overcome any limitations during early growth.
- If >20-30kg/ha N, seldom see a response.
- Excessive available N decreases levels of nodulation, can increase vegetative growth and negative impact yield impact.

Overview of starter fertiliser findings

CROP	C. peas			S. Beans			S. Beans			Vining pea			Most
Rates (kg/ha)	5	10	15	5	10	15	5	10	15	5	7.5	10	beneficial
Yield (+/-%)													
N + P	2%	26%	**-22%**	**-12%**	**-9%**	**-6%**	23%	15%	20%	9%	**-6%**	2%	10kg, 5kg
P	17%	5%	5%	**-7%**	**-7%**	**-9%**	19%	24%	28%	**-1%**	**-0.5%**	0.2%	5kg, 15kg
P INDEX		2			2			2			3		
K INDEX		3			3			2-			2+		
Significant		NO			NO			NO			NO		

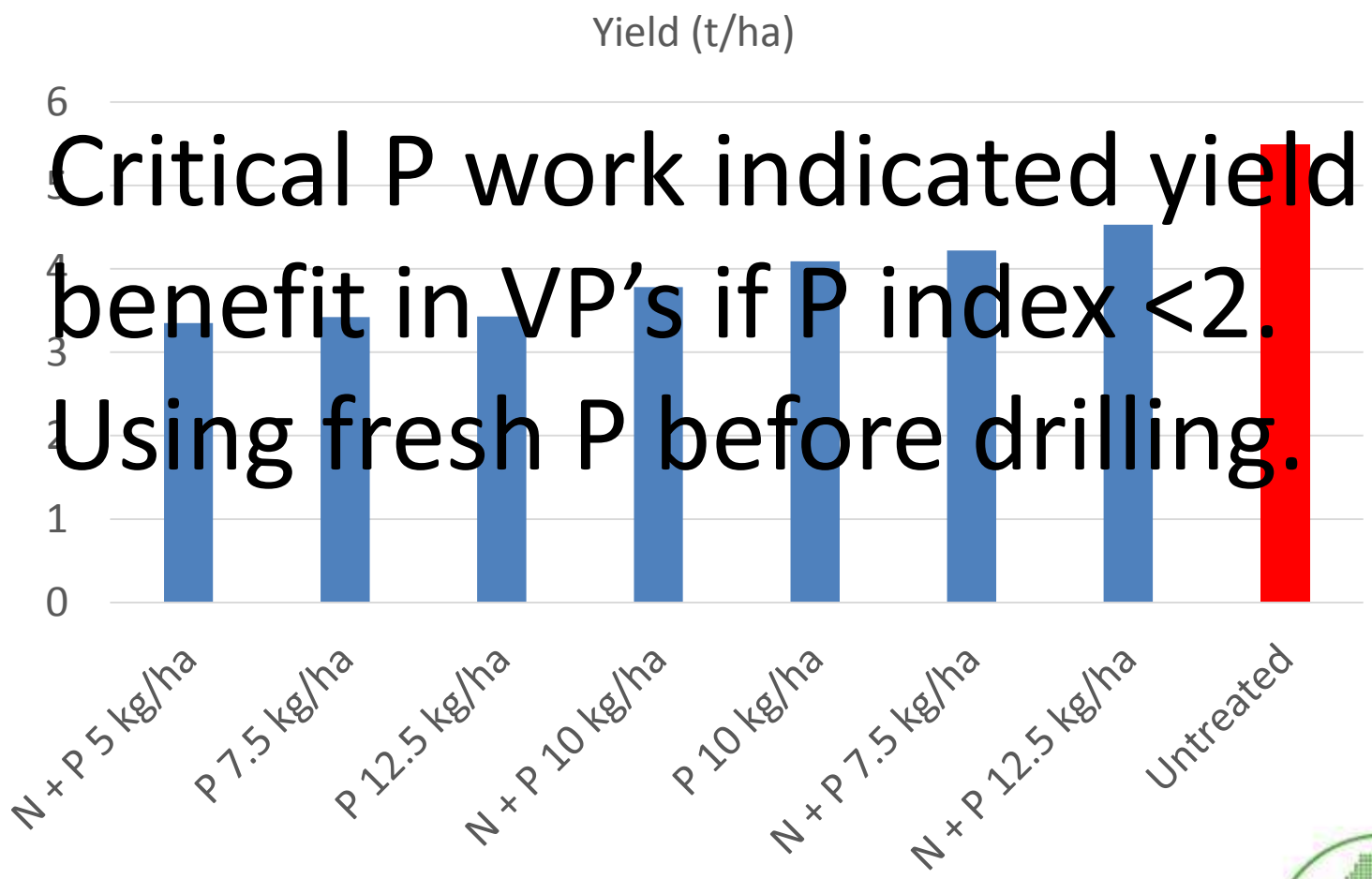
P index 6
K index 3

Vining pea yields 2016 – Trial 1



P index 1
K index 3

Vining pea yields 2016 – Trial 2

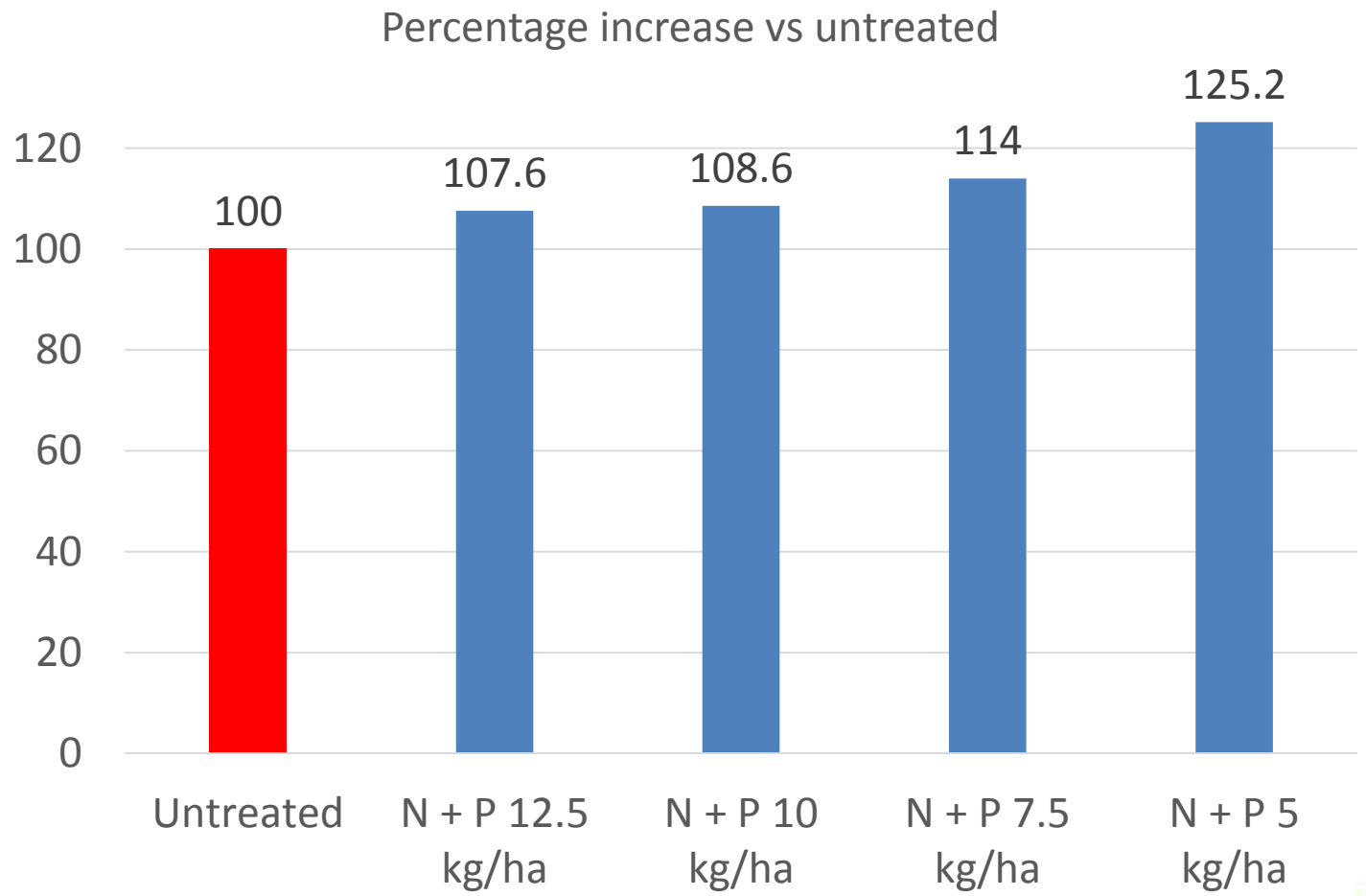


Critical P work indicated yield benefit in VP's if P index <2.

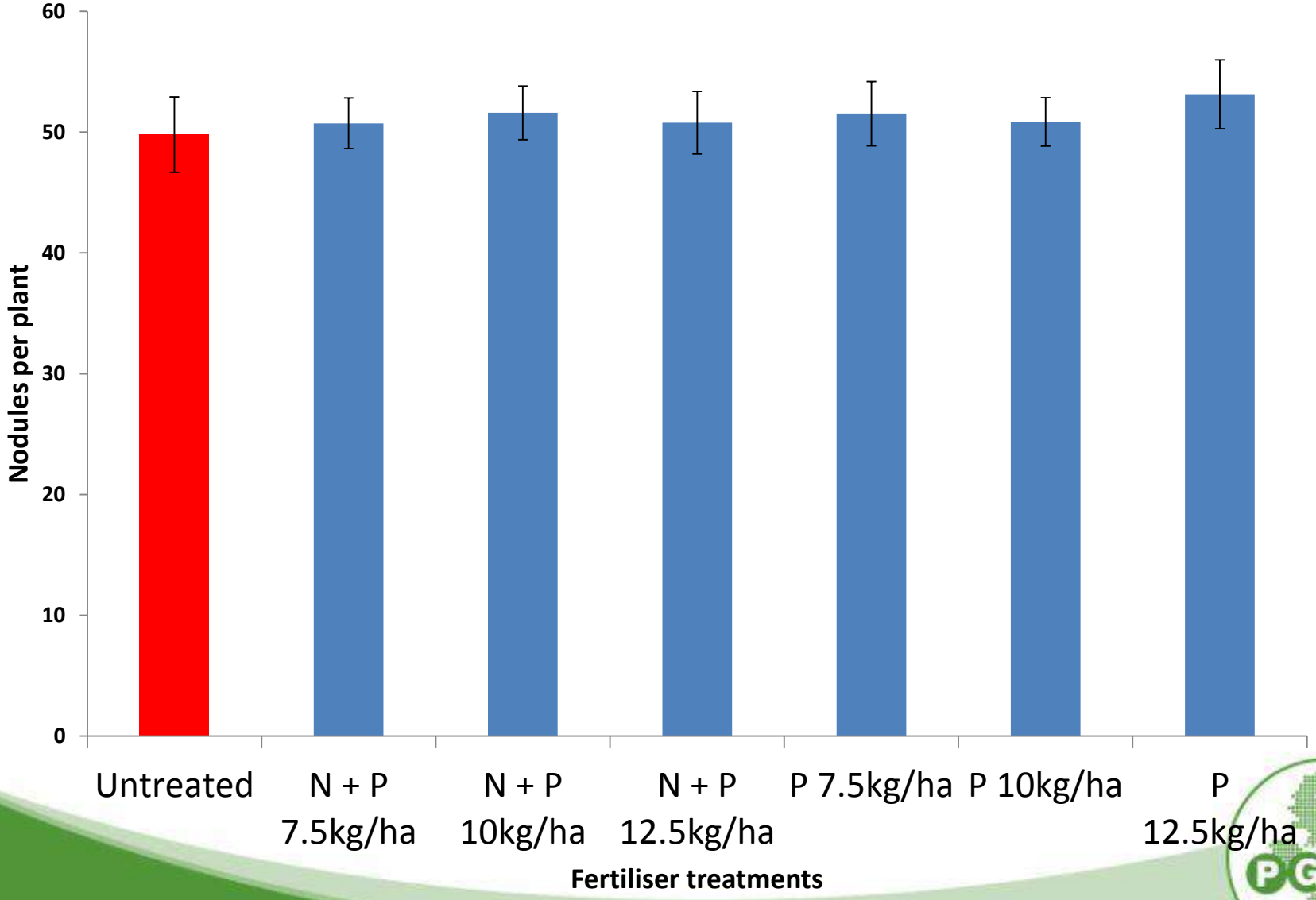
Using fresh P before drilling.

Spring Bean yields 2016 - Newborough

P index 3
K index 3



Fertiliser effect on rhizobia



Summary

Field trial results with starter fertilisers are inconsistent.

Yields can be increased and cover costs but……

Best rates to use difficult to pin down

Products not detrimental to crop

Thank you

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