SEED PHOSPHORUS EXPLAINED
And the Essential Role that BSN Seed Primer Plays

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What's in this Insight

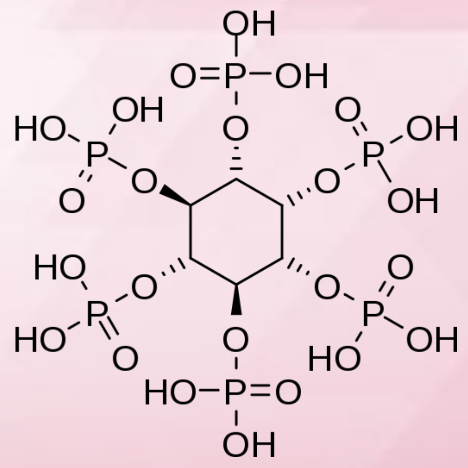
This Insight explains in detail exactly how seed phosphorus is constructed, and outlines both the essential role and beneficial outcomes that can emerge with the use of **BSN** Seed Primer in a range of cereal crops.

What is Seed Phosphorus ?

Phytic acid or inositol hexaphosphate (C6H18024P6, molecular weight 660) is the main storage form of phosphorus in crop seeds. The product forms from the reaction of inorganic phosphate with a cyclic sugar called inositol (C6H1206), during grain fill.

Phytic acid forms some 1% to 1.5% of seed weight*, about 70% of total phosphorus content of the seeds. For example, taking 4-kg of phosphorus in a tonne of wheat grain, the P as phytic acid is equivalent to approximately 3-kg. This phosphorus is not available for germination at early stages, and is also unavailable to human and non-ruminants.

**the phosphorus content of phytic acid is 28% based on weight of 6 atoms of phosphorus in a molecule of phytic acid. (6x31/660x100 = 28%P).*



How does it Work ?

Phytic acid releases its phosphate when broken down by the enzyme phytase, which is released by rumen bacteria in ruminants.

Human and non-ruminants like pigs and chickens do not have this enzyme and the phytic acid escapes their body and pollutes the water systems causing environmental problems. The phytic acid in such cases also acts as an anti-nutrient, by binding (chelating) with important cations and proteins in the alimentary tract. This lowers the bio-availability of minerals and proteins.

Some benefit (e.g. as an antioxidant) has been attributed to phytic acid as well.

Another aspect of phytic acid is its role in seed germination.

The higher the phytic acid level in seed, and the lower its rate of breakdown during germination, the lower the available phosphorus is (e.g. inorganic or super-type phosphorus) for seed germination.

As the following table shows some of the phytic acid breaks down during seed germination, however high quantities of phytic acid still remain intact in the seed to prevent considerable utilisation of the phosphorus, even 72-hours after germination.

The table shows that :

- in the case of oats, lupins and rapeseed, practically no inorganic phosphorus is released from phytic acid during germination for up to 72-hours
- in the case of wheat and barley, 31% and 18% respectively of phytic acid is broken down.

PHYTIC ACID CONTENT
(g/100g of fry matter)

CROP	Untreated	Soaked	Germinated		
			24 hours	48 hours	72 hours
Barley	1.01	0.95	0.86	0.80	0.82
Wheat	1.03	1.04	1.12	0.79	0.69
Oat	0.88	0.88	0.92	0.92	0.94
Rye	0.79	0.62	0.71	0.44	0.47
Lupin	0.67	0.74	0.68	0.68	0.63
Rapeseed	1.52	1.68	1.61	1.66	1.47

Trial data from I. Egli et al (2002). Journal of Food and Science – Vol. 67 No. 9

How BSN Seed Primer provides an Essential Service

The results shown on the above graph highlight just how significant the action of priming the seed with **BSN** Seed Primer can be. With its high phosphorus content and penetrating ability to become available during the very first days of germination, where sensing of inorganic phosphate by the embryo influences yield potential.

It is interesting that Dr Bolland from Agriculture WA has shown that in lupins (an inefficient species to utilise phytic acid), the yield potential is higher when seed phosphorus reserve is higher. Dr Bolland concludes that this yield response is observed regardless of phosphate fertiliser rates, emphasising the link between the seed phosphorus reserves and yield potential.

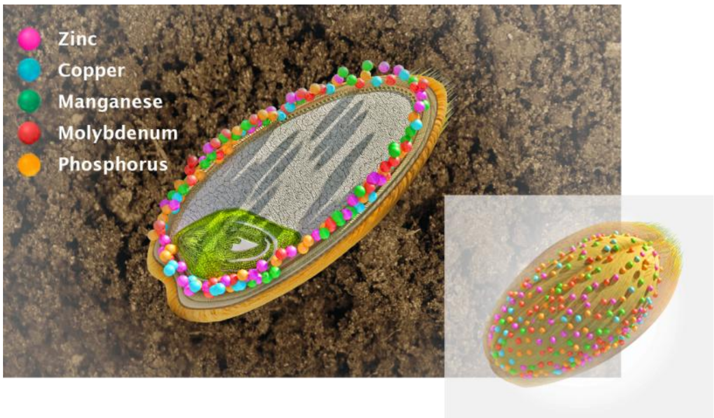
Seed phosphorus level directly relates to yield potential

At the start of germination, the inorganic phosphate reserve of the seed is important in the sensing of the embryo to take its course for maximum yield potential.

As some 70% of the seed phosphorus in the cereal is in organic form (i.e. phytic acid), and not detectable at the early stages of germination by the embryo, the priming of cereal seeds with **BSN** Seed Primer increases the inorganic fraction of the seed phosphorus by 2 to 3 folds depending on seed phosphorus content that varies generally from 2 to 4 kg/tonne of seed. As inorganic phosphorus is only 10% of total seed phosphorus and **BSN** adds over 0.5 kg of inorganic phosphate to every tonne of seed, the increase in available phosphorus of the seed by **BSN** treatment is generally more than 100%. This therefore signals a much higher yield potential to the embryo from the commencement of germination.

An observation most often made with **BSN** primed seeds is an increase in root surface area and general seedling vigour and health soon after emergence. This is the ideal 'platform' upon which the higher yield potential can be managed through to harvest.

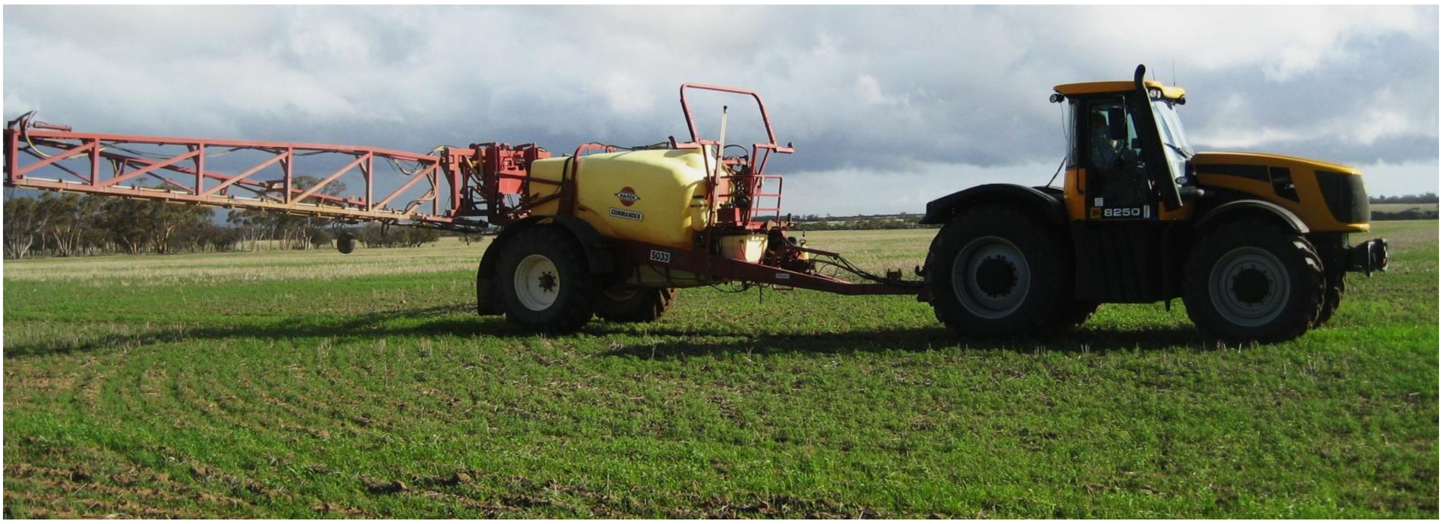
This figure illustrates.



Conclusion

The importance of phosphorus to the cycle of plant establishment, growth and ultimate yield is accepted and generally understood. What sometimes isn't known, is how all this 'happens', and how the process – so vital for an ongoing productive food cycle – can be enhanced with a value-adding process such as seed priming.

BSN Seed Primer has been tested and trialled over many years and has hundreds of proven performance results from across many countries and climates and for a vast number of crop types. Cereal crops especially, benefit from seed priming and the results can be viewed here.



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