

Trial 12

CHEAP NITROGEN MAKING LEGUMES WORK HARDER

How much do you pay for nitrogen

You cannot turn "mud into money" without nitrogen. If levels of available soil nitrogen are low then what sort of nitrogen do you add. The choice is between fertiliser N, legume inoculant or organic matter (compost, manure, mulch, etc) or a managed combination of these inputs. The costs is obvious for fertiliser N but not so obvious for legume inoculant . Just how much N can be added by legume inoculation? More recent on-farm trials by the CSIRO have consistently produced up to 400kg N / ha / season. This is equivalent to about one tonne of urea for the price of one pack of inoculant in other words inoculant can be about 100 times cheaper as a N input. Even if inoculant produces 100 Kg N/ha/ season you are still getting N about 25 times cheaper. As a general rule expect 100 kg N/ha/season for grain legumes and 40 Kg N/ ha/ season for legumes pastures. How do you achieve this return on inoculation every time, given a good season? The secret lies in understanding what is going on. It is not as simple as throwing on fertiliser.

How to maximise nitrogen fixation

Remember, legumes DO NOT fix nitrogen. Rhizobia fix nitrogen. So if you have no rhizobia or the wrong rhizobia then there will be no nitrogen fixation. If the legume cannot find the right rhizobia then it will use up soil nitrogen just like any other plant. In the majority of cases, because crop and pasture legumes are not native to Australia, it is essential to add high numbers of the correct rhizobia.

Many lucky farmers find inoculation inconvenient and often do not see why it is necessary. This is because of a lack of good advice in times. Managed properly, inoculation can be very rewarding financially and at the very least is cheap insurance.

The active ingredient in legume inoculant is Rhizobium bacteria at a minimum concentration of 1000 million live bacteria per gram. The target or site of action for inoculation is the tip of the emerging root just after germination. The idea is to place as many of these bacteria as possible ALIVE around the seed at germination so that the emerging root through the bacteria. This is when nodules are first initiated.

Nitrogen fixation can be managed to maximum efficiency by following a few rules:

1. Only sow inoculated legumes into soils low in available N. Never sow a legume after legume. Thus applies particularly when sowing after a legume pasture.
2. Inoculate legumes every time they are sown. You cannot over-inoculate and nodulation failure is costly.
3. Keep the rhizobia alive inoculation will not work unless the right sort of rhizobia are present in high numbers around the seed when it germinates.
 - a. Check the expiry date on the pack before you buy. Inoculant stored in a fridge will be fresher
 - b. Store packs in a fridge before use but do not freeze
 - c. Sow as soon as possible after inoculation into moist soil. Do not dry sow.
 - d. Do not expose rhizobia to direct sun, high temperatures, toxic chemicals or acidic fertilisers.
 - e. Do not use chlorinated water
 - f. When lime pelleting use finely ground limestone (calcium carbonate) not other forms of lime.
4. Rhizobia for pasture and some grain legume and some grain legumes (field peas, faba beans) do not survive acidic soils with a pH less than 5 (CaCl₂), in this case seed must be inoculated on every sowing and pasture seed should be lime pelleted. Plastide is not recommended.

What happens to nitrogen fixed by rhizobia

If rhizobia can fix up to 400 Kg N/ ha/ season then where does it go? This nitrogen is transported from within root nodules to all parts of the plant to be used as required. With a green manure crop the fixed nitrogen trapped in the legumes are often used for green manure. Because grain legumes concentrate most of their nitrogen into grain there is relatively little (say 10 %) left behind after to be returned to the soil. Hence pasture legumes are usually better for building soil nitrogen reserves.

Trouble Shooting

To see if inoculation is working try to leave a row uninoculated. Be careful to keep the row well away from inoculated rows otherwise the rhizobia may wash across. Also watch out for inoculant left behind on equipment used during sowing.

Another way to see if inoculation is working is to simply throw a handful of urea onto a path of inoculated legumes. If they show a growth response then nitrogen fixation is not working to maximum efficiency.

Remember, if you are not receiving a high return from inoculation then there is something wrong. The reason should not be hard to find if you know where to look and ask the right questions.

Simple tools or "ready reckoners" to help farmers measure and manage nitrogen fixation are not available as yet. However, the CSIRO, with GRDC support, is currently engaged in such a project . Contact Mark Peoples (06 2465244) or Bob Gault (06 2465148) for further information.

For technical detail on inoculation refer to "Rhizobium Tech Notes" numbers 1 to 9 available through IAMA dealerships or from Inoculant Services Australia Pty Ltd, RMB 8340, Wodonga, 3691, Alternatively, phone 060 264437 or fax 060 264524 for free advice.

Inoculum Demonstration

Aim: To demonstrate the effect of inoculating chickpeas

Results:

Desavic chickpeas uninoculated 1.11 t/ha	Desavic chickpeas inoculated 2.04 t/ha
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Interpretation: throughout the season the inoculated chickpeas looked much better and this carried through to harvest. In paddocks where chickpeas have not been sown before it is essential to sow inoculated seed.

Commercial Practice: on alkaline soils it is not necessary to inoculate chickpeas each time chickpeas are sown (after the first time when it is essential!). How many years the chickpea rhizobium survive in the soil is not known.