The efficacy of rhizobial inoculants when sowing pulses into dry soil

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With a push to increase the area of pulses cropped in areas traditionally considered "marginal" comes new challenges. One of these challenges in less reliable rainfall, to help manage this risk farmers often look to dry sow legumes to better manage time demands around sowing and ensure early establishment of crops. However, where legume inoculation is required, there remains a need to improve inoculation guidelines.

A series of greenhouse and laboratory experiments were completed to determine the survival of rhizobia under simulated dry sowing conditions. The three different rhizobia strains assessed (chickpea -Group N strain CC1192, faba bean-Group F strain WSM1455 and lupin-Group G WU425) all had similar survival rates when applied as peat slurry on seed and sown into a dry acid soil (0.5%w/w, pH_{Ca} 4.9). Numbers decreased tenfold between 24h and 14 days post sowing. Factors such as soil type, moisture level, temperature, inoculation rate and seed chemical dressing (P-Pickle T®) impacted on the survival of bean rhizobia on seed.

Seven field trials were conducted at four field sites in South Australia in 2017 and 2018 to assess the efficacy of a range of inoculant carriers when sown into dry soil. Three trials included multiple times of sowing (ranging from 0-4 weeks in dry soil (<2% w/w) and another three trials included different inoculant rates (peat on seed). Crop differed with site and included faba bean, lupin, chickpea and field pea. Nodulation (number and/or weight per plant), shoot and root dry weight was measured 10 weeks after crop emergence, peak biomass, shoot % N, %Ndfa (N derived from atmosphere – 15N natural abundance technique, Unkovich et al. 1997) was measured at mid pod fill and grain yield.

Standard inoculation (peat slurry on seed) practices did not provide satisfactory nodulation, especially where extended dry conditions (>2 weeks) were combined with other stresses such as low pH. Doubling the rate of peat slurry inoculant applied to seed significantly improved nodulation of bean, lupin and chickpea when sown into dry soil. The performance of granules varied with carrier and year, however granule formulations that delivered high numbers of rhizobia (>400,000 cells/ seed equivalent) improved nodulation of pulse crops under extended dry sowing conditions.

Ref: Unkovich MJ, Pate JS and Sanford P, 1997, Nitrogen fixation by annual legumes in Australian Mediterranean agriculture, Aust. J. Agric. Res. 48, 267-93.