1990

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DEEP BANDING PHOSPHATE FOR LUPINS

1990 RESULTS

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Deep P banding again produced some spectacular results in 1990.

There is no doubt that deep banding is the only effective way to provide an efficient supply of phosphorus for lupins in the eastern wheatbelt. Drilling phosphate with the seed is not as effective as deep banding, but worst of all is the practice of topdressing before seeding. Farmers contemplating topdressing yellow sandy loams should send their fertilizer cheque to me instead. I will return it next January. Getting your money back will be a better return than you will get from topdressing super (see Figure 1). While spectacular responses continue to occur in the eastern wheatbelt, responses in other areas have been inconsistent. Some trials have shown large yield responses to banding, others have not. Results from some farmers two-pass-operation paddock scale trials have been as large as those achieved in Department of Agriculture trials. Generally, where responses to deep banding have not occurred, there has also been no response to phosphate.

Lighter sands in medium and higher rainfall areas show huge responses to banding where the soil P level is low. However responses have been low, or non-existant on older land. In almost every trial in which there was little or no response to banding, lupins failed to respond to any phosphate at all. Establishment problems sometimes occurred in drying soil conditions in a two-pass banding system. In some trials manganese, and possibly potassium deficiencies induced by superphosphate application, reduced yields as P rate increased, irrespective of the method of application.

Deep banding necessitates cultivation. However, any lupin yield responses can usually be attributed to placement of the super and not to the cultivation while deep banding. Fifty three trials from 1981 to 1990 have compared lupin yields from direct drilling against seeding after cultivation, or with deeper cultivation while seeding. On average there has been no yield difference, with an average yield of 1.42 t/ha. There have been many cases of improved vegetative growth from cultivation without increasing grain yield.

Lupins have responded to deep banding of plain super, double super and TSP (Figures 2 and 3).

Wider row spacings are a real possibility for lupins when P is banded below the seed. This has significant benefits for seeding into stubble to greatly reduce brown leaf spot disease. We had thought that disease spore splash could be worse with wide row spacings. This was tested in one trial, in the absence of stubble in order to maximize disease. The resulting leaf disease was the same for the 18 cm and 36 cm row spacings when the same seeding rate a hectare had been used.

The average yield from ten results comparing row spacings was 1.28 t/ha for normal spacings and 1.33 t/ha for wide spacings (see Figures 4, 5 and 6). Possible problems with wide spacings are weed control, and CMV. Aphids may be more attracted to wider spaced rows and there may be less shading and therefore better survival of seed-infected plants. By maintaining the same rate of seed and fertilizer a hectare there are twice as many plants growing over twice the concentration of fertilizer banded below each seed row. This

may even result in more shading, however until more research is conducted, seed with a zero CMV test should be used. The research with wide spacings has only been conducted in the medium and low rainfall areas.

Glen Riethmuller is to carry out more research on tined machinery capable of banding in a one-pass, stubble retention system. Wide spacings are an obvious choice, although stubble handling with tines at any spacing is improved with narrow points digging deep in a banding operation. Wider points, working shallow, tend to pull out wheat root-crowns (especially on previously deep ripped paddocks) and blockages occur. Stubble handling at seeding really begins during the wheat harvest where straw must be cut short, chopped and spread or harvested diagonally to next years seeding to give a better trash flow. Glen's research will aim at accurate depth of the phosphate band under varying soil moisture and soil strength conditions. Not an easy task!

The following are some of the trial results, including farmers' paddock trials, from the 1990 season.

° Carrabin trial (90SC1) (Figure 1). A new-line variety, 430, (related to Gungurru). 100 kg/ha super banded yielded 0.25 t/ha more than 750 kg/ha of super topdressed. The topdressed yield was 1.16 t/ha. Banding 750 kg/ha super yielded 2.47 t/ha.

° Carrabin trial (90SC21) (Figures 2, 3, 5 and 6). Gungurru. History of 1000 kg/ha super in the last three years. There was a large yield advantage (up to 700 kg/ha or 85% more grain) from banding compared with drilling with the seed from all P rates tested. Wide spacing yielded equal to narrow spacing (36 cm vs. 18 cm) when fertilizer was banded below the seed, however toxicity occurred at high rates drilled with the seed on wide spacings. TSP was slightly better than super at the higher rates (lower toxicity perhaps).

° Carrabin trial (90SC12) (Figure 4). Gungurru. Super history of 1000 kg/ha in the last three years.

Table 1. Lupin yields from 200 kg/ha of super drilled or banded (12 cm deep) at two row spacings

Lupin yield (kg/ha)			
18 cm row space		36 cm row space	
Drilled	Banded	Drilled	Banded
630	1240	700	1430

° Carrabin (88SC28). Banding deep in the wheat year produced double the lupin yield the following year compared with drilling in the wheat year. However banding in the lupin year by far outyielded any residual value treatment.

° Banding directly below the lupin seed was only 6% better than deep banding between the seed rows in one trial. However, other observations have shown the best potential yield results from placement of the fertilizer directly below the seed. Both deep placements were over 50%

higher yielding than where P was drilled with the seed and over 200% better than where P was topdressed. Farmers two-pass systems, where the seed is not necessarily directly above the fertilizer, have given reported yield increases of 480 kg/ha (30% more grain) at Wongan Hills and 400 kg/ha (30%) west of Moora, over large areas. Other farmers reported good responses from test strips of two pass operations. Responses to the banding were: Dowerin 50%; Quairading 30% on white sand and 50% on Tamma scrub soil; Belka 50%, Baandee 100%, Yelbeni 600%. At Yelbeni the drilled treatment was severely affected by brown spot, however the two-pass banded treatment did not suffer as much. Yields were only 70 and 540 kg/ha respectively from a mid April sowing.

- One of the most important results of the year come from a trial conducted by Mark Sweetingham on an old rotation trial site. Deep banding of P yielded 65% more than drilled P, and 160% more than topdressed P. These responses were consistent over the four disease levels of brown spot induced by the rotations (Table 2).

Table 2. Lupin yields from three methods of super application for four disease levels of brown spot

Rotation	Disease level	Lupin yield (kg/ha) Topdressed	Drilled	Banded
WLWLL	4	60	230	460
LWLWL	3	90	490	1020
WLWWL	2	540	730	1140
WWWWL	1	800	930	1350

- Lupin grain responses to banding were limited on heavier or duplex soils where lack of finishing moisture restricted yield.

- Wheat did not respond to phosphate banding when compared with drilling P with the seed. Seven trials at Wongan Hills, Beverley, Merredin and Carrabin showed no wheat yield response to deep P placement, apart from the effect of the cultivation. In 1989, nine trials produced the same result of no response to banding. The largest individual trial result gave a 10% yield increase however this was balanced by another result of a 10% reduction. One banding trial for wheat, conducted on new land in 1987 indicated responses could be possible (a 14% increase was achieved at one of the banding depths). However it appears this may have been a chance result, and generally deep banding of P does not increase wheat yields.

  Deep banding nitrogen fertilizers reduced the toxic effect of drilling with the seed, but did not outyield topdressed N. Agras drilled with the seed reduced early crop vigour at rates of 150 and 300 kg/ha at Wongan Hills. However the final yields were equal to those where Agras had been banded below the seed, and reached 4 t/ha.

- Peas - both trials at Carrabin gave good responses. In one trial, with an average rate of super of 230 kg/ha, yields were; topdressed 1.27 t/ha, drilled 1.55 t/ha and banded 1.81 t/ha (Figure 7).

- Wongan Hills (90WH73). There was a 320 kg/ha lupin response to banding compared with drilling on this site with a soil test of 30 ppm P. In other trials little or no response occurred, however tined machines far outyielded discs.

- Trials have indicated that lupins will respond to much higher rates of P than originally thought, provided it is deep banded. This is of course expensive. However, four trials which had lupins sown in 1989 were cropped to wheat with no fertilizer in 1990. They showed an additional return from the residual value of P, and from the N production during the lupin year. For example, at Wongan Hills, 200 kg/ha of super drilled in 1989 produced 1.1 t/ha lupins plus 2.2 t/ha wheat. 400 kg/ha of super banded in 1989 produced 2.2 t/ha lupins plus 2.8 t/ha wheat - a total grain increase of 1.7 t/ha over the two years.

  This concept of more super for the lupins (for lupin yield, residual value, and N production) and less super for the wheat, is to be further investigated.

- On Badgingarra light sands there was a 10% lupin response to banding in one old land trial, with a yield of 3.5 t/ha being achieved. Two other trials gave no response and trials at Esperance and Kojaneerup on deep white sand produced no response to banding, nor to any phosphate rate. These sites had soil P distributed down the profile. A Badingarra trial which had super topdressed, drilled or banded in 1989 on new land wheat, was sown to lupins in 1990. The residual value of the previous years banded super produced a lupin yield 200% better than topdressed, and 50% better than drilled. These results indicate super history and P distribution down the profile may be important if leaching sands, in higher rain areas, are to give banding responses. The super history appears to be irrelevant on high fixing soils in the mid and eastern wheatbelt as nearly all applied P remains near the surface.

- There was no response to banding nor to P application in the trials conducted by the Geraldton office. Yields declined as the super rate increased. The probable reason is an induced manganese or potash deficiency and this is to be further investigated in 1991. In 1989, Ken McCarthy's trial at Nangetty indicated that deep banding responses are possible on sandplain in the Geraldton area. Yield from banding was 17% better than from topdressing and 36% better than from drilling, however, plant density was low in all treatments and the best yield was only 940 kg/ha.

- Canola - a small (12%) yield response was obtained at Wongan Hills and warrants further research.

- Pastures have, up until now failed to show responses. However, an observation that serradella survived a false break at Carrabin only on the area which had P deep banded the previous year could be extremely important. Similarly, self sown lupins only survived on previously deep banded plots, indicating that seeding on very early rains could be less of a risk if establishment is directly above deep banded phosphate.

Numerous trials will be commenced around the State in 1991, as well as existing trials being re-sown to investigate long term residual effects.

Researchers and farmers conducting trials with deep phosphate banding should ensure other nutrients (particularly manganese) are adequate. Preferably two rates of P (normal and high) should be tried. A nil P rate must also be included to indicate that the site does respond to phosphate.

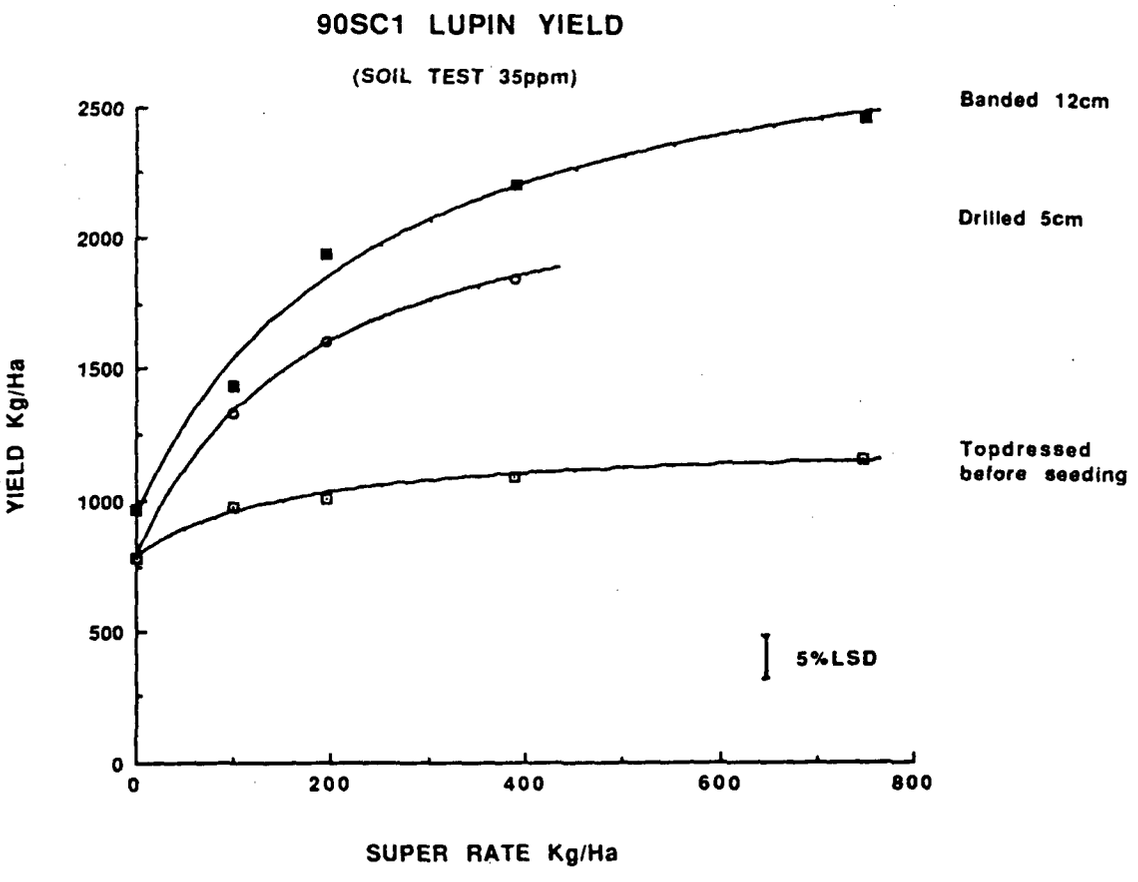
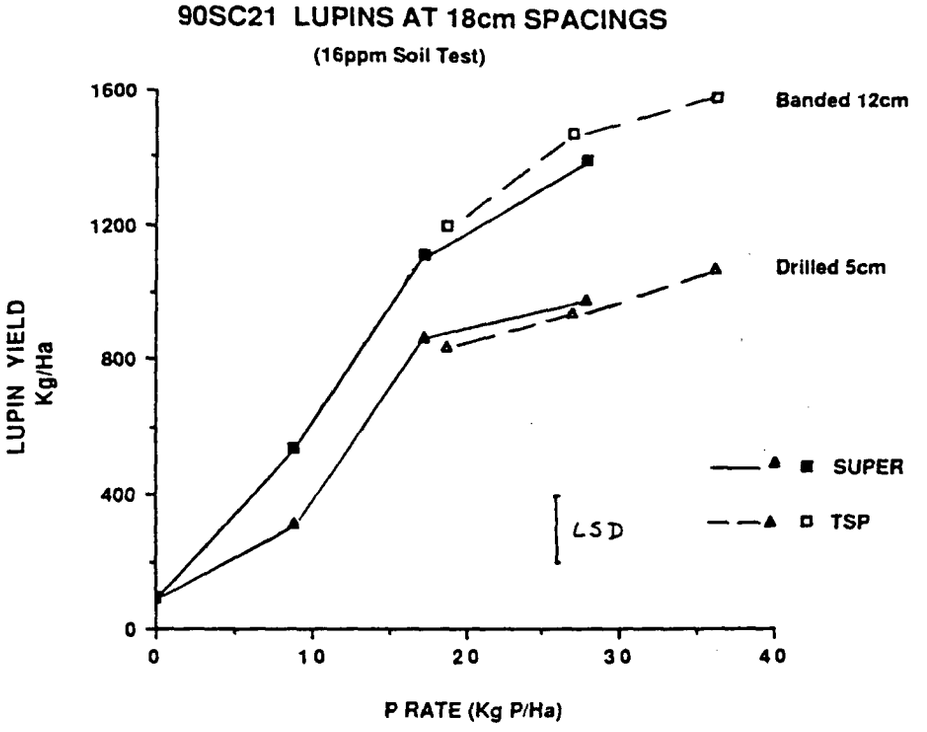
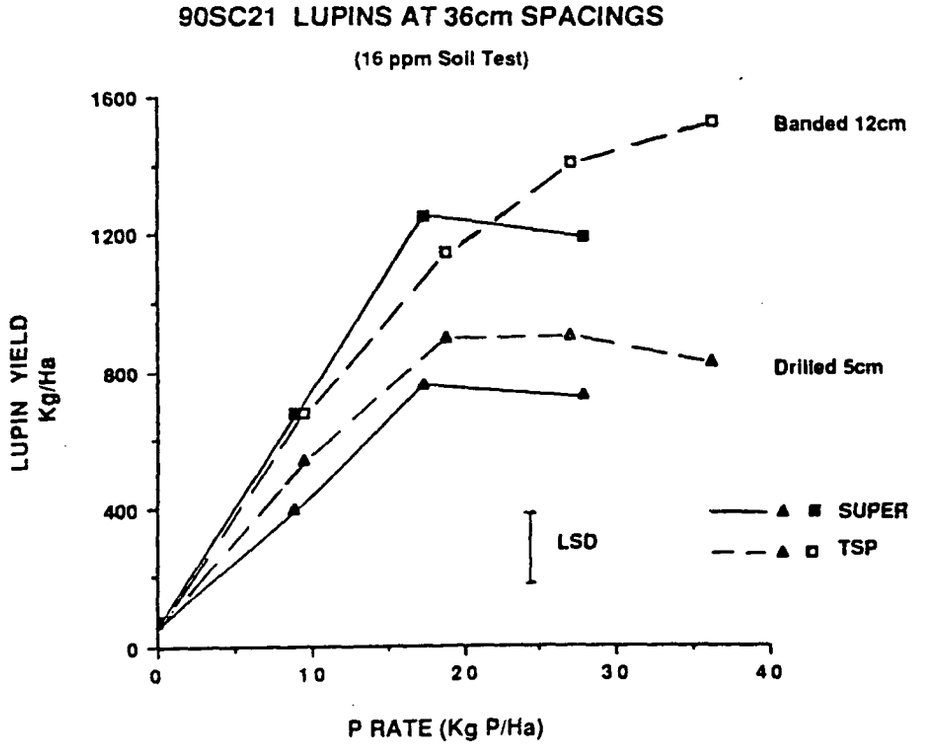


Figure 1. Lupin grain yield responses to application of super rates by three methods.





Figures 2 and 3. The effect of P source (super or TSP) on lupin grain yield when banded or drilled at two row spacings (20 kg P/ha is 220 kg/ha super or 102 kg/ha TSP).

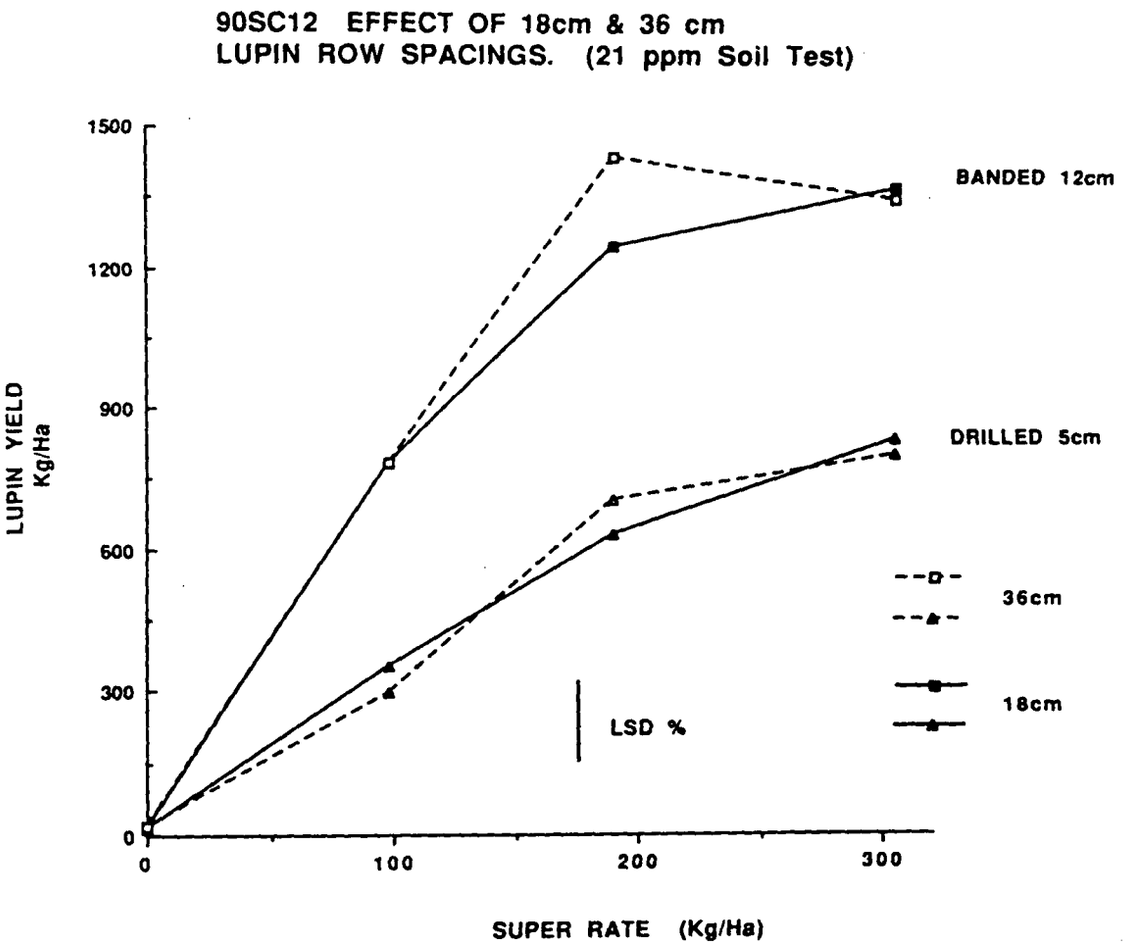
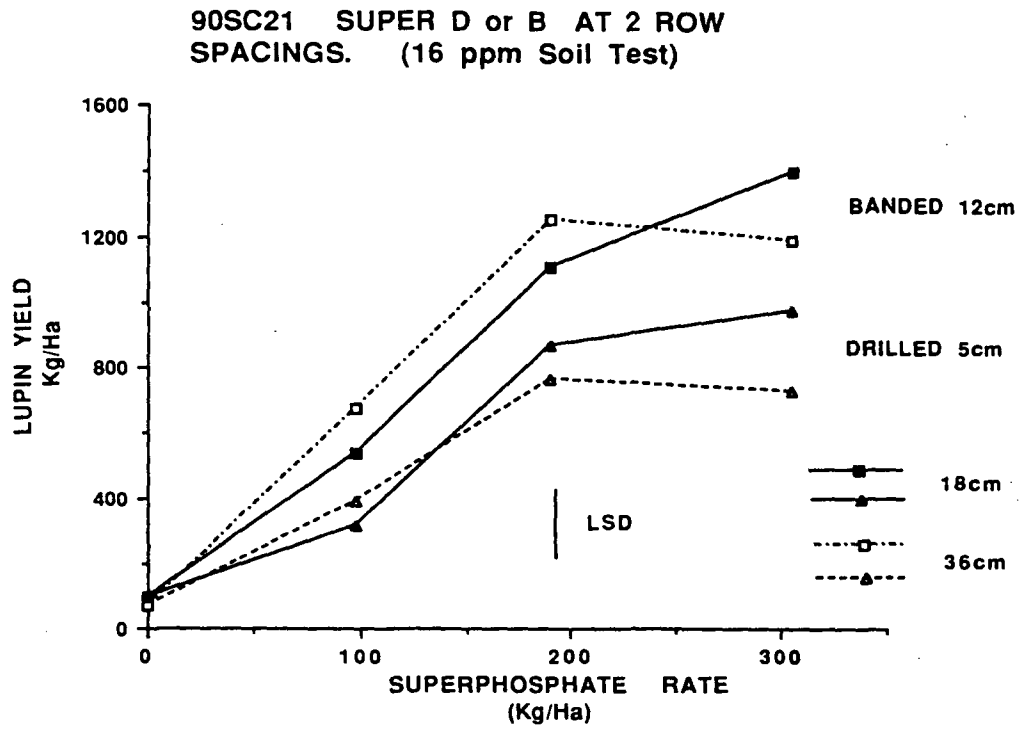
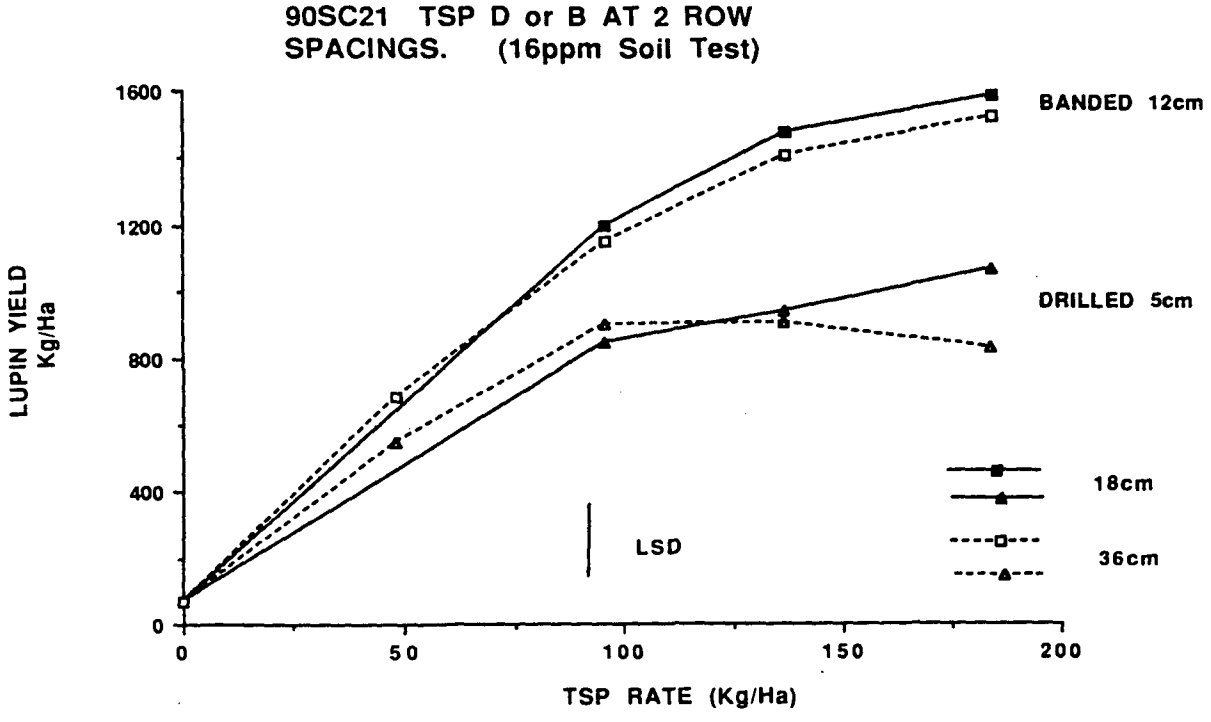


Figure 4. The effect on lupin yield of rates of super banded below, or drilled with the seed at two row spacings.





Figures 5 and 6. The effect of row spacing on lupin grain yield with banded or drilled super and TSP.

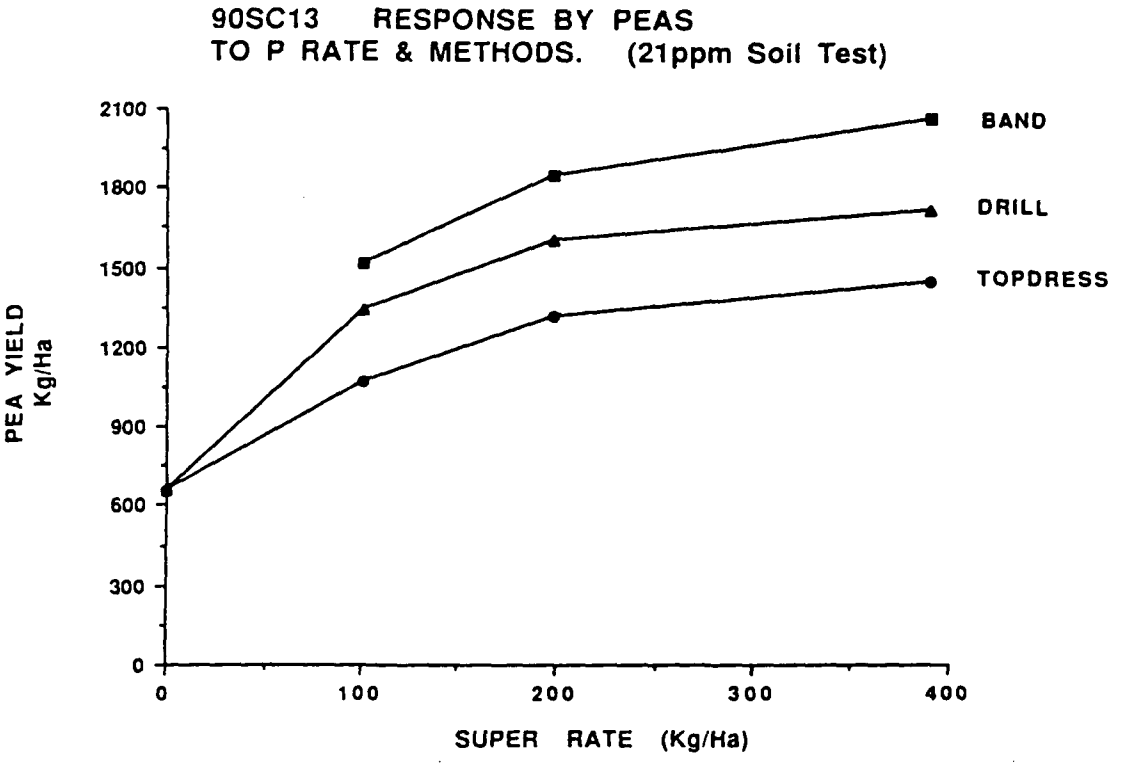


Figure 7. Pea yield responses to application of super rates by 3 methods.