

## **The effects of defoliation, flower removal, applied nitrogen, and partial nodule removal on nitrogen fixation and regrowth of phasey bean**

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Severe defoliation is detrimental to regrowth of pasture legumes, an effect associated with reduced carbon assimilation and symbiotic nitrogen fixation. It is generally assumed that nodule detachment, stubble leaf removal and retention of developing pods on the stubble suppress nitrogen fixation and regrowth, but there are few published data to support these assumptions. This paper examines the effects of high and low level cutting, applied nitrogen and the removal of pods, nodules and stubble leaves on nitrogen fixation and regrowth of phasey bean.

### **Methods**

Plants of phasey bean (*Macroptilium lathyroides* cv. Murray) were inoculated with *Rhizobium* CB 756 and grown to early flowering in a nitrogen-free nutrient solution. They were then cut at the fourth or eighth node or left uncut, retaining leaf areas of 8, 70 and 229 cm<sup>2</sup> per plant respectively. The effects of the following treatments on nitrogen fixation and regrowth were then investigated:

Removal of all residual leaves on 4-node stubble (on which no racemes were present) and 8-node stubble on which one or two racemes were present.

Removal of all flowers and flower buds remaining on 8-node stubble with or without residual leaf removal.

Three applications, 10 days apart, of 150 11M nitrogen (as NH<sub>4</sub>NO<sub>3</sub>) following node 8 cutting, with residual leaves and racemes retained.

Partial nodule removal (28% of nodules on dry weight basis) after node 8 cutting, with residual leaves and racemes retained.

Nitrogenase activity (acetylene reduction assay) and regrowth were measured on six occasions over the next 25 days.

### **Results and Discussion**

Cutting at node 8 or 4 (70 and 96% reduction in leaf area) caused a 75 or 90% reduction in nitrogenase activity respectively, three hours after defoliation. Following node 4 cutting nitrogenase activity further declined during the next five days but recovered 20 days after defoliation. In plants cut at node 8 with leaves and pods retained, nitrogenase activity declined significantly during pod-filling but rapidly increased following pod maturity. Residual leaf removal following node 8 or node 4 cutting reduced both nitrogen fixation and regrowth. However, in plants cut at node 8 the detrimental effects of leaf removal were overcome by flower removal. Partial nodule removal generally had no effect on nitrogen fixation or regrowth. With or without residual leaves, raceme (or pod) removal increased regrowth by approximately 145 and 120% respectively, an effect associated with substantial increases in nitrogen fixation. Applied nitrogen increased regrowth by 170% without affecting the yields of retained pods, but suppressed nitrogen fixation. Without applied nitrogen, cutting at node 8 increased regrowth, compared with node 4 cutting, only when pods were removed.

The results indicate that the pods provide a strong competitive sink for carbon and their development can suppress nodule activity and regrowth. Pods also create a stronger sink than the new shoots for symbiotic nitrogen.

Hence, contrary to results obtained with some other legumes (1,2), with phasey bean low level cutting which removes the sites for pod development can be less detrimental to regrowth than higher level cutting.

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2. Kessler, C.D.J., and Shelton, H.M. 1980. Exp. Agric. 16: 207-214.