Agronomic efficiency of polymer-coated nitrogen fertilizers in common beans in Midwest Brazil

Authors: Douglas Ramos Guelfi Silva[1]; Leandro Flávio Carneiro[2]; ***Luiz Roberto Guimarães Guilherme[1]*;*** *Rafael da Costa Leite[2]; Eduardo Lopes Cancellier; Danilo de Araújo Soares[1];*

[1]Universidade Federal de Lavras, Departamento de Ciência do Solo ;[2]Universidade Estadual do Mato Grosso do Sul ****Potential Speaker.***

Introduction

The common bean crop has a big socioeconomical importance for Brazil. Nitrogen, one of the most demanded nutrient by this crop, is easily lost from agroecosytems. One alternative to minimize N loss, and consequently increase N fertilization efficiency, in these agroecosystems, is the use of polymer-coated fertilizers. The aim of this work was to assess the agronomic efficiency of polymer-coated nitrogen fertilizers in the bean crop.

Material and Methods

The study was carried out in field conditions at midwest of Brazil. The design of the experiment field was in randomized blocks in a 3x4 factorial scheme, composed by three N sources [common urea (CU), polymer-coated urea (PCU) and polymer-coated monoammonium phosphate (PCMAP)]. Fertilizers were applied as sidedressing in four rates (0, 25, 50, and 75 kg of N ha^{-1}).

The experimental field was divided in four blocks with 12 plots each, randomly sorted. Plots were composed of five sowing lines four-meters-long, being evaluated always the three central lines, excluding 0.5 m in line extremities. Emergence occurred six days after seeding, standing 3.5 plants per linear meter at harvest. Nitrogen treatments were all applied in split doses, with half dose 22 days after emergence and another application at full flowering, with doses and sources as described in treatments.

The bean was harvested 120 days after sowing. In the harvest, grains and straw were weighted separately. Data analysis was carried out using SISVAR software (FERREIRA, 2011).

Results and Discutions

For grain yield, the interaction between factors (N rates of application and sources of fertilizer) were significant ($P < 0.05$), (Figure 1).

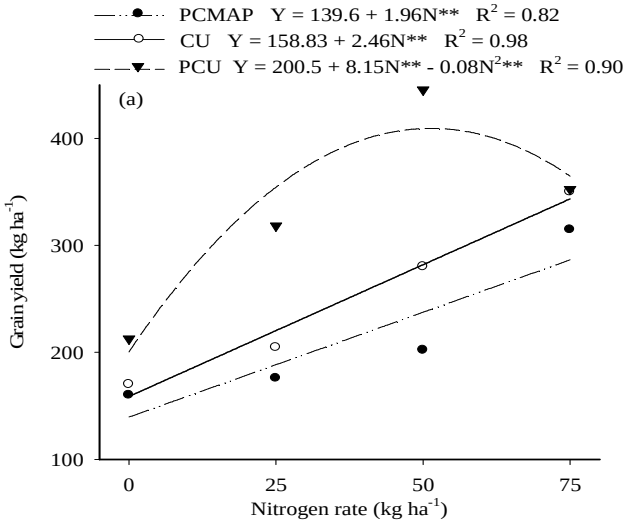

Figure 1. Grain yield and number of pods per plant (*, ** Significant at 1 and 5% of significance respectively.)

For CU and PCMAP regressions fitted linearly while for PCU a quadratic model was better adjusted (Figure 1). Bean yield for N sources was, in the decreasing order: polymer-coated urea (PCU)> common urea (CU) > polymer-coated monoammonium phosphate (PCMAP). With application of PCU the highest yield (444 kg grains ha^{-1}) was achieved with 51 kg N ha^{-1}. According to

the equations obtained in the Figure 1, PCMAP and CU would achieve 444 kg grains ha^{-1} with 155 and 116 kg N ha^{-1}, respectively, 3 and 2.3 times higher than the applied PCU dose.

There was a significant effect of nitrogen doses applied as sidedressing. Grain harvest index and nitrogen harvest index (Figure 2), despite the lack of significative differences with regard to N sources, presented an increase with increases in the amount of N applied. It shows an improved biomass partitioning and a relative increase in N movement into grains with higher nitrogen doses. Santi et al. (2006) found differences in grain harvest indexes with variable nitrogen split doses and sources of fertilizers. Grain harvest indexes found in this paper are relatively low when compared to those related in literature (ARAÚJO & TEIXEIRA, 2003, 2012; SANTI et al., 2006) and it may have occurred due to low grain yield.

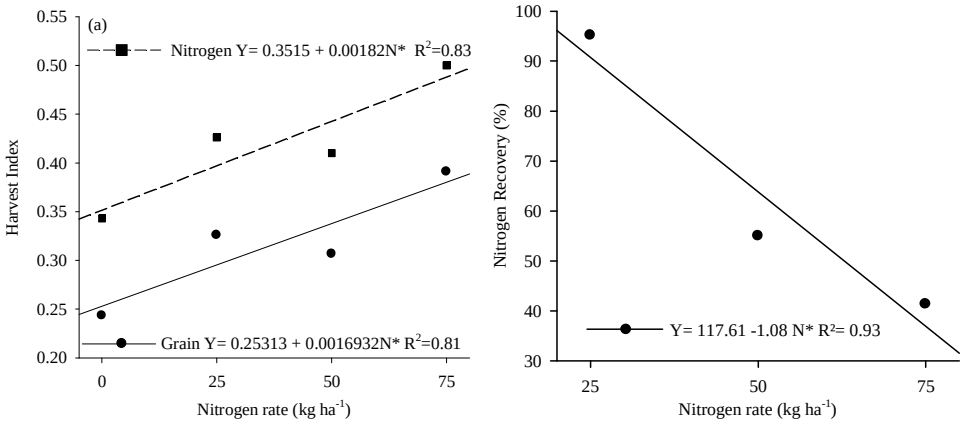

Figure 2. Grain and Nitrogen harvest index (a) and nitrogen recovery (b) of common bean fertilized with increasing rates of nitrogen (*, ** Significant at 1 and 5% of significance respectively).

Data of nitrogen recovery by plants were significant when concerning N doses. However, data from sources of N did not differ statistically (Figure 2b). Nitrogen recovery decreased sharply as nitrogen doses increased, reaching as low as 37% recovery. The recovery rate of N by plants was very high, especially with low N doses applied. However, N recovery must be carefully interpreted since a great part of N content in plant could have been assimilated through biologic nitrogen fixation, justifying recovery rates higher than 90% with the application of 25 kg ha^{-1}.

Conclusions

Polymer-coated fertilizers did no differ to common urea with regard to the efficiency index, even though polymer-coated fertilizers promoted higher grain yield.

Polymer-coated urea promoted higher grain yield than common urea and polymer-coated MAP and achieved its maximum yield with the lower rate of N.

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