THE EFFECT OF MAGNESIUM SULFATE FERTILIZER ON COMMON BEAN (*Phaseolus vulgaris* L.) PRODUCTION IN BRAZILIAN SAVANAH

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Beans as a legume produce well on moderate acid to neutral soils with medium levels of Ca and Mg. On fertile soil high Mg concentration induced the absorption of Ca and K, but excess Mg in soil has been reported as harmful to physical soil properties through reducing the soil volume for air and water, hence increases the bulk density that impede the root elongation (Levy et al, 1988). The availability of Mg and other exchangeable cations decreases by increasing soil depth. The largest loss of Mg is by soil erosion and to lesser extend to Mg export by grain harvest, which is about 2.0 kg of Mg per ton of grain produced (Feitosa et al. 1980).

Localized Mg deficiency is frequently encountered in recently cleared areas and in intensive-irrigated bean production systems using heavy input such as lime and fertilizers. Mg deficiency symptom appears frequently during pod formation, pod-filling stages suggesting the decreasing absorption capacity of the bean root toward maturing stages.

The concentration of Mg, N, Ca and P in the leaf influenced the root formation and development (Huang et al, 1990). Increasing Mg concentration in the tissue increases the synthesized chlorophyll, which in turn increases the net photosynthesis rate. Therefore constant Mg supply from early stages of growth to maturity is important for biomass production.

The most common practice to amendment the Mg deficient soil is to apply dolomitic lime or Mg fertilizers. For high bean productivity in the Savannah region the soil solution concentration of Mg and Ca should be higher than 5 to 10 $mmol_c\ dm^{-3}$ of Ca or Mg or 4.5 $mg\ kg^{-1}$ in leaf.

To evaluate the effect of five levels of Mg sulfate on bean yield an experiment was conducted on a farm, practicing more than 12 years no till cropping system, in Santa Helena/GO during winter 1999 on Oxisol with irrigation. The soil characteristic of the site is shown in Table 1. The Ca/Mg ratio is less than 3. This gives still the margin to increase the Mg concentration in the soil to improve the bean yield. The results are shown in Figures 1 and 2.

Table 1. Soil characteristics of the experimental site in Santa Helena/GO.

Soil depth (cm)	pH (2:1)	$mmol_c\ L^{-1}$			$g\ kg^{-1}$					$g\ kg^{-1}$
		Ca	Mg	Al	P	K	Cu	Zn	Mn	MO
0-20	5.80	50.7	18.0	0.80	28.9	156.7	2.8	7.27	60.6	24.8

The highest yield and pod number per plant was obtained from plot with 10 $kg\ ha^{-1}$ of Mg sulfate (Figures 1 and 2), whereas higher doses reduced significantly bean yield and its pod number per plant. The yield reduction at higher doses than 10 $kg\ ha^{-1}$ of Mg sulfate fertilizer suggests that bean cannot utilize the higher Mg availability in the soil. Higher Mg doses reduced the Mg, Ca concentrations at the fully opened trifoliate leaf taken at initiation of flowering stage. The P concentration was lower when Mg sulfate doses were higher than 10 $kg\ ha^{-1}$. whereas N and K were practically unchanged.

The results of this experiment suggest that that only a certain quantity of Mg is needed to increase bean yield in irrigated area. Higher doses proved to be harmful.

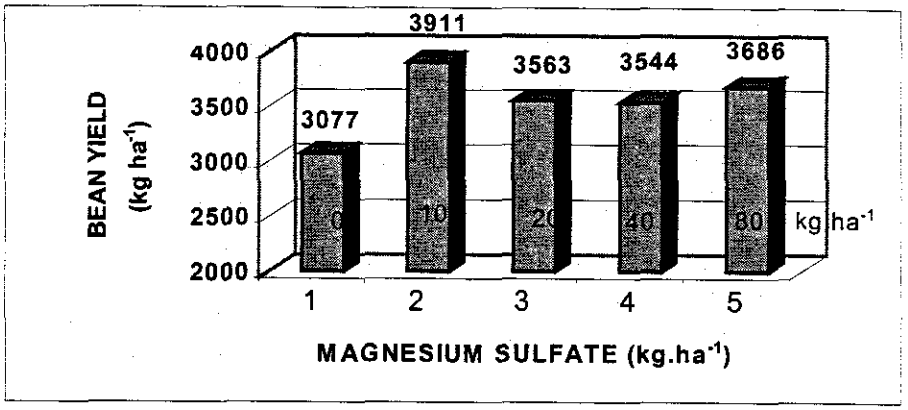

FIGURE 1. Effect of 5 levels of Mg sulfate on bean yield.

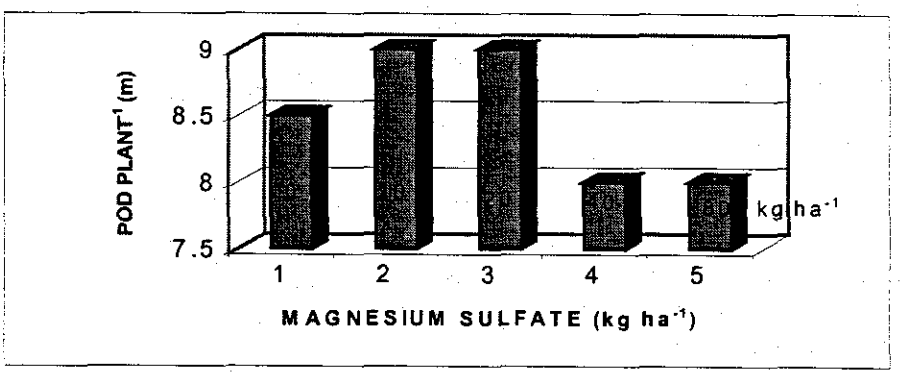

FIGURE 2. Effect of 5 levels of Mg sulfate on number of pods plant^{-1}.

Table 2 – Effect of increasing doses of Mg sulfate on the concentration of leaf nutrient.

Magnesium sulfate (kg ha^{-1})	g kg^{-1}				
	K	Ca	Mg	N	P
0	30.75	13.25	4.50	49.50	3.15
10	30.00	16.25	5.00	53.00	3.07
20	31.25	13.25	4.7	54.30	3.20
40	29.50	13.50	4.4	50.20	2.75
80	30.50	13.38	4.3	51.20	2.92

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