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Comparative study of sorghum growth in a greenhouse using commercial urea fertilizer and urea nanostructured material.

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Abstract – This study was a comparative analysis of plant growth in greenhouse using nanostructured materials that can reduce the rate of urea dissolution, leading to a controlled release and increased plant growth in relation to commercial urea. All compositions studied contained a polymer matrix and montmorillonite clay modified with adsorbed urea. The growth was characterized through tests carried in a greenhouse. The best systems observed were those containing polymers in the formulations. It follows that all composites evaluated demonstrated control of fertilizer release and differential plant growth relative to commercial fertilizer.

The question of the efficient use of nutrients by plants is of a paramount importance. The key point of this efficiency is the availability of these nutrients at the time of greatest need by plants in order to optimize their use and minimize losses. This can be accomplished with the use of controlled-release fertilizers, the so-called "smart fertilizers", ideally the ones that release the nutrients according to the needs of plants during their growth [1,2].

Polymer nanocomposites granules were prepared with four different systems: (1) montmorillonite clay/fertilizer, (2) montmorillonite clay/fertilizer and plasticized starch, (3) montmorillonite clay/fertilizer, plasticized starch and low density polyethylene (LDPE) and also (4) montmorillonite clay/fertilizer, plasticized starch and polycaprolactone. The formation of a nanostructured material was evidenced by elemental analysis (CHN) and X-ray diffraction (XRD). The compositions were processed in a Haake rheocord mixer and granulated to sizes between 4 and 8 meshes. The tests were carried with sorghum seeds in pots filled with planossolo, in a greenhouse, the growth of shoots and roots being measured. After germination, fertilizers were added in doses of 50, 100 and 200 kg / ha of pots area, and the simulated rainfall was of 30 mm. The tests had the duration 30 days, and after that it was measured the height and weight of shoots and roots (for plants eiher fresh and dry) for all pots and it was calculated the average height of the studied species for comparison. It was found that plants that were fertilized with nanostructured urea were 143% higher than the control and 29% higher than the ones that received commercial urea, at all evaluated doses, as shown in Figure 1. For the masses (Table 1), it was observed that plants with commercial urea had a continuous growth of roots, while plants with nanostructured materials had a growth in proportion to dose, which may indicate a control of the fertilizer release. It was concluded that the nanostructured fertilizer favored the growth of sorghum in relation to commercial urea. Further tests with other seeds in pots with larger areas to be produced.

Table 1: Plant roots masses of 50, 100 and 200 kg / ha doses after experiment in a greenhouse.

Material	Dose 50 kg/ha	Dose 100 kg/ha	Dose 200 kg/ha
Control	1,90	-	-
Commercial Urea	4,30	4,62	4,09
System 1	4,30	5,52	7,38
System 2	4,27	5,20	9,34
System 3	3,32	4,67	5,23
System 4	5,27	3,58	3,09

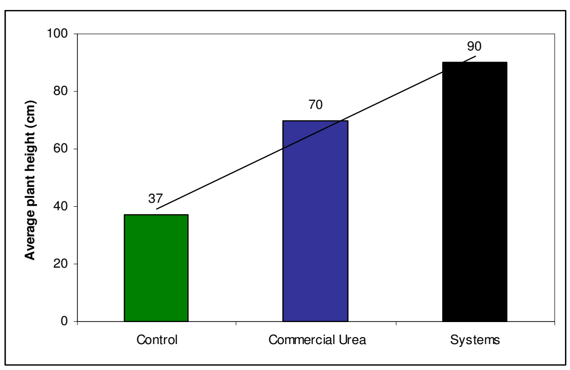

Figure 1: Measures of plant growth with nanostrutured and commercial fertilizers.

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