

Optimizing sodium alginate application rate for the production of fertilizer-coated capsicum (*Capsicum annum* L.) seeds to enhance germination, growth, and yield

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Fertilizer-coated seeds exhibit enhanced seed germination efficiency, improved nutrient usage, and increased establishment of initial seedling vigor. Therefore, determining the optimal polymer application rate is a critical factor in the fertilizer coating process for capsicum (*Capsicum annum* L.), an economically significant cash crop. Biopolymers such as sodium alginate (NaAlg) can be used as the polymer matrix for coating process due to its biodegradability, hence no environmental impact. However, excess coating thickness can negatively affect the seed germination, and overall growth and development of the plant. Since the application rate has not been clearly established, such a study concerns itself with addressing the need to determine the optimal coating level for better seed performance and nutrient use efficiency. Thus, this study aimed to determine the optimal NaAlg concentration for seed coating to enhance the growth and yield of capsicum. It helps in influencing the release of the nutrients, and establishment of the plants. The experiment was carried out under controlled environmental conditions with six NaAlg-fertilizer coated seeds treatments (0.5%, 1%, 1.5%, 2%, 2.5%, 3%) and uncoated seeds as control with each having four replicates. Gannoruwa Prarthana hybrid capsicum variety was selected purposively and used as planting material. Urea (0.5 g) and MOP (0.325 g) were used to coat seeds according to the Agriculture Department fertilizer recommendation for capsicum. Plants associated with the seeds treated with a 1% NaAlg solution exhibited significantly enhanced growth and yield, achieving the highest mean values for plant height (53.09 cm), number of branches (20), pods (34), flowers (30), and yield per pot (1833.34 g) compared to other concentrations. Furthermore, the highest nutrient use efficiency also resulted with 1% NaAlg treatment. Thus, this study provides valuable insights into advancing fertilizer-coated seed technology and introduce a novel sustainable approach to maximize nutrient use efficiency in capsicum cultivation.

Keywords: *Biopolymer coating, Capsicum annum L., Fertilizer-coated seeds, Nutrient use efficiency, Sodium alginate*