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Effects of Physical and Chemical Seed Priming Techniques on Seed Germination and Seedling Growth of Maize (*Zea mays* L.)

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ABSTRACT

Experiments including both physical and chemical priming were carried out in order to examine the influence of magnetism (MF) Ultraviolet-C radiation (UV-C), microwave radiation (MW), Gibberellic acid (GA_3), Ammonium molybdate (Mo) and hydro-priming (Hydro) on the development of corn from its seedling stage. Unprimed seeds were used as a control. Specifically, seed priming with MW 10 sec and UV-C 120 min significantly increased final germination percentage (FGP), GRI, GV, peak value (PV) and seedling vigour index (SVI) compared to control. Also, results showed that seed priming with UV-C 120 min, MF 6 h and UV-C 60 min significantly increased the SVI and shoot length (SL) compared with the control. However, the highest values for mean daily germination (MDG) were observed in seed priming with MW 10 sec, MF 6 h, UV-C 120 min and UV-C 60 min than other seed priming treatments. While the seed priming with MW 20 sec showed the highest values for MGT. However, the highest value for root length (RL) was observed in seed priming with gibberellic acid (GA_3), UV-C 120 min, MF 3 h, MF 6 h and UV 60 min. This experiment suggested that physical and chemical seed priming could boost maize seed germination and seedling growth.

Key words: Ammonium molybdate, gibberellic acid, hydro-priming, microwave radiation, ultraviolet radiation

INTRODUCTION

Seed priming is the method which is done before sowing of seeds in which seeds are moisturized until pre-germination metabolic activities begin and then dried to their original moisture level before germination, preventing the actual emergence of the radicle (Ashraf *et al.*, 2019). It treats seeds quickly, cheaply and sustainably. Priming seeds has been utilized to boost the metabolic process for quick germination, reduce seedling emergence time and improve seedling growth and final yield. Several seed priming techniques broadly can be categorized into traditional and advanced methods. Traditional priming methods include hydro-priming (soaking in water), osmo-priming (soaking in solutions of organic osmotica), bio-priming (hydration using biological compounds), solid-matrix priming (treatment of seed with solid matrices), and chemical priming (soaking in chemical solutions like gibberellic acid (GA_3), ammonium molybdate (Mo), potassium nitrate (KNO_3), zinc sulfate ($ZnSO_4$), and potassium chloride (KCl). Seed priming using physical agents including X-rays, gamma, ultrasonic waves, ultraviolet, magnetic fields, microwaves and others is more advanced and laser radiation. Various studies such as germination treatment (hydro-priming) and chemical pre-treatments as priming agents of seeds have reported improved seedling growth and seed germination parameters, such as ammonium molybdate in sorghum (Lazim, 2022), cowpea (Arun *et al.*, 2020), wheat (Lazim and Ramadhan, 2019) and chickpea (Singh *et al.*, 2014), and a gibberellic acid in maize (Adhikari and Subedi, 2022), lettuce (Adhikari *et al.*, 2022), green gram (Chakraborty and Bordolui, 2021) and sorghum (Shihab and Hamza, 2020). Moreover, various researches demonstrated that hydro-priming acts as plant growth promoting, such as sorghum (Dembele *et al.*, 2021), okra (Tania *et al.*, 2020) and bean (Damalas *et al.*, 2019). Physical treatments, in contrast, are given externally without hydrating or immersing the seeds in chemical substances. Some physical priming techniques, such as magnetic fields, microwaves and UV radiation, are commonly used successfully for rapid seed germination and growth in different crop plants in pre-sowing treatments. For instance, magnetic field treatments have been observed to promote germination in numerous plant species, such