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Improving Germination and Seedling Vigour of Cowpea (*Vigna Unguiculata* L.) with Different Priming Techniques

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Abstract: To assess the comparative efficacy of different priming techniques and their role in increasing germination and seedling growth and development of cowpea, a laboratory trial was conducted in the Allelopathy Laboratory of Department of Agronomy, University of Agriculture Faisalabad Pakistan, during 2010-11. The experimental design was complete randomized design (CRD) and was replicated four times. Eight seeds of cowpea were placed in each petri dish. Hydro priming, on-farm priming, halo priming with KNO_3 and primng with two concentrations (2% and 5%) of Moringa leaf extract were employed as experimental treatments. A control treatment was kept for comparison. The results revealed that all priming techniques were effective in increasing the germination, as well as, growth and development of cowpea. Priming with 5% Moringa leaf extract was instrumental in decreasing time to start germination (1.9 days) and time taken to 50% germination (2.8 days). It was also increased final germination percentage (88%) along with better root and shoot length. Priming with 5% Moringa leaf extract also gave significantly higher root and shoot fresh weight (0.23 and 0.27 g respectively) and it was followed by 2% Moringa leaf extract. Hydro priming performed better than on-farm priming and halo priming with KNO_3 but was much less significant than either concentration of Moringa leaf extract.

Key words: Allelopathy · Halopriming · Hydro Priming · Moringa Leaf Extract · On-Farm Priming

INTRODUCTION

Cowpea (*Vigna unguiculata* L.) is one of several species of the widely cultivated genus *Vigna* and family Fabaceae with origin in central Africa [1]. The other recognized subspecies of cowpea include textilis, pubescens and sinensis [2]. Cowpea is one of the most important food legume crops in the semiarid tropics covering Asia, Africa, southern Europe and Central and South America with some of the more well-known common names of black-eye pea, southern pea and crowder pea [3]. As a drought-tolerant and warm-weather crop, cowpeas are well-adapted to the drier regions of the tropics where other food legumes do not perform well. It also has the useful ability to fix atmospheric nitrogen through its root nodules and it grows well in poor soils. In addition, it is shade tolerant, so is compatible as an intercrop with maize, millet, sorghum, sugarcane and cotton. This makes cowpeas an important component of traditional intercropping systems, especially in the complex and elegant subsistence farming systems of the dry savannas in sub-Saharan Africa. In these systems the haulm (dried stalks) of cowpea is a valuable by-product, used as animal feed. The leaves of the cowpea plant have the highest percentage of calories from protein among vegetarian foods and also used as a protein rich forage. Its seed contains about 25% protein that is why it has been described as the poor man's meat. Germination and seedling establishment are critical stages in the plant life cycle. In crop production, stand establishment determines plant density, uniformity and management options. Poor germination and crop establishment result in significant reduction in economic yield [4-7]. Different priming techniques have been found to be effective in increasing crops germination and seedling establishment in almost all field crops [8-12]. Seed priming is pre-sowing strategy to affect the pre-germination metabolic activities to enhance the germination [13, 14]. Seed priming is done with different agents like tap water, distilled water, different salts and other nutrients and

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vitamins. Seed priming improves germination by early DNA replication, increases RNA and protein synthesis, accelerates embryo growth, repairs the damaged and deteriorated seeds and causes a significant reduction in leakage of metabolites and finally results in better germination, seedling establishment and better yield of field crops [15-18]. Hydro priming is simply soaking of seeds in distilled water for duration (mostly 12-24 hours) and then drying the seeds in shade before sowing. On-farm priming involves seeds dipping in tap water for 12-48 hours and then drying in shade before sowing [19-22]. Halo-priming is the technique of soaking seeds in salt solutions containing different salts like KCl, KNO_3, NaCl etc. [23-27]. Similarly, seed soaking in solutions containing different nutrient, plant growth regulators and promoters as well as vitamins, has also been found effective in increasing not only germination and seedling stand but also significantly higher crops yield were obtained. Similarly, Moringa (*Moringa oleifera* Lam.) tree has been recognized as a miracle tree as its leaf extract contains sufficient quantities of macro and micro nutrients, particularly a substance called zeatin has the potential to increase crops yield when applied as a foliar spray. However, Moringa leaf extract potential as a priming agent in increasing crops germination and seedling establishment has not been explored [28-32]. Cowpea in Pakistan is mostly grown as an intercrop either as a seed or forage crop to improve the production and quality of cereal forages like maize, sorghum, millets etc. which usually results in lower germination rate and poor crop establishment and ultimately results in significantly less yield as an intercrop than sole crop.

This study was designed to assess the role of different priming techniques such as hydro priming, on-farm priming, halo priming and priming with natural plant growth regulators that are present in Moringa leaf extract on germination and seedling growth and development of cowpea. This laboratory research was also intended to investigate the comparative efficacy of different priming techniques and to suggest the most suitable priming technique for cowpea.

MATERIALS AND METHODS

To investigate the comparative efficacy of different priming techniques on the germination and seedling growth and development, a laboratory trial was conducted in Allelopathy Laboratory of Department of Agronomy, University of Agriculture Faisalabad Pakistan, during 2010-11. The experimental design was complete randomized design (CRD) and was replicated four times. Eight seeds of cowpea (cv. P-518) were placed in each petri dish. Hydro priming was done by soaking cowpea seeds in distilled water for 12 hours and then shade dried before putting them into petri dishes and similarly on-farm priming was done in tap water for 12 hours. Halo-priming with 1% KNO_3 was done for 12 hours. 2% and 5% solutions of Moringa leaf extract were prepared and cowpea seeds were soaked for 12 hours. Time to start germination (days), time taken to 50% germination (days), final germiation (%), root length (cm), shoot length (cm), root fresh weight (g) and shoot fresh weight (f) were recorded during the course of this laboratory trial. The experiment was visited daily and the time was recorded as time to start emegence, when first seed was germinated. Time taken to 50% emergence was recorded by following the procedure suggested by Farooq *et al.* [33].

$$E50 = t_i + (N/2 - n_i)\ (t_j - t_i)\ (n_j - n_i)$$

where,
N is the final number of emerged seeds, n_i and n_j are number of emerged seeds at times t_i and t_j.

Moringa Leaf Extract (Mle) Preparation Bioassay: Moringa leaf extract (MLE) was prepared by collecting young and disease free leaves from Moringa tree. Theses leaves were washed and then frozen for two days in refrigerator at 4^0C. Leaves were grinded in a manual juicer to extract the leaf juice. The juice was collected and filtered by passing through a muslin cloth to remove all the green matter. After that the extract was stored at room temperature.

Statistical Analysis: All the data collected were subjected to Fisher's analysis of variance technique with the help of MSTAT-C computer software program [34] and the least significant difference test at 5% probability level was employed to compare treatment means [35].

RESULTS AND DISCUSSION

Time Taken to Start Germination (Days) and 50% Germination (Days): Time taken to emergence depicts the vigor of seeds as more vigorous seed emerge more rapidly and take less time to start germination when soil and environmental conditions are conductive to germination. The minimum time taken to start emergence (1.9 days) was recorded by 5% Moringa leaf extract (MLE)

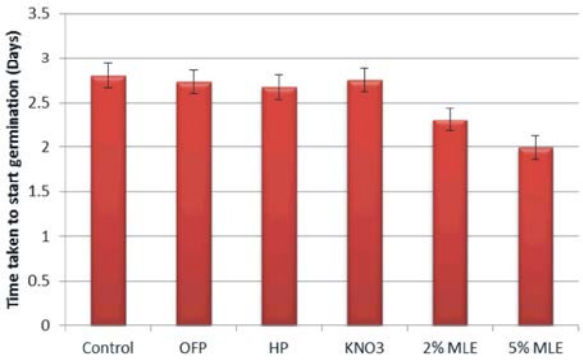

Fig. 1: Time taken to start germination (days) of cowpea as influenced by different priming techniques.

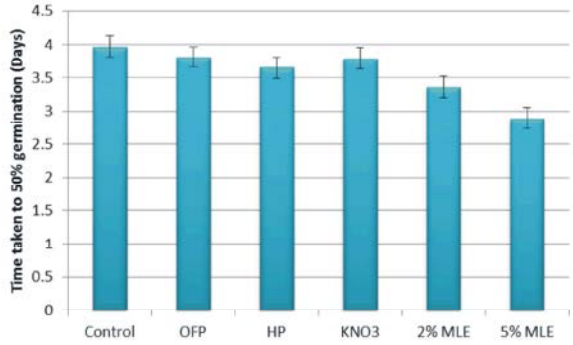

Fig. 2: Time taken to 50% germination (days) of cowpea as influenced by different priming techniques.

treated seeds and it was followed by 2% Moringa leaf extract (MLE) (2.31 days) (Fig.1). The maximum time to start emergence (2.8 days) was taken by seeds that were not subjected to any priming technique (control). Even hydro priming and halo priming performed better than control but it was much less significant than priming with 5% Moringa leaf extract. This was might be due to growth promoters present in the Moringa leaf extract which might had increased metabolic activity and ultimately germination started earlier than other treatments. Time taken to 50% emergence shows the time when half of the seeds have been germinated. The minimum time taken to 50% emergence (2.89 days) was recorded by 5% Moringa leaf extract (MLE) treated seeds and it was followed by seeds that were treated with 2% Moringa leaf extract (MLE) (3.36 days) (Fig.2). The maximum time to 50% emergence (3.97 days) was taken by seeds that were not subjected to any priming technique (control) as even on-farm priming, hydro priming and halo priming performed better than control but these were much less significant than priming with 5% Moringa leaf extract. The significantly less time taken to 50% emergence was might be due to better metabolic activity within the

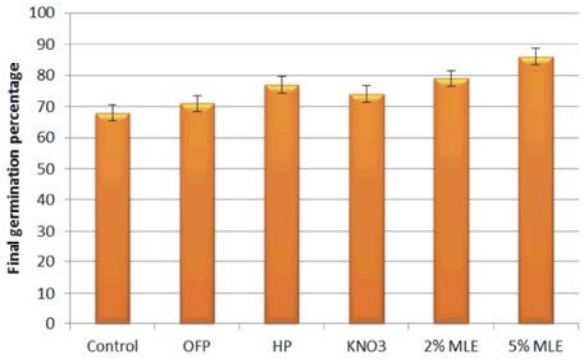

Fig. 3: Final germination (%) of cowpea as influenced by different priming techniques.

seeds that were treated Moringa leaf extract (MLE). These results are in line with those obtained by Gniazdowska [36], Aregheore [37] and Khan *et al.* [38], who concluded that Moringa leaf extract has the potential to increase the rate germination process by increasing the metabolic activity of seeds.

Final Germination: Final germination shows the number of seeds that have been germinated out of total sown seeds. Fig. 3 revealed that seed priming with 5% Moringa leaf extract (MLE) was instrumental in increasing the final emergence of soybean as it recorded the maximum final germination (86%) and it was followed by 2% Moringa leaf extract for 12 hours (79.5%). The minimum final germination was given by control treatment (68%). The significantly higher final germination given by 5% Moringa leaf extract was might be due to zeatin which is a natural plant growth regulator and other nutrients present in Moringa leaf extract. These results are in complete confirmation with Yasmeen *et al.* [39] and Foidle *et al.* [40], who observed more germination and seedling growth and development caused by zeatin.

Root and Shoot Length (cm): Seedling growth and development determines the final yield as good seedling establishment constitutes the first and foremost step in achieving the full potential of crops. The maximum root length (21.4 cm) was given by 5% Moringa leaf extract priming and it was followed by 2% Moringa leaf extract (18.7 cm) (Fig. 4). The minimum root length (14.23 cm) was recorded by control treatment that was much less than all other priming techniques. Similarly the highest shoot length (22.9 cm) was given by seeds that were treated with 5% Moringa leaf extract and it was followed by 2% Moringa leaf extract (19.3 cm) (Fig. 4). The significantly higher root length recorded by Moringa leaf extract was

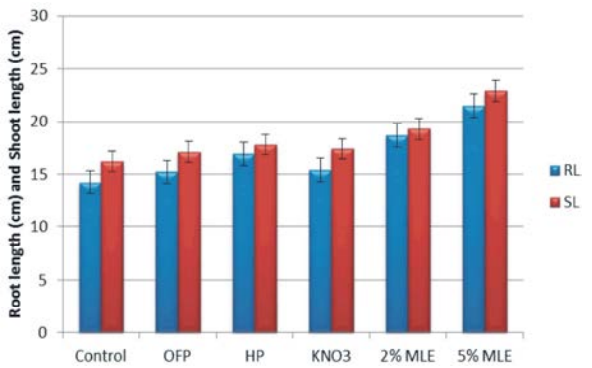

Fig. 4: Root and shoot length (cm) of cowpea as influenced by different priming techniques.

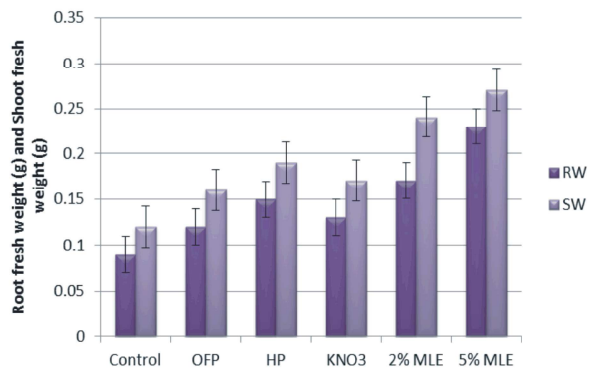

Fig. 5: Root and shoot weight (g) of cowpea as influenced by different priming techniques.

might be due to the presence of various growth promoters as well as macro and micro nutrients in Moringa leaf extract. These results are in line with those reported by Akinbode and Ikotun [41] and Phiri [42], who found Moringa leaf extract quite effective in increasing the seedling growth and development of many vegetable and agricultural crops.

Root Weight (g) and Shoot Weight (g): Fig. 5 reveals that the highest root weight (0.23 g) was recorded by 5% Moringa leaf extract (MLE) priming and it was followed by 2% Moringa leaf extract (0.17 g). Similarly the highest shoot weight (0.27 g) was again observed in priming with 5% Moringa leaf extract and it was followed by 2% Moringa leaf extract (0.24 g). The significantly higher root and shoot weight given by Moringa leaf extract was might be due the action of zeatin which is a natural growth promoting substance belonging to the class of cytokinins. These findings are in accordance with those reported by Phiri and Mbewe [43], Makkar and Becker [44] and Anjorin *et al.* [45], who found zeatin effective in increasing crops growth and yield.

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