

Influence of Seed Priming Agents on the Germination and Field Performance of Pepper (*Capsicum spp*) in Guinea Savannah Region of Nigeria

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Abstract: *Insufficient seedling emergence and inappropriate stand establishment are the main constraints in the production of crops particularly seeds of vegetables and small seeded grasses. Various studies have been carried out to reduce the period between sowing to emergence as this play a key role in crop production. One of the important developments in this area has been the use of seed priming technique. A field and screen house studies was carried out at the University of Abuja Research Farm to evaluate the influence of different priming agents on the establishment and performance of soybean in the Guinea Savanna region of Nigeria. Five treatments were used in the study, four priming agents (gibberrellic acid, sodium chloride (NaCl), coconut water and warm water) and the control. The study was arranged in randomized complete block design (RCBD) with three replicates. Seed priming improved germination percentage of pepper. The pepper primed with gibberrellic acid significantly increased growth and yield components (number of leaves, number of flowers length of main vine etc.) of both experiments.*

Keywords: Priming, Gibberrellic Acid, Coconut Water, Warm Water, Pepper

1. Introduction

In field crops, crop emergence and stand count which closely relates to plant population density determines to a very large extent, the yield of the said crop. The stand count and plant population density is mainly attributed to seed germination and emergence.

The emergence and stand establishment of pepper seeds are often slow and extremely erratic, particularly under cool stress conditions. Small seeded seeds like pepper seeds have been reported to lose viability under ambient conditions (Mohamed-Yassen *et al.*, 1994). One other significant factor responsible for low viability of pepper seed may be the very thin and weak seed coat which provides very limited resistance to attacks from well-defined external agencies like microbes and absorption of atmospheric moisture (Mohammed-Yassen *et al.*, 1994). It has become clear in recent years that the endospermic tissue enclosing the radicle tip of the embryo offers a mechanical barrier to the growing embryo, thus affecting germination (Andreoli & Khan, 1993). It has been reported that one of the major obstacles to high yield and production of crop plants is the lack of synchronized crop establishment due to poor weather and soil conditions (Mwale *et al.*, 2003).

Seed Priming is a process which increases the germination percentage and reduces the time of emergence; because the primed seeds of plants completed their chitting period (seed absorb maximum water and complete all processes before germination during priming). Seed priming is mainly used to increase germination and uniformity of different crops under non-supporting conditions. Mostly

priming is used to get uniform and healthy crop stand and it increase the vigour of seed (Draganic and Lekic, 2012). During priming process, seeds are soaked in different solutions with high osmotic potential. Different type of solutions according to the seed requirement was used for seed priming. The purpose of soaking of seed in the solution is to prevent the enough water absorption for radical emergence and expand the seed in lag phase. Seed priming protects the disease attack by applying the coating of fungicides, bactericides and nematicides. Seed priming is used to increase the germination percentage and seed vigor (Nawaz *et al.*, 2013). Primed seeds have great potential to grow under stressful conditions. It has strong resistance against disease and insect attack. Primed seeds have much growth potential and give more production as compared to non-primed seeds. It showed that more yield and uniformity as compare to non-primed seeds. Seed germination process occurs in the three phases. First phase in which seed uptake the water rapidly is called the Imbibitional phase, second phase which just change in the water content and third or last phase is radical emergence. Primed seeds completed first two phases during priming process so immediately germinate after sowing (Aymen and Hannachi, 2012).

This study was conducted to monitor the ease of seed germination under different seed treatment methods. It was also carried out to assess the influence of seed priming agents on seed germination and some field crops performance indicators like plant height, leaf count and the flowering of pepper in the southern Guinea Savanna region of Abuja, Nigeria.

2. Materials and Method

Study Location: The research was carried out at the Teaching and Research Farm and the Crop Science Laboratory of the University of Abuja, Nigeria during the 2017 cropping season. The location which lies on Latitude 8° 45' and Longitude 6° 45' and is characterized by a bimodal rainfall pattern. The mean annual rainfall is about 1500 mm, the soils are sandy loams and classified as Ferric Acrisol (FAO, 2017).

Experimental Materials: The materials used include the seeds of soybean, sourced from the International Institute of Tropical Agriculture (IITA) and Institute of Agriculture (IAR) Samaru, Zaria, Giberrellic Acid (a growth Hormone), Coconut water, NaCl, Distilled Water and Warm water.

Soil Sampling and Analysis: Prior to land preparation and sowing, soil samples were taken across the fields with an auger at the depth of 0-30 cm and bulked in a polythene bag to form a composite Soil Sample. The samples were later taken to the laboratory for physico-chemical analysis using standard laboratory procedures.

Seed Priming Treatments includes;

1. The seeds of pepper were soaked with coconut water for 12 hours, after which the seeds was removed and placed on top of a clean filter paper to air dry to its normal moisture content.
2. The seeds were soaked in warm water at 25 °C for one minute after which the seeds were removed and placed on top of a clean filter paper to air dry to its normal moisture content.
3. The seed were soaked with a solution of Giberrellic Acid (GA) at the concentration of 3g/ litre of water for four hours after which the seeds were later removed and placed on top of a clean filter paper to air dry to its normal moisture content.
4. The seeds were planted without any treatment application (Control).
5. The seeds were soaked with a solution of sodium chloride (NC) at the concentration of 12g/litre for 24 hours after which the seeds were removed and placed on top of a clean filter paper to air dry to its normal moisture content.

Experimental Design and Field Lay Out: The experimental design adopted had treatments arranged in a Randomized Complete Blocks Design (RCBD) with two (2) varieties of soybeans and Five (5) - Priming Agents No Primers, Giberrellic Acid(GA), Coconut water(CW), Warm water(WW), and NaCl (NC)making up 10 treatments replicated three (3) times. The plot size measured 3 M by 4 M with inter – row spacing of 0.75 and intra - row spacing 0.1m. Plots measured 0.5m apart while blocks were 1m apart.

Crop Husbandry: The field was disc-ploughed and harrowed twice, to a fine seed-bed, before the layout was done to produce plots measuring 3M wide and 4M long spaced 0.5M within the rows that were 0.75M apart. Two

seeds were sown along the rows at 10cm to produce 40 stands along the rows and 160 stands within a plot and 320plants per plot. All agronomic appropriate practices (weeding, disease and pest control etc) were carried out as and when due.

Data Collection/Observations: Germination count, seedling emergence, plant height, number of leaves and days taking to attain 50% flowering by all the plants in the plot were carried out as described below-

- Percentage emergence =**

$$\frac{\text{Number of emerged seedlings}}{\text{Expected number of plants (no of seed sown)}} \times 100$$
- Plant height (cm)** will be measured at 2, 4 and 6 WAS using a measuring tape from randomly selected and marked plants from which an average was calculated per plant.
- Number of leaves:** was counted at 2, 4 and 6 WAS from randomly selected and marked plants from which an average was calculated per plant.
- Number of flowers:** was determined by carefully observing and counting the numbers of flowers daily until about half of the total plants in the field have flowered.

Data analysis: Data collected were subjected to analysis of variance (ANOVA) using GENSTAT 11th edition (GenStat, 2009). Fischer's least significant difference (LSD) was used to separate means.

3. Results

The Effect of Priming Agents on Pepper Germination %: GA induced the highest germination % on seeds of pepper though it was not significantly different from the effect of CW. The control caused the lowest pepper germination % (Table 1).

The effect of the priming agents on the leave count of pepper: In table 2 the number of leaves counted on the pepper plants is presented. The number of pepper leaves due to the different priming agents was not significantly different at 2 and 6 WAS but at 4WAS, the pepper seeds treated with GA produced the highest number of leaves and there was no significant difference among the control, NC and WW.

Table 1: Effect of Priming Agents on Pepper Germination % at 5, 10 and 15 Days after Sowing (DAS)

Priming Agent	5 DAS	10 DAS	15 DAS
Control	42.80d	47.10c	56.57c
NaCl	58.77bc	65.07b	71.93b
Giberrellic Acid	78.00a	73.93ab	86.93a
Coconut Water	69.00ab	83.60a	81.60ab
Warm Water	49.00cd	53.47c	59.47c
S.E.	5.11	4.41	5.00

Means with the same letter in a column are not significantly different ($P \leq 0.05$). S.E = standard error.

Table 2: Effect of priming agents on number of pepper leaves at 2, 4 and 6 weeks after sowing (WAS).

Priming Agent	2 WAS	4 WAS	6 WAS
Control	2.87	11.67c	64.73
NaCl	2.67	17.20bc	65.73
Giberrellic Acid	4.00	26.33a	73.60
Coconut Water	3.73	21.40ab	59.20
Warm Water	2.53	14.73c	59.47
S.E.	0.75	2.47	8.26

Means with the same letter in a column are not significantly different ($P \leq 0.05$). S.E. = standard error

Effect of priming agents on pepper plant height: From the results presented in Table 3, there was no significant difference among all the priming agents including the control in respect to pepper plant height at 2 and 6 WAS. However, at 4 WAS, the plant height was not significantly different between GA and CW. The control and NC had the shortest plants that were not significantly different.

Effect of priming agents on the number of Pepper flowers: As presented in Table 4, pepper seeds treated with GA produced the highest number of flowers compared to other priming agents at 50, 60 and 70 DAS. At 70 DAS the number of pepper flowers counted was not significantly different among the priming agents including the control.

Table 3: Effect of priming agents on pepper plant height (cm) at 2, 4 and 6 weeks after sowing (WAS).

Priming Agent	2 WAS	4 WAS	6 WAS
Control	1.91	46.56c	71.53
NaCl	1.84	54.51bc	78.75
Giberrellic Acid	1.98	69.30a	79.03
Coconut Water	1.88	62.36ab	74.87
Warm Water	1.49	58.12b	73.94
S.E.	0.31	4.79	9.41

Means with the same letter in a column are not significantly different ($P \leq 0.05$). S.E. = standard error

Table 4: Effect of Priming Agents on the Number of Pepper flowers of peppers at 50, 60 and 70 Days after sowing (DAS)

Priming Agent	50 DAS	60 DAS	70 DAS
Control	76.70abc	78.07ab	75.8
NaCl	72.80bc	75.83ab	73.1
Giberrellic Acid	84.50a	86.43a	91.7
Coconut Water	83.23ab	85.70a	88.0
Warm Water	67.97c	70.37b	71.5
S.E.D	4.78	4.81	156.3

Means with the same letter in a column are not significantly different ($P \leq 0.05$). S.E. = standard error

4. Discussion

Effect of priming agents on germination % on pepper: Under normal field conditions depicted here by the control, the germination of peppers is poor. It was observed that less than half (50%) of the seeds germinated by 10DAS and just barely attained 56.7% germination at 15DAS. On the other hand some primers like GA and CW had stimulated 69% and 78% of the seeds respectively germinated in just five days. At 15 DAS over 80% of the seeds treated with GA and CW had germinated. This slow

and poor germination/emergence of the unprimed seed and the enhanced germination rate and volume agrees with observations reported by other workers who asserted that priming improved seed vigour capacity and rate (Cokkizgin and Bolek, 2015). These findings are also in agreement with findings of Dezfuli *et al.* (2008) who reported that primed seeds completed their germination processes early as compared to non-primed seeds.

The effects of this priming agent did not only stop at germination but continues in the field in the form of number of leaves counted, plant height and flowering. The trend followed a similar pattern where plants resulting from seeds primed with GA and CW showed superiority in these traits over the plants that developed from seeds primed with WW, NC and the control which also agrees with other reports (Rezaee and Amir 2015).

5. Conclusion

Plants primed with GA and CW recorded the highest germination percentage, number of leaves and plant height while the control (no-priming) had the lowest. Gibberellic acid and coconut water have high capacity to improve seed vigour which resulted in high germination percentage and growth of pepper. In view of the relative availability and affordability of coconut water and its superior performance, it will be advisable for pepper farmers to adopt it as a seed priming agent.

References

- [1] Andreoli, C. and Khan, A.A.(1993) Improving Papaya Seedling Emergence by Matri conditioning and Gibberelin Treatment. FAO Home Page <http://www.nal.usad.gov>
- [2] Aymen, E. M. and Hannachi, C. (2012, May 5). Effects of NaCl priming duration and concentration on germination behaviour of Tunisian safflower. *Eurasian J Bio Sci.* 6, 76-84.
- [3] Çokkizgin, H., and Bolek, Y. (2015). Priming treatments for improvement of germination and emergence of cotton seeds at low temperature. *Plant Breeding and Seed Science* 71, 121-134.
- [4] Dezfuli, P. M., Sharif-Zadeh, F., and Janmohammadi, M. (2008, December 20). Influence of priming techniques on seed germination behavior of maize inbred lines (*Zea mays* L.). *ARPN Journal of Agricultural and Biological Science* 3, 22-25.
- [5] Draganic, I., and Lekic, S. (2012, August, 21). Seed priming with antioxidants improves sunflower seed germination and seedling growth under unfavorable germination conditions. *Turkish Journal of Agriculture and Forestry* 36, 421-428.
- [6] Mohammed-Yassen, Y., Barringer, S.A., Splittstoesser, W.E and Constanza, S.(1994). The Role of Seed Coats on Seed Viability. *Botanical Review* Vol.60 No 4 (Oct-Dec, 1994) pp 426-439 Springer On behalf of the New York Botanical Gardens Press.
- [7] Mwale, S. S., Hamusimbi, C. and Mwansa, K. (2003). Germination, emergence and growth of sunflower

- (*Helianthus annuus* L.) in response to osmotic seed priming. *Seed Sci Tech.* 31: 199-206.
- [8] Nawaz, J., Hussain, M., Jabbar, A., Nadeem, G. A., Sajid, M., Subtain, M., Shabbir, I. (2013) Seed priming a technique. *International Journal of Agriculture and Crop Sciences*, 6 (20), 1373-1381. Available at: <http://ijagcs.com/wpcontent/uploads/2014/02/1373-1381.pdf>
- [9] Rezaee, S. M., Amir, B.B. (2015, June 8). Cotton Seed germination as affected by salinity by and priming. *Indian journal of fundamental and applied life sciences* 5, 312-318

