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Effect of Hydropriming Treatment On Seed Germination Parameters, Growth and Yield Components of Corchorus olitorius (Jute Mallow)

Muhammed, H.M[1], Gabi, U.A.[1] , Stephen, D.Y.[1], Aliyu, D.A.[1], Danladi, G.H[2] and Rabe. A.M.[3]

[1]Department Of Biological Science, Ibrahim Badamasi Babangida University, Lapai, Niger state, Nigeria
[2]Department of plant science and Biotechnology, Aleiro University of Science and Technology, Aleiro, Kebbi State.
[3]Department of Botany Usmanu Danfodiyo University Sokoto

Abstract

A field experiment was conducted during the 2023 cropping season in Biology Department Botanical Garden, Ibrahim Badamasi Babangida University, Lapai, Niger state, to investigate the effect of hydropriming treatment on seed Germination parameters, Growth and Yield Components of *Corchorus olitorius*. The Objectives are to determine the effect of hydropriming treatment on seed Germination parameters, Growth and Yield Components of jute seed and to know which gives the highest germination percentage at intervals of 0,12,24,36 and 48 hours duration. The treatments were arranged in a Complete Randomized design (CRD) in five replications. Data collected were, Germination percentage (%), Germination index, Plant height (cm), Number of leaves per plant, Number of branches per plant, Number of flowers per plant, Number of fruits per plant and fruit length (mm). Germination index was significantly highest when seeds were primed for 36 hours when compared with 0, 12, 24 and 48 hours priming duration with the lowest germination index recorded in the control were seeds were not primed. A similar trend was observed for number of leaves per plant and number of branches per plant. Hydro primed seeds for a duration of 36 hours resulted to better germination percentage, germination index, growth and yield than untreated (unprimed seeds). Hydropriming *Corchorus olitorius* . seed for a duration of 36 hours is recommended for optimum germination, growth and yield of the crop.

Keywords: *Corchorus olitorius, Germination index, Growth, hydropriming, yield*

Introduction

Jute mallow (*Corchorus olitorius L)*. is one of the popular tropical leafy vegetable in Africa, Asia and some parts of the Middle East and Latin America (Odofin, *et al*., 2018). It is a leading leafy vegetable in Cote d'Voire, Benin, Nigeria, Cameroon, Sudan, Kenya, Uganda and Zimbabwe (Fondo and Grubben, 2016). The mucilaginous leaves are consumed along with other staples. It is extremely consumed as a health vegetable, because it contains abundant β-carotene and other carotenoids, vitamins B1, B2, C and E, and minerals. The vegetable also has varying proportion of dietary fibre and protein required for health (Schippers, 2019). Nutritionally, Jute mallow on the average contain 85-87g H_2O, 5.6 g protein, 0.7 g oil, 5g carbohydrate, 1.5 g fiber 250-266 mg Ca, 4.8 mgFe, 1.5 mg vitamin A, 0.1 mg thiamine, 0.3 mg riboflavin,1.5 mg nicotinamide, and 53-100 mg ascorbic acid per 100 g (Ndiovu and Afolavan, 2008). The leaves have been variously used in folk medicines for ascites, pain, piles, tumors, cystitis, dysuria,fever, and gonorrhea while the cold infusion is said to restore appetite and strength. Jute mallow is also a stem fibre of international importance. It is the world most important bagging and wrapping textile crop (Adesina *et al*, 2017).

In spite of these enormous benefits associated with this vegetable crop, a lot of factors have limited its production. Poor and delayed germination orchestrated by seed dormancy has been one of the major challenges limiting production of this crop. Several methods have been employed by many researchers (Schippers, 2019, Fondo and Grubben, 2016, Oladiran, 2017) to break dormancy of the seed before planting to enhance totality and speedy germination. Dormancy poses a serious problem to successful seed germination and seedling establishment in jute mallow and different methods have been employed to alleviate the problem. Hydropriming is a very simple, economic and environmental friendly type of seed priming. Odofin, *et al*., (2018) reported the effectiveness of hydro priming in this respect which has been confirmed by other reports (Schippers, 2019; Fondo and Grubben, 2016). Nkomo and Kambizi, (2019) recorded best germination when seeds of *Corchorus olitorius L.* were hydroprimed for48 hours before they were planted. Exposure of the seed of this crop to dry heat at 90°C for 5 or ten minutes has also been reported to break dormancy by (Denton *et al*, 2013). According to (Halford, 2017), the temperature required to break seed dormancy in *C. cunninghamii* in Australia ranged between 80-100°C. It was therefore concluded that soil heating from bush fire would promote the germination of seeds of this species. (Emongo *et al*., 2018;Chauhan and Johnson, 2020) reported the effectiveness of sulphuric acid and seed coat scarification respectively. Earthworm cast leach ate has also been found effective in dormancy breaking in *C. olitorius L.* seeds (Oladiran,2017). Of all the methods stated above, though not an exhaustive list, the use of hot water appears to be the most favoured as water is cheaply available and can be more safely handled by all users. Germination failure may lead to reduction in yield or even total crop failure. In seeds with prolonged dormancy period, like *Corchorus olitorius L.* (Halford, 2017), it is necessary to shorten the dormancy period for better germination. In view of the foregoing, it is imperative to determine the effect of hydropriming treatment on seed germination parameters, growth and yield components of *Corchorus olitorius*

Materials and Method

Experimental Location

This experiment was conducted at the Biology Department Botanical Garden, Faculty of Natural Sciences, Ibrahim Badamasi Babangida University main campus, Lapai, Niger State, Nigeria which lies between the latitude of 9.0674^{O}N and longitude 6.5618^{O}E.

Experimental Materials and Collection

Materials needed for the experiment were samples of *Corchorus olitorius* . seeds of cultivars Oniyaya which were harvested in November, 2022, and soaking was done before planting (Elouaer, and Hannachi,2019).

Experimental Design and Procedure

Harvested *Corchorus olitorius L.* Seeds were divided into five (5) parts and soaked in water for a duration of 30min. watering was done to the boxes to provide moisture needed for germination (Tolorunse *et al.*,2015). Germination count was taken daily for 50 days. The treatments were arranged in complete randomized design (CRD) in three replications. Duration of sow seeds were at 0,12,24,36 and 48 hours respectively.

***Data Collection*:** Data collected were**:**

Germination percentage

Germination percentage is an estimation of the viability of seeds within a population which was also taken and recorded.

Germination index

Germination index was taken by counting the number of seeds that germinated in each bag which was also recorded.

Plant height

The plant height was taken by measuring, using tape rule to measure the plant height (mm) from top to bottom which was also recorded.

Number of leaves per plant

The number of leaves per plant was taken by counting the number of leaves on the tagged plants and the average also taken and recorded.

Number of branches per plant

The branches per plant on the tagged plants were counted and the average taken represent number of branches per plant.

Number of flowers per plant

The number of flowers per plant was taken by counting the number of flowers on the tagged plants and the average also taken and recorded.

Number of fruits per plant

The number of fruits on the tagged plants were counted and the average taken represent fruits number per plant.

Fruit Length The fruit length was measured in (cm) using tape rule which was recorded.

Data Analysis

Data collected on all the mentioned parameters were subjected to Analysis of Variance (ANOVA) using Minitab statistical software and significant means will be separated using Tukey Pair wise Comparison at 95% probability level.

Results

Mean Squares from Analysis of Variance for Growth Attributes of Jute

The mean square from analysis of variance for growth attributes of jute is shown in Table 1. The result of the table indicated a highly significant ($P \leq 0.01$) effect of priming duration on germination percentage, germination index, number of leaves per plant and number of branches per plant.

Mean Squares from Analysis of Variance for Yield Attributes of Jute

Table 2 showed the mean squares from ANOVA for yield attributes of jute. The table showed that priming duration was highly significant for ($P \leq 0.01$) for number of flowers per plant, number of fruits per plant and fruit length.

Table 1. Mean Squares from Analysis of Variance for Growth Attributes Jute

SOV	DF	Germination %	Germination Index	Plant Height (cm)	Number of Leaves/ Plant	Number of Branches/ Plant
Replication	2	32.11	11.34	14.45	312.12	431.67
Priming Duration	4	0.321**	52.456**	112.32NS	0.871**	52.841**
Error	12	36.87	32.12	6.56	15.67	31.54
Total	18					

KEY: SOV = Source of Variation; **DF** = Degree of Freedom; ****** = Highly Significant at (P≤0.01); G%= Germination Percentage; Gl = Germination Index pLT HT= Plant Height NOL = Number of Leaves per Plant NOB\PLT = Number of Branches per Plant

Table 2. Mean Squares from Analysis of Variance for Yield Attributes of Jute

SOV	DF	Number of Flowers/Plant	Number of Fruits/Plant	Fruit Length (mm)
Replication	2	63.00	301.35	51.67
Priming Duration	4	1.342**	23.45**	54.89**
Error	12	11.05	61.74	9.36
Total	18			

KEY: SOV = Source of variation; **DF** = degree of freedom; ****** = highly significant at (P≤0.01; NOFL\PLT= Number of Flowers per Plant; NFR\PLT =Number of Fruit per Plant; FL= Fruit Length

Mean Effect of Seed Priming Duration on Growth Attributes of Jute

The mean effect of seed priming duration on growth attributes of jute is presented in Table 3. The table showed that priming for 36 hours duration recorded significantly the highest germination percentage compared to 0, 12, 24 and 48 hours duration. The lowest germination percentage was observed in the control (0 hours priming). Similarly, germination index was also significantly highest when seeds were primed for 36 hours compared 0, 12, 24 and 48 hours priming duration with the lowest germination index recorded in the control where seeds were not primed at all. A similar trend was observed for number of leaves per plant and number of branches per plant.

Table 3. Mean Effect of Seed Priming Duration on Growth Attributes of Jute

Priming Duration (Hours)	Germination %	Germination Index	Plant Height (cm)	Number of Leaves/ Plant	Number of Branches/ Plant
0	34.12d	3.11d	53.21a	43.56b	3.14b
12	32.78d	3.54d	52.72a	42.76b	2.89b
24	45.67c	5.45c	52.56a	40.32b	3.19b
36	78.67a	9.67a	51.03a	54.89a	6.37a
48	52.45b	6.23b	49.76a	41.34b	3.11b

* Means with the same letter within a column are not significantly different; G%= germination percentage; GI = germination index; PLT HT= Plant Height; NOL\PLT= Number of Leaves per Plant; NOB\PLT= Number of Branches per Plant

Mean Effect of Seed Priming Duration on Yield Attributes of Jute

Mean effect of seed priming duration on yield attributes of Jute is shown in Table 4. The Table showed that number of flowers per plant was highest in seeds primed for 36 hours relative to seeds primed for 0, 12, 24 and 48 hours. The control (with 0 hours priming) recorded the least number of flowers. More so, number of fruits plant was highest in seeds primed for 36 hours duration relative to 0, 12, 24 and 48 hours priming duration. The control (0 hours priming) produced the least number of fruits per plant even though it was not significantly different from 12 hours priming duration statistically, it was however numerically lowest in the number of fruits produced per plant. A similar trend was observed in fruit diameter.

Table 4. Mean Effect of Seed Priming Duration on Yield Attributes of Jute

Priming Duration (Hours	Number of Flowers/Plant	Number of Fruits/Plant	Fruit Length (mm)
0	45.31c	21.47d	4.27c
12	44.67c	24.76d	5.61bc
24	67.89bc	50.21c	7.69a
36	97.67a	78.67a	6.51ab
48	75.41b	63.73b	8.54b

* Means with the same letter within a column are not significantly different; NOFL\PLT= Number of Flowers per Plant; NFR\PLT= Number of Fruits per Plant; FL= Fruit Length

Discussion

The variations in germination percentage, germination index, number of leaves per plant, number of branches per plant, number of flowers per plant, number of fruits per plant and fruit length is an indication that hydro-priming had effect on germination, growth and yield of jute. Germination is an important prerequisite for continuation of further growth and other physiological process including production or yield.

In this study, hydro primed seeds for a duration of 36 hours resulted to better germination percentage and germination index than untreated (unprimed seeds). This might be due to hydration of seeds enough for it to enable metabolic events before germination to take place. This observation was similar to the reports by (Farooq *et al.*, 2009) who reported superior germination percentage and index in *Amaranthus* seeds when hydro primed for 36 hours. Harris *et al*., (2018) reported that each crop cultivar requires a critical soaking duration and it should be for sowing.

Having thick seed coat sometimes makes proper absorption of water becomes difficult. This results in late germination and also dormancy of seed. Soaking of seeds before sowing may be beneficial in this aspect. Soaking helps to absorb water easily and also remove some surface pathogen of seeds. Seed priming, the controlled hydration and dehydration of seeds, is used extensively to increase the rate and uniformity of seedling establishment of commercial vegetable and flower seeds (Bradford, 1986; Khan, 1992). Jute showed faster germination, early emergence and vigorous seedlings achieved by soaking seeds in water for same time followed by surface drying before sowing, which may result in higher crop yield (Harris *et al.*, 2018).

In this study, hydro primed seeds gave healthy vigorous seedlings which ultimately ensured more number of branches and number of leaves than that of untreated seeds. This is in line with the findings of Murungu *et al.*, (2004)who reported higher number of branches, number of leaves per plant and some yield traits of garden egg when as a result of hydro priming.. Higher numbers of flowers were produced which led to higher number of fruits per plant for seeds primed for 36 hours. This is similar to the report of Jamil *et al.*, (2016) who reported higher fruit number and fruit length when seeds were hydro primed for certain durations.

Conclusion

In this study, the result showed that *Corchorus olitorius L.* seeds were influenced by hydro priming duration. Hydro priming of jute *Cochorus olitorius* seeds for a duration of 36 hours produced superior germination percentage, germination index as well as growth and yield. The control (0 hours priming) recorded the most inferior germination, growth and yield attributes of *Cochorus olitorius.*

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