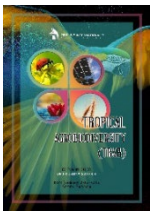
ZIBELINE INTERNATIONAL™ PUBLISHING
ISSN: 2716-7046 (Online)
CODEN: TARGCA

Tropical Agrobiodiversity (TRAB)

DOI: http://doi.org/10.26480/trab.02.2024.110.112



RESEARCH ARTICLE

EFFECT OF DIFFERENT PGRS ON SEED GERMINATION OF OKRA (*ABELMOSCHUS ESCULENTUS* L. MOENCH) IN BARDIBAS, MAHOTTARI, NEPAL

Sapana Lamichhane[a], Sailesh Shrestha[b*], Nicky Karn[a], Ranju kumari Yadav[a], Sadikshya Bogati[a] and Saroj Pandit[a]

[a]Agriculture and Forestry University, College of Natural Resource Management (CNRM), Bardibas, Mahottari, Nepal
[b]Institute of Agriculture and Animal Science, Tribhuvan University, Kirtipur, Kathmandu, Nepal
**Corresponding Author mail: shresthasailesh2022@gmail.com*

ARTICLE DETAILS

Article History:

Received 24 September 2024
Revised 28 September 2024
Accepted 02 October 2024
Available online 27 November 2024

ABSTRACT

Okra is cultivated in tropical and sub-tropical areas and consists of a naturally hard seed coat So, to increase the germination percentage, an experiment was conducted in the lab of the College of Natural Resource Management, Bardibas, Mahottari. The experiment was designed in CRD block which consists of 10 treatments in which T_1 is carried out with distilled water and rest (T_2-T_{10}) with different concentrations (120,150 and 180 ppm) of IBA, NAA, and GA_3. Among the different PGRs, GA_3 with 150 ppm performed well in overall parameters such as total germination percentage, speed of germination, mean germination time, root length, shoot length, and the ratio of root and shoot.

KEYWORDS

Effect, IBA, NAA, GA_3, Seed germination.

1. INTRODUCTION

Okra (*Abelmoschus esculentus* L.) is an annual herbaceous crop belonging to the family Malvaceae originated from an area that includes Ethiopia, Eritrea, and the eastern higher part of Anglo-Egyptian Sudan. It has been known by few names such as Lady's finger, Bhidi, okura, quimgombo, bambia, gombo, and Lai Long ma in different geographical regions of its cultivation. It is major crop of tropical and subtropical regions. Okra is often referred to as the "ideal vegetable for villagers" due to its hardy characteristics, high dietary fiber content, and unique seed protein composition, which is well-balanced in the essential amino acids lysine and tryptophan (Lamichhane et al., 2021).

As looking the today's scenario, Okra production is estimated at 6 million tons per year in the world. Over the years, the production of okra has been increased. In between the years 2006-2007, the area raised to 0.396 million hectares, and production was 4.07 million tons. While in 2009-2010 the area increased to 0.43 million hectares and the production was 4.54 million tons (Sorapong, 2012). To sum up, from the latest data the world production of okra was 11,232,656 t. (FAO, 2021). In Nepal, total okra production was 1,12,260 mt in 9,397 ha of land with productivity of 11.94 mt/hac (AITC, 2023). Okra production in the Mahottari district was 5,379 mt in 461 ha of land with a productivity of 11.66 mt/ha (AITC, 2023).

Okra pods are highly nutritious and excellent sources of dietary fiber, protein, phosphorus, potassium, zinc, copper, calcium, magnesium, and manganese (Nisar et al., 2021). Okra has been served as a potentially rich source of vitamin carbohydrates and possesses a β-carotene, riboflavin, and vitamin B complex at approximate concentrations of 185 µg, 0.08 mg, and 0.04 mg respectively (Elkhalifa et al., 2021).

PGRs are known to modify and regulate many growths and physiological processes in plants (Nisar et al., 2021). The application of proper doses of PGRs plays a crucial role for germination to the proper growth and development. IBA enhances root development and supports shoot elongation, apical dominance, and fruit thinning. It also aids in dormancy breaking, promotes flower development, and facilitates fruit formation. Similarly, NAA increases plant height and the number of pods per plant in okra. Additionally, GA_3 significantly affects seed germination, breaking dormancy, and plant height in dwarf plants (Tahir et al., 2019). As we all know, it's considered to be an easily available, low-cost vegetable crop with various nutritional values and potential health benefits (Elkhalifa et al., 2021).

The seed germination potentiality holds the uniform plant density. Okra seeds germinate slowly and unevenly although they are viable seeds (Purquerio et al., 2010). As okra consists of a hard seed coat, the germination % of seedlings is quite low which affects the uniform plant performance thus to improve the germination rate of seeds the different concentrations of PGRs application can play a crucial role. To find out this, the effective doses of PGRs (IBA, NAA, and GA_3) experiment is conducted.

2. MATERIALS AND METHODS

2.1 Experimental Site

The experiment was carried out in the laboratory of the College of Natural Resource Management, Bardibas, Mahottari which is located at the latitude of 26°54′6.84″ to 27°08′46.90″ and longitude of 85°47′42.67″ to 85°56′42.97″. The location is characterized by topical climate and receives annual rainfall of 139.49 mm with 80% of rainfall occurring during the period from June – July.

2.2 Seed Materials

The okra seed (Laxmi-501) of the truthful label was obtained from a nearby agro vet which was certified from Durga Seeds Corporation located at New Delhi, India.

2.3 Sterilization of Materials

The seeds of okra were already treated with fungicide. And petri dish, forceps, beaker, spatula, and so on were rinsed by using ethanol of 99.9 % for 3 min and washed with distilled water one to three times.

2.4 Experimental Details

The experiment consists of a total of 10 treatments, in which one treatment i.e. (T_1). is carried out with distilled water and others i.e. (T_2-T_{10}) with different conc. of IBA, NAA, and GA3 in the CRD block design.

Quick Response Code	Access this article online	
	Website: www.trab.org.my	**DOI:** 10.26480/trab.02.2024.110.112

Cite the Article: Sapana Lamichhane, Sailesh Shrestha, Nicky Karn, Ranju kumari Yadav, Sadikshya Bogati and Saroj Pandit (2024). Effect of Different Pgrs on Seed Germination of Okra (*Abelmoschus Esculentus* L. Moench) in Bardibas, Mahottari, Nepal. *Tropical Agrobiodiversity, 5(2): 110-112.*

Table 1: Treatments and their concentration used in this research		
IBA	**NAA**	**GA_3**
T_2 - 120 ppm	**T_5 - 120 ppm**	**T_8 – 120 ppm**
T_3 - 150 ppm	**T_6 - 150 ppm**	**T_9 – 150 ppm**
T_4 - 180 ppm	**T_7 – 180 ppm**	**T_{10} – 180 ppm**

2.5 Preparation of PGR Solution

In this study, IBA, NAA, and GA_3 were used at 120 ppm, 150 ppm, and 180 ppm concentrations. To prepare a solution of respective concentration, we know that, 1ppm = 1mg/l. So, by calculating, 50 ml of water was added to 6 mg, 7.5 mg, and 9mg of IBA/ NAA/ GA3 to prepare 120 ppm, 150 ppm, and 180 ppm of solution.

Table 2: Experimental layout of research					
R1		**R2**		**R3**	
T_1	T_6	T_5	T_7	T_7	T_3
T_9	T_4	T_8	T_2	T_5	T_{10}
T_2	T_5	T_3	T_4	T_4	T_8
T_7	T_{10}	T_{10}	T_9	T_1	T_6
T_3	T_8	T_1	T_6	T_2	T_9

2.6 Experimental Procedure

At first, the okra seeds were soaked in PGR solution for about 12 hours then, the next day 20 seeds were placed in each petri dish over the filter paper as shown in the experiment layout. The experiments were conducted in the Completely Randomized Design (CRD) Method under lab conditions. The number of Seed germination was recorded for about 1 week and other parameters were measured and determined on the 7th day of the experiment.

2.7 Determination of Germination Rate

The no. of germinated okra seeds was observed every day till 1 week. Seeds were counted as germinated only if their radicles emerged from the seed coat. The germination rate of okra seed was calculated as;

Germination rate of seed(G)	G= Germinated seeds/Total no.of seeds in petri dish
Germination percent	G.P= Ni/N×100 (Rezaie and Yarnia, 2009)
Speed of germination	S= ni/di (Ranal abd De Santana, 2006)
Mean germination time	MGT= ∑ni×di/N (Tompsett and Pritchard, 1998)
Root length	Ruler(cm)
Shoot length	Ruler(cm)

2.8 Determination of Root and Shoot Length

After 1 week of growth, 3 seedling samples were taken for the measurement of roots and shoot length from each petri dish and measured in cm.

2.9 Statistical Analysis

The data obtained was analyzed using Gen Stat version 15. The design was one-way CRD. Analysis of variance (ANOVA) was conducted to study the significant effect of different PGRs (IBA, NAA, GA_3) on the germination of okra seed. The least significant difference (LSD) test was applied at a 5% significance level to compare the mean differences that showed significant effects.

3. Results and Discussion

The results obtained from the research as well as relevant discussion have been summarized under the following headings: -

3.1 Effect of IBA on Okra Germination

The experimental data revealed the significant effect of applying IBA on okra germination. Among the different doses of IBA, T_3 (48.33bcd) shows higher germination percentages, and T_4(45.00a) shows a rapid speed of germination. Likewise, T_3 has attained a better speed of vigor as well as mean germination is obtained maximum in T_4 (4.500a). Similarly, the root length is longest in T_4 (4.500a), the shoot length is maximum in T_4(3.233cd) and the root/shoot ratio is highest in T_2 (1.1189ab). Thus, the data shows that T_4 performed better among T_2 and T_3. IBA 180 ppm performed well in maintaining speed of germination, mean germination time which in better root and shoot length development. This result is line with (Mohammadi et al., 2014 and Oliveira et al., 2019).

3.2 Effect of NAA on Okra Germination

From the research conducted, the data showed the rate of applying certain doses of NAA on Okra germination found that T_6(45.00 bcd) indicated rapid germination percentage, T_5 (3.400bc) showed superior speed of germination and T_6 (325.5cd) has higher speed of vigor. Similarly, mean germination time is better in T_5 (3.400 bc) , root and shoot length was better in T_5(3.400 bc) and T_6 (3.76bc) respectively. The root and shoot ratio is maximum in T_5 (0.9934bc). As result from the data demonstrated that T_5 (120 ppm) performed well in germination speed, mean germination time, root length and the ratio of root and shoot length. This result is more related to (Muhammad and Shik Rha, 2007).

Table 3: Effect of seed priming on germination and its parameter.							
Treatment	**Total germination %**	**Speed of germination**	**Speed of Vigor**	**Mean Germination Time**	**Root length**	**Shoot length**	**Root-shoot ratio**
T_1	48.33^{bcd}	0.1429^{c}	389.5^{bc}	0.1429^{c}	0.1429^{c}	3.533^{cd}	1.2789^{a}
T_2	43.33^{cd}	382.2^{b}	291.2^{de}	382.2^{b}	382.2^{b}	3.233^{cd}	1.1189^{ab}
T_3	48.33^{bcd}	3.842^{a}	293.8^{be}	3.842^{a}	3.842^{a}	3.067^{cd}	0.9873^{bc}
T_4	45.00^{cd}	4.500^{a}	264.0^{de}	4.500^{a}	4.500^{a}	3.233^{cd}	0.8241^{cd}
T_5	41.67^{d}	3.400^{bc}	284.8^{de}	3.400^{bc}	3.400^{bc}	3.467^{cd}	0.9934^{bc}
T_6	45.00^{bcd}	0.761^{d}	325.5^{cd}	0.761^{d}	0.761^{d}	3.767^{bc}	0.9221^{bcd}
T_7	41.67^{d}	0.1429^{c}	237.3^{e}	0.1429^{c}	0.1429^{c}	3.033^{d}	0.8941^{bcd}
T_8	53.33^{ab}	283.7^{cd}	438.5^{b}	283.7^{cd}	283.7^{cd}	4.633^{a}	0.7805^{cd}
T_9	56.67^{a}	3.921^{a}	548.3^{a}	3.921^{a}	3.921^{a}	4.83^{a}	1.0024^{bc}
T_{10}	51.67^{abc}	3.500^{b}	378.3^{bc}	3.500^{b}	3.500^{b}	4.300^{ab}	0.7061^{d}
ese(±)	2.528	0.00631	21.52	0.0947	0.1438	0.2153	0.0804
LSD(0.05)	7.456	0.01861	63.49	0.2792	0.2490	0.6350	0.2372
CV%	9.2	7.2	10.8	4.5	7.2	10.0	14.6
G. Mean	47.50	0.1525	345.1	3.634	3.467	3.710	0.951

[Note: the common letter(s) within the column indicate a non-significant difference based on the Duncan multiple range test (DMRT) at 0.05 level of significance]

3.3 Effect of GA3 on the Germination of Okra

Based on the research analysis, the data revealed that treatment T_9 with GA_3 resulted in the highest germination percentage (56.67a) and the fastest germination rate (3.921a). Similarly, mean germination time was greater in T_9 (3.921a), the root length was maximum in T_9 (3.921a) and the length of shoot was higher in T_9(4.83a). Thus, root and shoot ratio was maximum in T_9 (1.0024bc). From all the above results, T_9 (150ppm) performed altogether better in all the above-mentioned parameters. This result is line with (Maiti et al., 2011; Tania and Rhaman, 2020).

4. Conclusion

Priming okra seeds is an effective method to address reduced and delayed germination caused by seed hardness in both fresh and stored seeds. Pre-sowing priming promotes plant growth, development, and yield. Research indicates that GA3 (150 ppm) is more effective than IBA and NAA in enhancing seed germination, as it more rapidly breaks seed dormancy. This technique improves germination percentage, rate, seedling growth, mean germination time, and overall tolerance to various abiotic and biotic stresses.

5. Acknowledgement

The authors would like to express their special thanks to the Agriculture and Forestry University, CNRM, Bardibas, Mahottari, Nepal, for providing the resources and for all assistance and guidance during the research.

References

AITC, 2023. Agriculture and Livestock Dairy. Hariharbhawan, Lalitpur: Agriculture Information and Training Centre, Ministry of Agriculture and Livestock Development, Government of Nepal.

Elkhalifa, A. E., Alshammari, E., Adnan, M. A., Awadelkareem, A. M., Eltoum, N., E., M. K., Ashraf, S. A., 2021. Okra (Abelmoschus Esculentus) as a Potential Dietary Medicine with Nutraceutical Importance for Sustainable Health Applications. Molecules, 26(3), Pp. 696. https://doi.org/https://doi.org/10.3390/molecules26030696

FAO, 2021. FAOSTAT Database. Retrieved from http://www.fao.org/faostat

Lamichhane, A. K., M., S. M., and Baral, B., 2021. Effect of Seed Priming on Germination of Okra (Abelmoschus esculentus var. Arka Anamika). Malaysian Journal of Sustainable Agriculture, 2 (111-114), Pp. 5. https://doi.org/https://doi.org/10.26480/mjsa.02.2021.111.114

Maiti, R. K., Vidyasagar, P., Rajkumar, D., Ramaswamy, A., Gonzalez, and Rodriguez, H., 2011. Seed Priming Improves Seedling Vigor and Yield of few Vegetable Crops. International Journal of Bio-Resource and Stress Management, 2(1), Pp. 125-130.

Mohammadi, G., Khah, E. M., Petropoulos, S. A., Chachalis, D. B., Akbari, F., and Yarsi, G., 2014. Effect of Gibberellic Acid and Harvesting Time on the Seed Quality of Four Okra Cultivars. Journal of Agricultural Science, 6(7). https://doi.org/10.5539/jas.v6n7p200

Muhammad, J., and Shik Rha, E., 2007. Gibberellic Acid (GA3) Enhance Seed Water Uptake, Germination and Early Seedling Growth in Sugar Beet under Salt Stress. Pakistan Journal of Biological Sciences, 10(4), Pp. 654-658. https://doi.org/10.3923/pjbs.2007.654.658

Nisar, M., Rahman, H. U., Khan, M. S., Khan, I., Fatima, S., Waseem, K., and Rahman, K., 2021. Assessing Impact of Naphthalene Acetic Acid on the Growth and Yield of Okra (Abelmoschus esculentus (L.) Moench). Pakistan Journal of Scientific & Industrial Research Series A: Physical Sciences, 64(1), Pp. 35-45. https://doi.org/https://doi.org/10.52763/PJSIR.PHYS.SCI.64.1.2021.35.45

Oliveira, C. E., Steiner, F., Zuffo, A. M., Zoz, T., Alves, C. Z., and De Aguia, V. C., 2019. Seed priming improves the germination and growth rate of melon seedlings under saline stress. Ciencia Rural, 49(7), Pp. 1-11. https://doi.org/https://doi.org/10.1590/0103-8478cr20180588

Purquerio, L. F., Lago, A. A., and Passos, F. A., 2010. Germination and hardseedness of seeds in okra elite lines. Horticultura Brasileira, 28(2), Pp. 232-235. https://doi.org/https://doi.org/10.1590/S0102-05362010000200017

Ranal, M. A., and De Santana, D. G., 2006. How and why to measure the germination process? Revista Brasileira de Botanica, 29(1), Pp. 1-11. https://doi.org/https://doi.org/10.1590/S0100-84042006000100002

Rezaie, F., and Yarnia, M., 2009. Allelopathic effects of Chenopodium album, Amaranthus retroflexus and Cynodon dactylon on germination and growth of safflower. Journal of Food, Agriculture and Environment, 7(2), Pp. 516–521.

Sorapong, B., 2012. Okra (Abelmoschus esculentus (L.) Moench) as a valuable vegetable of the world. Ratarstvo i Povrtarstvo, 49(1), Pp. 105-112. https://doi.org/https://doi.org/10.5937/ratpov49-1172

Tahir, M. T., Anjum, M. A., Saqib, M., Khalid, M. F., and Hussain, S., 2019. Seed primig and foliar application of plant growth regulators affect the growth and yield of okra under calcareous soil. Acta Scientiarum Polonorum Hortorum Cultus, 18(4), Pp. 25-33. https://doi.org/https://doi.org/10.24326/asphc.2019.4.3

Tania, S. S., and Rhaman, M. S., 2020. Hydro-priming and halo-priming improve seed germination, yield and yield contributing characters of Okra (Abelmoschus esculentus L.). Journal of the Society for Tropical Plant Research, 7(1), Pp. 86-93. https://doi.org/https://doi.org/10.22271/tpr.2020.v7.i1.012

Tompsett, P. B., and Pritchard, H. W., 1998. The effect of chilling and moisture status on the germination, desiccation tolerance and longevity of Aesculus hippocastanum L. seed. Annals of Botany, 82(2), Pp. 249-261. https://doi.org/ https://doi.org/10.1006/anbo.1998.0676