Original Research Article

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Effect of Pre-Sowing Seed Treatment of Organic and Electromagnetic Field on Growth, Yield Attributing Traits and Seedling Characters of Okra (*Abelmoschus esculentus* L.) cv. Arka Anamika

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ABSTRACT

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The present experiment was conducted in field and laboratory at Department of Genetics and Plant Breeding, Naini Agriculture Institute, SHUATS, UP. To investigate the effect of pre-sowing seed treatment of electric, magnetic and botanicals on okra seeds of variety ArkaAnamika. Okra seeds were treated with different intensities of magnetic field (100mT, 125mT, 150mT for 30 minutes), different intensities of electric field (200 mA, 300 mA, 400 mA for 1 minute), seaweed extract (10%,15% for 12 h), Panchagavya (5% for 12 h), Agniastara (15%,20% for 30DAS). The pre-sowing seed treatment with magnetic field(150mT for 30 minutes) has performed the best results in field parameters like field emergence, days to 50% flowering, plant height 30DAS, plant height 60DAS, plant height 90, number of branches per plant, number of capsules per plant, length of capsule, girth of capsule, number of seeds per capsule, seed index, seed yield per plant, seed yield per plot and in lab parameters like germination percentage, shoot length, root length, seedling length, fresh weight, dry weight, vigour index-I, seed vigour index-II followed by magnetic field(125mT for 30 min) and electric field (300 mA for 1 min).Hence seed treatment of okra seeds with magnetic field is the best treatment compared to electric field and other pre-sowing seed treatments.

Introduction

Okra (*Abelmoschus esculentus* L.) commonly known as lady's finger or bhendi. Okra belongs to the family Malvaceae. The genus *Abelmoschus* is Asiatic origin. Oka is often-cross pollinated crop and having chromosome number 2n=130. Okra is an annual, erect

herbaceous crop and 1-2m height (Musara *et al.*, 2015). Okra is a fruit vegetable which is used in many parts of the world especially in Asia and Africa. It is a heat and drought tolerant crop. Okra occupies major position among fruit vegetables due to its high nutritive and medicinal values, growing in all seasons, wider adoptability, easy cultivation,

good export potential and high returns (Reddy *et al.*, 2013). Composition of okra per 100g edible pods is water 88.6g, energy 36 Kcal, protein 2.10g, carbohydrates 8.20g, fiber 1.70g, fat 0.20g. Ca 84mg, P 90mg, Fe 1.20mg, riboflavin 0.08mg, thiamine 0.04mg, niacin 0.60mg, ascorbic acid 47mg, (Gopalan *et al.*, 2007).

Okra is an annual crop propagated from seed, grown for its green tender fruits, which are cooked and consumed as a vegetable purpose in a variety of ways (Chattopadhyay *et al.*, 2011).

Pre sowing seed treatments

The magnetic and electric field may provide a feasible non-chemical seeds in agriculture. At the same time, it offers advantages to protect environment and also safety for the applicator. Among the main advantage of application of magnetic field on seeds has greater facility of multiplication with a minimal risk to damage, when compared to manipulation with tissues of leaves, roots or stems.

One of the main reasons why the seeds treated with magnetic fields has spread worldwide lies in positive impact that has on good recovery of seeds exhibiting a poor quality for certain vegetable species.

Materials and Methods

The field and lab experiments were conducted during Kharif season 2019-2020. Department of Genetics and plant breeding, Naini Agriculture Institute SHUATS, Prayagraj, (UP).

The statistical designs applied were carried out with Randomized Block Design (RBD) with 13 treatments and 3 replications and Complete Randomized Design (CRD) with 13 treatments and 4 replications. Seed material

consists of Okra variety ArkaAnamika. The treatments were represented as

T₀-Control

T₁ – Magnetic field (100mT)-30minutes

T₂– Magnetic field (125mT) -30minutes

T₃– Magnetic field(150mT)-30minutes

T₄ – Electric field (200mA)-1minute

T₅ – Electric field (300mA)-1minute

T₆– Electric field(400mA)-1minute

T₇– Panchagavya (5%)-12hours,

T₈– Panchagavya (3%)-12hours,

T₉– Seaweed extract (15%)–12hours,

T₁₀– Seaweed extract (10%)–12hours

T₁₁– Agniastra (15%)– foliar spray 30DAS

T₁₂– Agniastra (20%) -foliar spray 30DAS

Magnetic treatment

Magnetic field the seeds are treated with magnetic field generator “OMEGA EMU-10” was used. It has two cylinders having space between them to place and treat the material magnetic field flows through the cylinders when switch on the power supply constant power supply of 230AC (0-4AMP) (+/- 10%AC 50HZ) used to pass the current into the magnetic field generator. The metallic probe made of indium arsenide crystal and encapsulated to a non -magnetic sheet is used.

Electric treatment

To treat seeds with electric field electric field generator was fabricated by using NaCl as an electrolyte with zinc(-) and copper(+) electrodes. 24V DC battery was used as power source for electrolytes the 2 electrodes were placed vertically inside the beaker containing seed material which were placed in prepared electrolyte solution *i.e.*, sodium chloride solution, Electric power cords were fix with power supply unit with respective places. An electric current of 24VDC was passed for required intensities and for different durations.

Results and Discussion

The results shown in table-1 indicate the parameters *i.e.*, germination%, root length, shoot length(cm), seedling length(cm), fresh weight(g), dry weight(g), vigour index-I, vigour index-II and table 2 indicate the parameters *i.e.*, field emergence (%), days to 50% flowering, plant height 30,60,90DAS, number of branches per plant, number of capsules per plant, length of capsules(cm), girth of capsules(cm), number of seeds per capsules, seed yield per plant, seed yield per plot, seed index. In the present experiment the suitable pre sowing seed treatment is T₃- Magnetic field 150mT for 30minutes. In the present investigation the best performed pre sowing seed treatment is T₃- Magnetic field 150mT for 30minutes when compared to

other treatments and control, followed by T₂- Magnetic field 125mT for 30minutes and the third highest is T₅- Electric field 300mA for 1 min.

Similar results are found in tomato that SMF application significantly enhanced seed performance *i.e.*, germination, seedling length, seedling dry weight and vigour (Ananta Vashisth *et al.*, 2013). A research revealed that the effects of magnetic field and exposing time on germination and seedling growth(shoot length, root length, seedling fresh, dry weights) and enzyme activity of cumin were statistically significant (Majid *et al.*, 2013). Similar results are found in maize seeds *i.e.*, the highest increase in fresh weight and dry weight magnetic treated seeds when compared to control.

Table.1 Mean performance of okra (ArkaAnamika) for 8 seedling characters

S.no	Treatment	Germination (%)	Shoot length (cm)	Root length (cm)	Seedling length (cm)	Fresh weight (g)	Dry weight (g)	Vigour index- I	Vigour index- II
1.	T ₀	74.000	12.728	9.650	22.378	4.175	0.378	1,649.135	28.150
2.	T ₁	85.000	16.165	11.848	28.013	5.690	0.495	2,381.880	42.830
3.	T ₂	86.000	17.003	13.485	30.488	6.328	0.513	2,625.930	43.840
4.	T ₃	87.500	17.545	13.880	31.425	6.508	0.523	2,749.995	45.715
5.	T ₄	79.500	14.943	11.148	26.090	5.625	0.483	2,075.455	38.360
6.	T ₅	86.500	16.718	12.048	36.265	5.933	0.500	2,489.170	43.260
7.	T ₆	78.000	14.568	10.713	25.280	5.310	0.465	1,973.640	35.800
8.	T ₇	81.500	13.448	9.930	23.378	5.295	0.435	1,905.840	35.345
9.	T ₈	82.500	13.810	10.898	24.708	4.790	0.420	1,990.125	35.345
10.	T ₉	79.000	12.870	10.433	23.303	5.075	0.418	1,842.480	33.090
11.	T ₁₀	82.000	15.805	11.770	27.575	5.665	0.490	2,261.930	40.450
12.	T ₁₁	81.500	14.020	11.673	25.693	5.155	0.378	2,094.120	30.735
13.	T ₁₂	80.500	15.520	10.795	26.315	4.650	0.388	2,120.630	31.170
Grand Total		1063.5	195.143	148.271	350.911	70.199	5.886	28160.33	484.09
F Test		S	S	S	S	S	S	S	S
SE(m)		1.834	0.521	0.577	2.258	0.211	0.015	94.675	1.479
SE(d)		2.594	0.737	0.816	3.194	0.298	0.021	133.891	2.091
C.D		5.267	1.497	1.657	6.484	0.605	0.042	271.842	4.246

Table.2 Mean performance of 13 growth and yield characters of Okra (Arka Anamika)

Sr no	Treat ment	Field Emergence	Plant Height			Days to 50% flowering	Number of branches per plants	Number of Capsules per plants	Length of Capsule (cm)	Girth of capsule (cm)	Number of seeds per capsules	Seed Yield per plant	Seed Yield per plot	Seed Index
			30DAS	60DAS	90DAS									
1.	T ₀	74.070	22.187	63.487	144.483	52.667	3.933	14.800	15.847	3.543	34.867	40.233	367.523	4.813
2.	T ₁	87.030	26.527	74.483	156.493	43.000	4.733	18.133	19.863	4.570	44.067	48.373	448.050	6.367
3.	T ₂	90.733	27.993	78.077	166.660	42.000	5.133	22.367	20.343	4.807	49.467	49.543	492.530	6.777
4.	T ₃	92.587	28.540	81.263	168.497	40.333	5.200	25.367	21.433	4.867	51.467	50.597	495.787	7.120
5.	T ₄	83.330	25.003	72.243	160.527	47.667	4.600	19.600	18.303	4.443	27.193	46.403	434.293	5.510
6.	T ₅	90.733	27.300	77.053	165.600	43.333	4.933	22.300	20.250	4.757	48.067	49.053	450.580	6.633
7.	T ₆	84.810	25.287	70.207	158.497	46.000	4.667	15.833	19.317	4.183	39.133	46.423	431.007	5.580
8	T ₇	85.180	22.377	69.637	147.517	48.000	4.200	21.837	17.513	4.000	38.533	42.440	372.593	5.227
9.	T ₈	83.327	25.120	69.193	151.790	50.000	4.600	20.667	17.307	4.240	35.667	43.797	395.800	5.157
10	T ₉	88.883	22.710	65.373	148.463	50.333	4.000	20.000	16.490	3.920	41.400	44.553	419.907	5.353
11	T ₁₀	88.880	26.373	74.60	163.39	44.333	4.867	21.947	19.280	4.603	46.600	47.907	443.013	5.863
12	T ₁₁	79.623	23.123	67.58	150.12	47.000	4.667	17.200	16.447	3.713	36.000	45.107	388.230	5.107
13	T ₁₂	75.920	24.240	65.857	147.677	46.000	4.067	16.833	18.340	3.837	35.200	44.883	425.473	5.077
Grand Total		1105.106	326.78	929.06	2029.717	600.666	59.6	256.884	240.733	55.483	527.661	599.312	5564.786	74.584
F Test		S	S	S	S	S	S	S	S	S	S	S	S	S
SE(m)		2.432	1.103	1.953	1.509	1.523	0.229	0.826	1.087	0.286	3.583	1.216	11.581	0.147
SE(d)		3.440	1.559	2.762	2.134	2.154	0.324	1.169	1.537	0.404	5.066	1.719	16.378	0.208
C.D		7.141	3.237	5.735	4.431	4.472	0.672	2.426	3.190	0.839	10.519	3.570	34.003	0.431

In addition to that magnetic treated plants grew higher and heavier (Florez, *et al.*, 2005). Soheil *et al.*, (2017) found that the best germination percentage and other seedling characters were observed when exposing the seeds of sweet corn for 6 hours to a static magnetic field of 150 mT. Some authors found an increase in the germination percentage, seeds as a positive response to various static magnetic fields for different periods exposure times in crops rice, wheat, maize and barley seeds (Martinez *et al.*, 2017). Similar results are found in lentil seeds that electromagnetic field causes physiological-biochemical changes and increases the germination percentage in the lentil seeds (Asgharipour and Omrani, 2011).

The present study concluded that magnetic treatment of okra seeds has given the best results compared to electric and other pre sowing treatments. Among various pre sowing priming treatments T₃– Magnetic field (150mT) for 30minutes performed the best results. It was followed by T₂– Magnetic field (125mT) for 30minutes and T₅ – Electric field (300mA) for 1minute. The present study showed that high magnetic field dosage improves the seed germination, vigour, plant growth and yield. Magnetic field exposure to okra seeds gave more significant results when compared to electric and organic treatments.

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