Influence of electric, magnetic and bio film on the growth, yield, and yield attributing traits of radish (*Raphanus sativus* L.)

ARTICLE TITLE: ***Original Research Article***

ABSTRACT

The present study was carried out for **Influence on electric, magnetic and Bio - film in the growth, yield, and yield attributing traits of radish (*Raphanus sativus* L.)** was made to identify the effect of seed priming of different kinds on seed quality characters of radish and to find out suitable seed priming method for radish. For this purpose, 13 priming treatments were taken in Randomized Block Design including control on radish seed was studied under field conditions during Rabi, 2020-21. Analysis of variance for the data revealed that significance mean sum of squares due to seed priming treatments were observed for all the characters under study viz., Fieldemergence percentage, Plant height (20, 40 DAS and at harvest), Days to maturity, total number of leaves, dry weight of leaves, fresh weight of leaves, seed yield per plot, seed yield per plant and seed yield per hectare which were highly significant at 5% level of significance indicating presence of good amount of variability among the treatments for these characters. Seed priming with T3 – Magnetic (600 gauss) significantly affected characters studied in field experiment. Thus, application of T3 – Magnetic (600 gauss) may be useful for improving growth, yield, and yield attributing traits of radish. The experiment was laid out in Randomized block design (RBD).

Key words: Magnetic, Electric, Bio film, methyl cellulose, alginate, polyvinyl glycol

INTRODUCTION:

Radish (Raphanus sativus L.) is an important root vegetable belonging to family Cruciferae. It is one of the most important and popular root vegetable grown in tropical, sub-tropical and temperate regions of the world. It is grown both as an annual and a biennial crop.Radish is predominantly a cool season vegetable crop. In the mild climate, radish can be grown over all year except for few months in summer. It is grown and consumed all over the world and considered as the part of the human diet. It is used as salad. It has pungent flavour and considered as an appetizer. The roots, leaves, flowers and pods are active against gram positive bacteria, urinary complaints, piles and gastrodynia.

Seed is an extremely complex system and its state cannot always be controlled by changing of seed vitality indices viz., germinating energy, germination and uniformity of germination. Bio-priming, which combines a variety of plant extracts, microbial products, and biotic agents to manage seed crops and target them against biotic and abiotic stresses, has been hailed as a novel effective management because it uses fewer chemicals, increases the efficacy of the seeds, reduces management costs, eliminates pollution risks, and interferes with biological equilibrium to the least amount possible. One essential strategy for managing biotic and abiotic challenges is seed biopriming, which ensures homogeneous stand establishment under adverse conditions. Therefore, it is necessary to develop research programmes that cover the discovery, genetic modification, and commercial use of new biocontrol agents (fungal and bacterial strains).

Techniques for priming seeds offer several advantages, including a decrease in fertiliser consumption, increased agricultural output through synchronised seed germination, and the induction of systemic resistance in plants that is both economical and environmentally beneficial. A practical and affordable procedure called seed priming is used to achieve consistent seed development in field crops. It improves crop production, nutrient absorption, water usage effectiveness, release of photo- and thermo-dormancy, and maturity. (Elham *et al,* 2014).

It is apparent that the effect of magnetic field exposure of seeds and seedlings bring about certain physiological, biochemical and metabolic changes in plants and therefore, it is evict that the use of optimum level of magnetic field will definitely prove to be a pre-treatment catalyst in agriculture promoting growth, vigour and good yield of crops. Presumably, in the future, this lab to land programme using magnetic field can provide feasible solution for higher productivity and may help to improve the overall potato tuber production It is to be documented here that even with the diverse nature of a subcontinent like India; considerable success can be achieved only by adopting such new technologies for improving the overall agricultural situation in requisites of quality promoting growth vigour and good yield of crop. In order to improve quality of seed in respect of crop stand, many workers studied the effect of magnetic field on seed viability, vigour, seed germination and seedling growth and found positive results. Physical methods of stimulation are an innovative area of research and emerged as a magic tool which could improve the yield of crops.

MATERIALS AND METHODS:

The present research on Influence of electric, magnetic and bio filming on the growth, yield, and yield attributing traits of radish (Raphanus sativus L.) was made to identify the effect of seed priming of different kinds on seed quality parameters of radish and to find out suitable seed priming method for radish. The experiment was laid out in Randomized Block Design with thirteen treatments including control which were replicated thrice in *Rabi se*ason 2021. The treatments are as follows, T0- Control, (T1, T2, T3, T4, - Magnetic - 200, 400, 600, 800 gauss), (T5, T6, T7, T8 – Electric – 100, 200, 300, 400 mA mp), (T9, T10, T11, T12 – Bio filming @ 1% (methyl cellulose, alginate, polyvinyl glycol, adhesive) respectively. The radish seeds were primed with above different priming agents in above different concentrations and intensities for a given duration. After priming seeds were dried to initial moisture content at room temperature. After that the primed seeds were used to grow under field conditions. Field experiment was laid out in Randomized BlockDesign (RBD) with three replications during Rabi 2021-22. Data were recorded for 16 characters i.e.

pre-harvest characters viz., Field emergence, Plant height (cm), Number of leaves, Leaf area per plant (cm), total fresh weight of leaves, dry weight of leaves, Days to maturity.

post–harvest characters viz., Root length, root diameter, Fresh weight of roots (g), Dry matter content of roots, Total fresh weight of plants (g), Total dry weight of plants (g), Yield per hectare (tons), Yield per plot (g), Yield per plant (grams).

RESULTS AND DISCUSSION:

Pre – harvest observations:

1. **Plant height:** maximum plant height was recorded in treatment T3 - Magnetic – 600 gauss (56.51 %), was statistically at par with T6 – Electric – 200 Ma mp (55.91 %) was significantly higher than other significant treatments. **XU et *al,* (2009)** studied effect of magnetic treatment on seed germination and photosynthetic characteristics of wheat with different magnetic field strength and time. The seed germination rate, germination energy, vigor index and germination index seedling chlorophyll content and net photosynthetic rate, intercellular CO_2 concentration, stomatal conductance, and inspiration rate of wheat were determined in this study. The results showed that the most above-mentioned indexes in treated seeds and seedlings were higher than that in the control.
2. **Number of leaves:** The mean performance of number of leaves per plant ranged from 12 to 17 with the mean value of 15. The minimum number of leaves per plant was exhibited by treatment T0 [control] (12), while maximum number of leaves per plant was recorded in treatment T3 - Magnetic – 600 gauss (17), was statistically at par with T6 – Electric – 200 Ma mp (16) was significantly higher than other significant treatments.
3. **Leaf area per plant:** minimum leaf area per plant was exhibited by treatment T0 [control] (98.00), while maximum leaf area per plant was recorded in treatment T6 – Electric – 200 Ma mp (105.6) was statistically at par with T4 - Magnetic – 600 gauss, T5 - Electric – 100 ma mp, T7 - Electric – 300 Ma mp, T8 - Electric – 400 Ma mp and T9 - Bio filming-Methyl cellulose were

significantly higher than other significant treatments. Naz et al. (2012) treated seedlings with magnetic fields before to planting. The germination %, number of flowers per plant, leaf area (cm2), plant height (cm) at maturity, number of fruits per plant, pod mass per plant, and number of seeds per plant all showed a significant increase (P=0.05). When compared to the control, the 99 mT for 11 min exposure produced better outcomes.

4. **Days to maturity:** The mean performance of days to maturity ranged from 52.33 to 59.33 with the mean value of 55.36 %. The minimum days to maturity was exhibited by treatment T0 [control] (59.33), while maximum days to maturity was recorded in treatment T3 - Magnetic – 600 gauss (52.33) was statistically at par with T6 – Electric – 200 Ma mp (53.67) were significantly higher than other significant treatments.
5. **Total fresh weight of leaves:** minimum fresh weight of leaves was exhibited by treatment T0 [control] (87.45), while maximum fresh weight of leaves was recorded in treatment T4 - Magnetic – 600 gauss (106.94) was statistically at par with T7 – Electric – 200 Ma mp (104.58) were significantly higher than other significant treatments.
6. **Dry weight of leaves:** The minimum dry weight of leaves was exhibited by treatment T0 [control](6.93), while maximum dry weight of leaves was recorded in treatment T4 - Magnetic – 600 gauss (9.03), was statistically at par with T7 – Electric – 200 Ma mp (8.56) were significantly higher than other significant treatments.

Influence of Electric, Magnetic and Bio – filming on plant height, days to maturity, leaf area per plant.

TREATMENT	PLANT HEIGHT	DAYS TO MATURITY	Leaf area per plant
T0 – Control	**45.40**	**59.33**	98
T1 – Magnetic – 200 gauss	48.68	55.00	101
T2 – Magnetic – 400 gauss	53.73	55.33	101.3
T3 – Magnetic – 600 gauss	**56.51**	**52.33**	102
T4 – Magnetic – 800 gauss	49.37	54.67	104.2
T5 – Electric – 100 m Amp	49.01	53.33	105
T6 – Electric – 200 m Amp	**55.91**	**53.67**	105.6
T7 – Electric – 300 m Amp	51.66	56.00	102.4
T8 – Electric – 400 m Amp	48.52	**59.33**	103
T9 - Bio filming 1% (Methyl cellulose)	55.26	55.00	103.2
T10 - Bio filming 1% (Alginate)	47.48	54.33	100.3
T11 - Bio filming 1% (polyvinyl glycol)	49.45	57.00	101.00
T12 – Bio filming 1% (Adhesive)	49.71	54.33	101.20
F test	S	S	S
S. Em (±)	0.562	0.552	**1.34**
CD (p=0.05)	1.642	1.611	**3.9**

Influence of Electric, Magnetic and Bio – filming on number of leaves, fresh weight of leaves, dry weight of leaves of radish.

TREATMENT	No.of leaves	Total fresh weight of leaves	Total dry weight of leaves
T0 – Control	12	**87.45**	**6.93**
T1 – Magnetic – 200 gauss	14	95.22	8.02
T2 – Magnetic – 400 gauss	16	99.87	8.55
T3 – Magnetic – 600 gauss	17	**106.94**	**9.03**
T4 – Magnetic – 800 gauss	14	98.20	8.24
T5 – Electric – 100 m Amp	15	96.94	8.20
T6 – Electric – 200 m Amp	16	**104.58**	**8.56**
T7 – Electric – 300 m Amp	15	96.48	8.16
T8 – Electric – 400 m Amp	15	94.32	7.92
T9 - Bio filming 1% (Methyl cellulose)	16	102.97	8.30
T10 - Bio filming 1% (Alginate)	14	92.21	7.42
T11 - Bio filming 1% (polyvinyl glycol)	13	94.67	7.88
T12 – Bio filming 1% (Adhesive)	15	96.87	7.50
F test	S	S	S
S Em (±)	0.203	0.764	0.121
CD (p=0.05)	0.593	2.232	0.354

Influence of Electric, Magnetic and Bio – filming on seed yield per plant, plot and hectare.

TREATMENT	Seed yield/plant	Seed yield/plot	Seed yield/hectare
T0 – Control	85.59	3.06	96.39
T1 – Magnetic – 200 gauss	113.40	4.05	127.71
T2 – Magnetic – 400 gauss	127.31	4.55	143.37
T3 – Magnetic – 600 gauss	146.25	5.22	164.71
T4 – Magnetic – 800 gauss	101.17	3.61	113.94
T5 – Electric – 100 mA mp	112.47	4.02	126.66
T6 – Electric – 200 mA mp	129.83	4.64	146.21
T7 – Electric – 300 mA mp	107.33	3.83	120.88
T8 – Electric – 400 mA mp	116.20	4.15	130.86
T9 - Bio filming 1% (Methyl cellulose)	114.80	4.10	129.29
T10 - Bio filming 1% (Alginate)	110.13	3.93	124.03
T11 - Bio filming 1% (polyvinyl glycol)	116.95	4.18	131.70
T12 – Bio filming 1% (Adhesive)	127.03	4.54	143.06
F test	S	S	S
S Em (±)	3.588	0.128	4.041
CD (p=0.05)	10.474	0.374	11.795

YIELD ATTRIBUTES:

7. **Seed yield per plant (gm):** The treatments showed significant effect of pre-sowing seed treatment on seed yield per plant. The mean performance of seed yield per plant ranged from 3.06 to 5.22 with the mean value of 4.14. The minimum and maximum seed yield per plant was exhibited by treatment T0 [control](3.06 gm) and treatment T4 - Magnetic – 600 gauss (5.22 gm) was statistically at par with T7 – Electric – 200 Ma mp (4.64 gm) were significantly higher than other significant treatments. Magnetic field treatment in order to improve germination and seedling growth of Festuca arundinacea Schreb and Lolium perenne L., it was found that magnetic field significantly decreased the time of germination (e. g. 10% compared to the control); however, root characters of treated seedlings increased significantly compared to the control **(Carbonnel *et al.*, 2008)**.
8. **Seed yield per plot (gm):** The treatments showed significant effect of pre-sowing seed treatment on seed yield per plot. The mean performance of seed yield per plot ranged from 85.59 to 146.25 with the mean value of 116.03. maximum seed yield per plot was recorded in treatment T4 - Magnetic – 600 gauss (146.25) was statistically at par with T7 – Electric – 200 Ma mp (129.83) were significantly higher than other significant treatments. Low frequency magnetic fields' effects on sugar beet output and quality were investigated by Rochalska and Orzeszko- Rywka in 2005. treatment of seeds with a low frequency magnetic field prior to planting (16 Hz, 5mT). The emergence of seeds was accelerated by magnetic treatments, particularly for weak seeds. The plant's yield rose as a result.
9. **Seed yield per hectare:** maximum seed yield per hectare was recorded in treatment T4 - Magnetic – 600 gauss (164.71) was statistically at par with T7 – Electric – 200 Ma mp (146.21) were significantly higher than other significant treatments. **Radha Krishna, (2018)** reported that Seed yield is the representative of growth and tolerance of the plant to the biotic and abiotic factors which were usually commenced by a plant in a process to completes its life cycle. Electro priming of wheat seeds maintains the proper hormonal balances, synthesized a greater number of enzymes, increased the range of metabolites and further increased the yield.

CONCLUSION:

It is concluded from the present study that the seeds of Radish (Minu early) were treated with Magnetic – 600 gauss (T4) showed highly significant in growth, yield and yield attributing traits followed by Electric – 300 Ma mp (T7) as compared to control (untreated) seeds.

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