Original Research Article

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

ABSTRACT

The present investigation was carried out for **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 mustard and to find out suitable seed priming method for radish. For this purpose, 13 priming treatments including control on radish seed were used to study under filed 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., Field emergence 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.

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

INTRODUCTION:

Radish (Raphanus sativus L.) is an important root vegetable cultivated in tropical and temperate regions of the world, 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 vegetable crop depending upon the purpose of which it is grown. Radish is predominantly a cool season vegetable crop. However Asiatic types can tolerate higher temperature than European varieties. In the mild

climate, radish can be grown almost all year round except for few months in summer. Radish is grown and consumed all over the world and is considered part of the human diet, even though it is not common among some populations. Its young tuberous roots can be eaten raw in salad or cooked as a vegetable. It has a 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 priming techniques have multiple benefits such as reduce the use of fertilizers, enhance crop yield by synchronized seed germination, and induce systemic resistance in plants which is both cost-effective and eco- friendly. To obtain uniform seed development in field crops, seed priming is used which is an economical and feasible technology. It has beneficial effects such as nutrient uptake, water use efficiency, release photo- and thermo-dormancy, maturity, and crop yield (Bagheri, 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. 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.

Integration of diverse plant extracts, microbial products and biotic agents through bio-priming for managing seed crop targeting against biotic and abiotic stresses has been considered as a unique approach, as it requires lesser amounts of chemicals, enhances efficacy of the seeds, reduces the cost of management and eliminates pollution hazards while causing minimum interference with biological equilibrium. Seed biopriming is one of the vital seed enhancement tool in management of biotic as well as abiotic stresses and

guarantees uniform stand establishment under stress conditions. Therefore, research programmes encompassing identification and genetic manipulations of novel biocontrol agents (fungal and bacterial strains) along with its commercial application needs to be devised.

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. 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 Block Design (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:

Plant height: The minimum plant height at harvest was exhibited by treatment T0 [control] (45.40 %), while 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. **Zheng and XU Jian (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. **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. The beneficial effects of SMF pre sowing on seedling growth are not only the result of stimulation of reserve mobilization and respiration initiated in germination but also of metabolic changes as protein biosynthesis from mRNAs, gene transcription and cellular repairs (Racuciu et al., 2008; Shabrangi and Majd, 2009). **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., (2010)** using pre-sowing magnetic treatment of seeds. A significant increase ($P<0.05$) was observed in germination percentage, 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 The 99 mT for 11 min exposure showed better results as compared to control. **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.

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. **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.

Table 1. **Influence of Electric, Magnetic and Bio – filming on plant height, days to maturity, leaf area per plant.**

TREATMENT	PLANT HEIGHT	DAYS TO MATTURITY	Leaf area per plant
T0 – Control	**45.40**	**59.33**	98
T1	48.68	55.00	101
T2	53.73	55.33	101.3
T3	**56.51**	**52.33**	102
T4	49.37	54.67	104.2
T5	49.01	53.33	105
T6	**55.91**	**53.67**	105.6
T7	51.66	56.00	102.4
T8	48.52	**59.33**	103
T9	55.26	55.00	103.2
T10	47.48	54.33	100.3
T11	49.45	57.00	101.00
T12	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**

Table 2. **Influence of Electric, Magnetic and Bio – filming on number of leaves, fresh weight of leaves, dry weight of leaves of radish.**

TREATMENT	Number of leaves	Total fresh weight of leaves	Total dry weight of leaves
T0 – Control	12	**87.45**	**6.93**
T1	14	95.22	8.02
T2	16	99.87	8.55
T3	17	**106.94**	**9.03**
T4	14	98.20	8.24
T5	15	96.94	8.20
T6	16	**104.58**	**8.56**
T7	15	96.48	8.16
T8	15	94.32	7.92
T9	16	102.97	8.30
T10	14	92.21	7.42
T11	13	94.67	7.88
T12	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

Table 3. **Influence of Electric, Magnetic and Bio – filming on seed yield per plant, seed yield per plot, seed yield per hectare.**

TREATMENT	Seed yield per plant	Seed yield per plot	Seed yield per hectare
T0 – Control	85.59	3.06	96.39
T1	113.40	4.05	127.71
T2	127.31	4.55	143.37
T3	146.25	5.22	164.71
T4	101.17	3.61	113.94
T5	112.47	4.02	126.66
T6	129.83	4.64	146.21
T7	107.33	3.83	120.88
T8	116.20	4.15	130.86
T9	114.80	4.10	129.29
T10	110.13	3.93	124.03
T11	116.95	4.18	131.70
T12	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:

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 seed yield per plant was exhibited by treatment T0 [control](3.06 gm), while maximum seed yield per plant was recorded in 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)**. **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. The minimum seed yield per plot was exhibited by treatment T0 [control] (85.59), while 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. **Rochalska et al., (2008)** studied an impact of low frequency magnetic fields on yield and quality of sugar beet. Pre-sowing treatment of seeds using a low frequency magnetic field (16 Hz, 5mT). It' s Magnetic treatments increased the emergence of seeds, especially for low vigour seeds. As a result, the yield of plant was increased. **Seed yield per hectare:** The maximum seed yield per hectare was exhibited by treatment T0 [control](96.39), while 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 R. et al., (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 (T3) showed significant increase in growth, yield and yield attributing traits followed by Electric – 300 Ma mp (T7) as compared to control (untreated) seeds. These recommendations are based on six months experimentation and therefore further investigation is needed to arrive at valid recommendation.

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