Original Research Article

"Standardization of different pre-sowing seed treatments on growth, yield and yield attributing traits of wheat (*Triticum aestivum* L.) *var.* DBW-187."

ABSTRACT

The present study entitled, **"Standardization of different pre-sowing seed treatments on growth, yield and yield attributing traits of wheat (*Triticum aestivum* L.) *var.* DBW-187."** was carried out to assess the effect of electric priming, magnetic priming and bio-filming of varying stickers with polyvinyl glycol, methyl cellulose and alginate with an objective during Rabi 2021-2022 to find the promising pre-sowing treatment for wheat. The results indicated that all treatment recorded significant variation for growth and yield attributes that were studied and performed well to the untreated control (T_0). The treatment T_6- Electric priming @200m Amp for 60 sec. significantly recorded the field emergence of 94.00 %, 9.59 tillers per plant, test weight of 42.49 g, seed yield of 7.82 g per plant, seed yield of 477.22 g per plot, seed yield of 34.77q per hectare, 56.71q biological yield per hectare, 61.30% of harvest index, B:C ratio of 1.14 with gross returns of 69,540.00/- and net returns of 37,055/- respectively and found to be promising and can be suggested for commercial cultivation.

Keywords: Alginate, electric priming, magnetic priming, methyl cellulose and polyvinyl glycol**.**

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INTRODUCTION

Wheat (*Triticum aestivum* L) is the most essential cereal crop; In India, it is the second most important staple crop cultivated after rice and it comprises nearly 72% carbohydrates and 20% of the food calories spent globally and hence its consumption is directly proportional to the increasing population **(Ghulam Rasool *et al.*, 2021)**. Wheat is grown in India in an area of about 31.36 million ha. with a production of 107.86 million metric tonnes per ha. In India, Uttar Pradesh, Punjab, Madhya Pradesh, Haryana, Gujarat and Maharashtra are the leading states where wheat is cultivated. In 2021, wheat crop is produced mainly in Uttar Pradesh 35.50 million tonnes, Madhya Pradesh 17.61 million tonnes and Punjab 17.13 million tonnes.

Good crop establishment is one of the major challenges to wheat production and its importance is recognized by farmers as well as researchers. Constraints to good seedling and crop establishment on wheat include seed bed preparation, low quality seed, untimely sowing, poor sowing technique, inadequate soil moisture, adverse soil conditions, presence of bacterial and fungal pathogens with the

seed, delayed seedling emergence and impact of biotic and abiotic factors **(Shendhil Ramdas *et al.*, 2019)**. Seed enhancement *viz.*, priming, hardening, pelleting, encrusting, film coating *etc.*, is a pre-sowing treatment that improves the germination or seedling growth or facilitates the seeds to deliver such materials that aid in germination and vigour of seedling which ultimately has a better crop stand **(V. A. Pawar *et al.*, 2018)**.

Physical priming with electric and magnetic intensities is an unconventional method of priming approach as of other conventional methods that leaves the seed with some amount of water and that added proportion of water affects the storability of the primed seed and may have invisible negative effects on the seed at later stages of the seedling development **(Maryam Ghaemi *et al.*, 2019)**. Electrical functioning takes place altogether the living cells for surviving and their tissues also reveal electrical properties. The strength of the electrical field has the best effect on the seed germination of the primary fraction, while seed moisture has the best impact on the seed germination of the second fraction.

Magnetic seed stimulation could be employed to recover seed potency by increasing enzymes and proteins activity. Consequently, without any alteration in the seed's chemical composition, biochemical functions such as ion concentration, electrical charges, and free radicals are enhanced and can make the membrane more permeable with the effect of magnetic priming **(Neo. E. Nayakane *et al.*, 2019)**. The positive effect of electro-magnetic priming mainly depends on the duration and intensity of electric and magnetic intensities; this study was carried with an object to assess the effect of electro-magnetic priming at varying strengths.

Bio-filming acts as carriers assists in the distribution of the bioagent on the seed surface, promote better adherence and prolong the viability of the bioagent **(Firoz Ahmadh Ansari *et al.*, 2018).** Alginate is a polysaccharide that has a positive effect on shoot and root lengths, number of leaves, yield and quality, chlorophyll contents, carbonic anhydrase activity, nitrate reductase activity and proline content of crops **(Dawid Sakryzpczak *et al.*, 2021)**. Priming with methyl cellulose enhances ion transportation, increases strength of cell wall there by reducing the impact of fungal pathogens, enhances metabolic rates and maintains proper hormonal balances and there by an ultimate raise in seed yield. Effect of polyvinyl glycol has been successfully demonstrated to improve germination and field emergence in seeds of many crops, particularly seeds of vegetables and small seeded grasses; many researchers suggests that under diverse environmental stresses such as salinity, water deficiency and high and low temperatures polyvinyl glycol leads to cellular, sub-cellular and molecular changes

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in seeds and subsequently promotes seed vigour during germination and emergence **(P. Suma Varshini *et al.*, 2018)**.

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MATERIALS AND METHODS

Genetically pure seeds of DBW-187 (Karan Vandana) were collected from ICAR- Indian Institute of Wheat and Barley Research, Karnal.

METHOD OF ELECTRIC TREATMENT

Wheat seeds were treated with electric field in the department of Physics, SHUATS, Prayagraj. To expose the seeds to electric energy, an electric field generator was fabricated by using metallic conductor. A 24V DC battery, which is used as power source is connected with ammeter to measure electric current and ammeter with rheostat to adjust current supply. The seeds were placed in metallic conductor and electric current was passed at 100 Amp, 200 Amp, 300 Amp, 400 Amp and subjected to the duration of 8 mins.

Comment [Gh7]: Explain the treatments more exactly and experimental design

METHOD OF MAGNETIC TREATMENT

The magnetic treatment of wheat seeds was done in department of Physics, SHUATS, Prayagraj. An electro-magnetic field generator OMEGA EMU-10 with adjustable magnetic strength having a gap of 5cm between pole spaces was used. Electric supply of 230 AC (0-4 Amp) with continuous current supply was used to generate the magnetic field. Using a digital gauss meter OMEGA DGM-20, seeds were treated at desired intensities of 200, 400, 600, 800 gausses and subjected to the duration of 8 mins.

METHOD OF BIO-FILMING

Bio-filming of wheat seeds with various stickers was carried out by coating of seeds with methyl cellulose, polyvinyl glycol and alginate of 1% solution for duration of 15 mins.

RESULTS AND DISCUSSION

The results on effect of electro-magnetic priming and bio-filming with various stickers on wheat were presented in the table 01.

1. **Field emergence %**

Seed priming with electric priming @200m Amp for 60 sec. significantly recorded the maximum emergence of 58.00%, 90.00% and 94.00% recorded the minimum emergence of at 4, 7 and 10 DAS respectively. Minimum emergence was recorded by untreated control of 41.00% and 79.00 % at 4, 7 DAS and T_4- Magnetic priming @800 gauss for 8 min. of 82.33% at 10 DAS respectively. Electric

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priming increases the ion transport and permeability of cell membrane and helps to synthesize enzymes that favours germination. These results are in well conformity with the earlier findings of **(Babar Ijaz *et al.*, 2012).**

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2. **Plant height at harvest**

   The table 01. indicates that seed priming with the treatment T_6- Electric priming @200m Amp for 60 sec. significantly recorded the maximum plant height of 96.40 cm and T_4-Magnetic priming @800 gauss for 8 min shown 82.20 cm which was found to be minimum amongst the treatments. Electric priming enhances metabolites, enzymes and increased respiration rates strongly alters the mitotic index; there by increase in plant growth.

3. **Days to 50% flowering**

   The treatment T_2- Magnetic priming @400 gauss for 8 min. recorded the least number of 71.33 days for 50% flowering while T_5-Electric priming @100m Amp for 60 sec. took maximum number of 75.00 days for 50% flowering respectively. Similar number of days for 50% flowering were in conformity with the findings of **(Anil Kumar Neetam *et al.*, 2020).**

4. **Days to maturity**

   The treatment T_2- Magnetic priming @400 gauss for 8 min. recorded the least number of 112.67 days for maturity and T_5-Electric priming @100m Amp for 60 sec. took maximum number of 117.00 days respectively. Similar trends for days to maturity in wheat were found by **(Anil Kumar Neetam *et al.*, 2020).**

5. **Number of tillers per plant**

   Remarkably, highest number of tillers of 9.59 tillers per plant was shown by T_6- Electric priming @200m Amp for 60 sec. and T_4- Magnetic priming @800 gauss for 8 min. recorded minimum of 6.86 tillers respectively. Pre-sowing exposure of wheat seeds to electric priming reduces the amount of amylase enzymatic activity and increased the average number of tillers per plant and also the spike length.

6. **Test weight (g)**

   Maximum increase in test weight of 42.49 g was recorded by T_6- Electric priming @200m Amp for 60 sec. while minimum test weight of 36.75 g was recorded with T_4- Magnetic priming @800 gauss for 8 min. Increased ion transportation, metabolic rates, high assimilation rate and proper hormonal balances enhances the storage content of each seed and there by an ultimate raise in the test weight.

7. **Seed yield per plant (g)**

   Seed priming with the treatment T_6- Electric priming @200m Amp for 60 sec. significantly recorded mean yield of 7.82 g per plant which was maximum amongst the treatments and T_4- Magnetic priming

@800 gauss for 8 min. recorded the minimum of 5.23 g yield per plant respectively. These findings are validating the results of earlier research work of **(Rajender Singh Chokkar *et al.*, (2017).**

8. **Seed yield per plot (g)**

The treatment T_6- Electric priming @200m Amp for 60 sec. recorded yield of 477.22 g per plot which was maximum amongst the treatments; while effect of T_4- Magnetic priming @800 gauss for 8 min. recorded the minimum of 319.23 g yield. Proper balance of enzymes, amino acids and increased metabolic rates helps to thrive the plants under biotic and abiotic stress conditions and produces maximum yield.

9. **Seed yield per hectare (q)**

Wheat seeds primed with T_6- Electric priming @200m Amp for 60 sec. significantly showed maximum yield per hectare of 34.77 q and T_4- Magnetic priming @800 gauss for 8 min. recorded minimum of 23.26 q per hectare respectively. Similar trends in wheat were found by earlier research work of **(Raj Paul Meena *et al.*, 2013).**

10. **Biological yield per hectare (q)**

Electric priming of wheat seeds @ 200 Amp for 60 sec. recorded significantly maximum biological yield of 56.71 q per hectare and T_4- Magnetic priming @800 gauss for 8 min. recorded 54.12 q per hectare which was least amongst the treatments. Increased metabolites, high assimilation rate, high mitotic index and balanced hormonal system increases the physiological content in plants. These results are in considerable with the earlier findings of **(Muhammad Farooq *et al.*, 2020)**

11. **Harvest index (%)**

Seed priming with the treatment T_6- Electric priming @200m Amp for 60 sec. shown maximum harvest index of 61.30% while T_4- Magnetic priming @800 gauss for 8 min. shown minimum of 42.98% harvest index respectively. Similar kind of results were declared by **Rahul Amin *et al.*, (2015).**

12. **Economics**

Benefit cost ratio is the resultant of gross returns of the total yield to the profitable net returns that are left out after carrying out the whole production; The table 02. depicts that the treatment T_6- Electric priming @200m Amp for 60 sec. recorded the maximum B:C ratio of 1.14 with gross returns of 69,540.00/- and net returns of 37,055/- and T_4- Magnetic priming @800 gauss for 8 min. recorded the lowest B:C ratio of 0.43 with 46,520.00/- gross returns and 14,035.00/- net returns respectively.

CONCLUSION

The results shown that seed priming with electro-magnetic priming and bio-filming shown significant variation with the untreated control for growth and yield parameters that were recorded. The treatment T_6- Electric priming @200m Amp for 60 sec. performed well with the seed yield of 34.77q per hectare and 61.30% of harvest index with B:C ratio of 1.14 having net returns of 37,055/- and was found to be promising and can be suggested for commercial cultivation.

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Table 01. Response of wheat *var.*DBW-187 for growth and yield attributes to magnetic priming, electric priming and bio-filming.

TREATMENTS	FIELD EMERGENCE AT 4 DAS	FIELD EMERGENCE AT 7 DAS	FIELD EMERGENCE AT 10 DAS	PLANT HEIGHT AT HARVEST	DAYS TO 50% FLOWERING	DAYS TO MATURITY	NUMBER OF TILLERS PER PLANT
T_0	41	79.00	84.33	83.30	73.00	116.67	7.29
T_1	48	82.33	87.00	87.33	72.67	113.33	7.57
T_2	52	87.00	91.33	91.10	71.33	112.67	8.77
T_3	46	80.00	83.33	85.48	74.00	114.33	7.26
T_4	42	79.00	82.33	82.20	73.33	114.00	6.86
T_5	47	84.67	87.67	87.23	75.00	117.00	7.83
T_6	58	90.00	94.00	96.40	74.67	115.33	9.59
T_7	49	81.67	85.33	88.68	73.67	116.33	7.56
T_8	51	81.33	84.33	86.24	73.33	114.00	7.35
T_9	47	82.67	86.33	88.43	74.67	115.67	8.06
T_{10}	49	82.33	86.67	88.80	72.67	113.33	8.36
T_{11}	56	88.00	93.67	93.00	71.67	114.00	9.05
T_{12}	49	82.00	85.00	86.00	74.00	117.00	8.22
GRAND MEAN	49	83.08	87.03	88.02	73.38	114.90	7.98
F TEST	**S**	**S**	**S**	**S**	**S**	**S**	**S**
S. Em	1.15	0.83	0.62	0.70	0.74	0.96	0.17
S. Ed	1.63	1.17	0.88	1.03	1.05	1.36	0.24
C.V.	4.10	1.73	1.24	1.39	1.75	1.45	3.07
T. value	2.06	2.06	2.06	2.06	2.06	2.06	2.06
C.D.	3.37	2.43	1.82	2.07	2.43	2.81	0.52

TREATMENTS	100 SEED WEIGHT	SEED YIELD PER PLANT (g)	SEED YIELD PER PLOT (g)	SEED YIELD PER HEACTARE (Q)	BIOLOGICAL YIELD (q/ha)	HARVEST INDEX (%)
T_0	38.52	5.42	330.42	24.07	54.31	44.32
T_1	40.55	5.62	342.62	24.96	54.51	45.78
T_2	41.20	6.34	386.74	28.18	55.23	51.02
T_3	38.01	5.54	337.74	24.61	54.43	45.21
T_4	36.75	5.23	319.23	23.26	54.12	42.98
T_5	40.76	7.19	438.79	31.97	56.08	57.00
T_6	42.49	7.82	477.22	34.77	56.71	61.30
T_7	41.11	6.50	396.30	28.87	55.39	52.13
T_8	39.43	6.22	379.42	27.64	55.11	50.16
T_9	39.83	6.40	390.20	28.43	55.29	51.42
T_{10}	40.30	6.54	398.94	29.07	55.43	52.44
T_{11}	42.07	7.40	451.20	32.87	56.29	58.40
T_{12}	39.58	6.12	373.32	27.20	55.01	49.44
GRAND MEAN	40.05	6.33	386.32	28.15	55.22	50.89
F TEST	**S**	**S**	**S**	**S**	**S**	**S**
S. Em	0.43	0.13	8.23	0.62	0.13	0.99
S. Ed	0.61	0.19	11.65	0.87	0.19	1.41
C.V.	1.89	3.81	3.81	3.81	0.43	3.37
T. value	2.06	2.06	2.06	2.06	2.06	2.06
C.D.	1.27	0.41	24.01	1.81	0.41	2.89

Cont. 01

Table 02: Economics on Response of wheat *var.*DBW-187 for growth and yield attributes to magnetic priming, electric priming and bio-filming.

Treatments	Cost of production (Rupees/hectare)	Gross returns (Rupees/hectare)	Net returns (Rupees/hectare)	Benefit: cost ratio
T_0	32,485.00	48,140.00	15,655.00	0.48
T_1	32,485.00	49,920.00	17,435.00	0.53
T_2	32,485.00	56,340.00	23,855.00	0.73
T_3	32,485.00	49,200.00	16,715.00	0.51
T_4	32,485.00	46,520.00	14,035.00	0.43
T_5	32,485.00	63,940.00	31,455.00	0.96
T_6	32,485.00	69,540.00	37,055.00	1.14
T_7	32,485.00	57,740.00	25,255.00	0.77
T_8	32,485.00	55,280.00	22,795.00	0.70
T_9	32,485.00	56,860.00	24,375.00	0.75
T_{10}	32,485.00	58,120.00	25,635.00	0.78
T_{11}	32,485.00	65,740.00	33,255.00	1.02
T_{12}	32,485.00	54,400.00	21,915.00	0.67

COMPETING INTERESTS DISCLAIMER:

Authors have declared that no competing interests exist. The products used for this research are commonly and predominantly use products in our area of research and country. There is absolutely no conflict of interest between the authors and producers of the products because we do not intend to use these products as an avenue for any litigation but for the advancement of knowledge. Also, the research was not funded by the producing company rather it was funded by personal efforts of the authors.

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