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Short Communication

Effect of DC Voltage on Quality of Vegetable Seed

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Seed processing involves more skills and engineering principles than any other areas of seed technology. To meet the seed lot to the minimum standards, commercial seed cleaners which works on physical properties like size, shape, length, specific gravity, texture, terminal velocity, color etc. are used. But in case of small sized seeds e.g. vegetable seeds where there is a small difference in physical properties, these cleaners fail in efficient seed separation. Therefore, for such mixtures some other seed property like electrical conductivity of seed can be used to make effective separation.

As with increase in static electrical charge holding capacity of seed, viability of seed increases [1], productivity of vegetables can be increased by sowing the viable seeds only through its electrostatic processing. In view of this, the present research was conducted to study the effect of different D.C. electrode voltages of electrostatic separator on the quality of brinjal, chilli and onion cultivars.

The seeds of cultivars of brinjal (Aruna, Manjari Gota), chilli (Jayanti, Surakta) and onion (Selection Local White, Pusa Red) were obtained from Chilli and Vegetable Research unit of Dr. PDKV, Akola. All the seed cultivars obtained were produce of *kharif* and *rabi*. The electrostatic separator (Figs. 1 and 2) which is made up of a hopper, a thin mild steel plate (negative electrode), a rotating aluminum drum (positive electrode), a brush to remove the seed from the rotating drum along with separating troughs with capacity 1 to 1.2 kg/hr was used for seed separation purpose along with the high voltage unit which supplies a D.C. voltage from 22 kV to 28 kV to the electrode. A dimmer (240 volts, 6 amp) was used to obtain the different ranges of high voltages by regulating the 220 volts input A.C. supply. The machine parameters like position of electrode, seed rate, outlet positions etc., which would cause efficient seed separation with its more germination percentage were optimized after number of investigations.

After determining the moisture content of seeds as per the standard procedure [2] and calibration of unit, 250 gm of raw vegetable seeds of any of crop under investigation were metered from hopper of electrostatic separator into the electric field of 22 kV D.C., where they become charged according to its electrical conductivity [3]. Depending upon the field characteristics and charge on the seed, separation of seeds (good and rejected) takes place in the outlets. The sample collected in the outlet containing good seed was weighed separately. Each seed type was tested at three electrode voltages (D.C.) i.e. 22 kV, 25 kV and 28 kV in replicated trials and quality of seed in terms of recovery percentage, physical purity, germination percentage, vigor index and thousand seed weight was determined as per procedure outlined for the respective crop in the rule of seed testing [4]. The statistical analysis for all the quality parameters studied was carried out using the Factorial Design [5]. Data were transformed into Arc Sin values for per cent germination for purpose of analysis.

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The moisture content was found to be 10.20 per cent (w.b.) for Aruna and 9.68 per cent (w.b.) for Manjari Gota in brinjal seed, 10.37 per cent (w.b.) for Jayanti and 10.88 per cent (w.b.) for Surakta in chilli seed, 9.53 per cent (w.b.) for Selection Local White and 9.17 per cent (w.b.) for Pusa-red in onion seed. The results indicated that in all types of seed, recovery percentage was decreased with increase in voltage. An electrode voltage of 22 kV resulted in to maximum recovery for all seed types. At high D.C. voltage of 28 kV, seed recovery percentage was minimum

Table 1. Effect of electrode voltages on recovery percentage, germination percentage, vigor index, purity percentage and test weight of brinjal seeds

Treatment	Recovery percentage	Germination percentage	Vigor index	Purity percentage	Test weight (gm)
Variety (V)					
Aruna (V_1)	90.43(9.50)	69.83[56.77]	540.97	96.21(9.80)	3.38
Manjari Gota (V_2)	86.47(9.28)	67.08[55.89]	530.14	95.47(9.76)	3.32
SE (M) ±	0.009	0.549	1.797	0.010	0.029
CD (5%)	0.027	1.665	5.451	0.030	0.087
Electrode Voltage (S)					
0 kV(S_1)	100(10)	59.33[52.04]	481.62	90.44(9.50)	2.83
22 kV (S_2)	87.09(9.33)	68.67[55.97]	546.88	95.94(9.79)	3.25
25 kV (S_3)	84.71(9.20)	71.50[57.74]	553.87	97.62(9.87)	3.51
28 kV (S_4)	82.00(9.05)	74.33[59.57]	559.85	98.84(9.93)	3.80
SE (M) ±	0.012	0.776	2.541	0.014	0.041
CD (5%)	0.038	1.355	7.709	0.043	0.123
Interaction (VxS)					
V_1S_1	100(10)	60.67[51.16]	493.47	90.80(9.52)	2.89
V_1S_2	89.56(9.46)	70.33[57.00]	553.23	96.78(9.83)	3.24
V_1S_3	87.72(9.36)	73.00[58.69]	557.23	97.63(9.87)	3.52
V_1S_4	84.45(9.19)	75.33[60.23]	559.93	99.02(9.94)	3.86
V_2S_1	100(10)	58.00[52.93]	469.77	90.09(9.48)	2.77
V_2S_2	84.63(9.19)	67.00[54.94]	540.53	95.11(9.75)	3.26
V_2S_3	81.70(9.03)	70.00[56.79]	550.50	97.61(9.87)	3.51
V_2S_4	79.56(8.91)	73.33[58.91]	559.77	98.66(9.93)	3.75
SE (M) ±	0.017	1.098	3.594	0.020	0.057
CD (5%)	0.053	3.330	10.902	0.061	0.174

Figures in parenthesis are square root transformation values; Figures in square bracket are arc-sin transformation values

Table 2. Effect of electrode voltages on recovery percentage, germination percentage, vigor index, purity percentage and test weight of chilli seeds

Treatment	Recovery percentage	Germination percentage	Vigor index	Purity percentage	Test weight (gm)
Variety (V)					
Jayanti (V_1)	88.81(9.41)	77.75[61.98]	701.57	96.54(9.82)	3.17
Surakta (V_2)	92.08(9.58)	78.83[62.84]	662.81	96.60(9.82)	3.09
SE (M) ±	0.009	0.173	2.153	0.006	0.010
CD (5%)	0.03	0.526	6.532	0.018	0.031
Electrode Voltage (S)					
0 kV (S_1)	100(10)	68.83[56.07]	588.95	92.10(9.59)	2.46
22 kV (S_2)	88.85(9.42)	79.17[62.85]	691.12	96.48(9.81)	3.11
25 kV (S_1)	86.88(9.32)	81.33[64.41]	712.75	97.73(9.87)	3.37
28 kV (S_4)	86.08(9.27)	83.83[66.32]	735.95	99.49(9.97)	3.58
SE (M) ±	0.014	0.245	3.045	0.008	0.014
CD (5%)	0.042	0.745	9.237	0.025	0.045
Interaction (VxS)					
V_1S_1	100(10)	69.67[56.58]	631.63	93.04(9.64)	2.52
V_1S_2	86.35(9.29)	78.33[62.26]	705.00	96.32(9.81)	3.10
V_1S_1	84.86(9.21)	80.33[63.68]	725.67	96.63(9.87)	3.43
V_1S_4	84.05(9.16)	82.67[65.40]	744.00	99.19(9.95)	3.66
V_2S_1	100(10)	68.00[55.55]	546.26	91.17(9.54)	2.41
V_2S_2	91.33(9.55)	80.00[63.44]	677.23	96.64(9.82)	3.13
V_2S_1	88.88(9.42)	82.33[65.15]	699.83	98.82(9.93)	3.32
V_2S_4	88.13(9.38)	85.00[67.24]	727.90	99.79(9.98)	3.50
SE (M) ±	0.019	0.347	4.306	0.011	0.021
CD (5%)	0.059	1.053	13.064	0.035	0.063

Figures in parenthesis are square root transformation values; Figures in square bracket are arc-sin transformation values

due to increase in number of charge holding seeds with its quality parameters above minimum acceptable limits in all the types of seed. Amongst the different types of seed, less seed recovery was noticed in brinjal seed at all the voltages with 68.67 per cent germination at 22 kV, which may be due to a peculiar characteristic of brinjal seed that sometimes it remained somewhat hollow inside. Therefore it gets charged while passing through electrostatic field but gets rejected in germination test. Similar trends were reported by Kerdonfag *et al.* [6].

Table 3. Effect of electrode voltages on recovery percentage, germination percentage, vigor index, purity percentage and test weight of onion seeds

Treatment	Recovery percentage	Germination percentage	Vigor index	Purity percentage	Test weight (gm)
Variety (V)					
Selection					
Local white (V_1)	94.15(9.69)	72.16[58.26]	508.20	96.61(9.82)	4.05
Pusa-Red (V_2)	93.54(9.66)	68.83[56.12]	482.37	95.83(9.78)	3.78
SE (M) ±	0.001	0.118	2.156	0.007	0.036
CD (5%)	0.003	0.360	6.542	0.022	0.110
Electrode Voltage (S)					
0 kV(S_1)	100(10)	61.33[51.55]	431.36	91.60(9.56)	3.34
22 kV (S_2)	92.72(9.62)	72.33[58.27]	502.81	96.98(9.84)	3.81
25 kV (S_1)	91.92(9.58)	73.50[59.04]	518.15	97.60(9.88)	4.11
28 kV (S_4)	90.74(9.52)	74.83[59.91]	528.82	98.70(9.92)	4.39
SE (M) ±	0.002	0.168	3.050	0.010	0.051
CD (5%)	0.005	0.510	9.252	0.030	0.156
Interaction (VxS)					
V_1S_1	100(10)	62.33[52.14]	438.40	91.70(9.57)	3.46
V_1S_2	93.04(9.63)	73.66[59.12]	518.10	97.42(9.86)	3.93
V_1S_3	92.42(9.60)	75.66[60.45]	532.20	98.14(9.90)	4.27
V_1S_4	91.15(9.54)	77.00[61.35]	544.10	99.20(9.95)	4.54
V_2S_1	100(10)	60.33[50.96]	424.33	91.50(9.56)	3.22
V_2S_2	92.40(9.60)	71.00[57.42]	487.53	96.54(9.82)	3.69
V_2S_3	91.43(9.55)	71.33[57.63]	504.10	97.07(9.85)	3.96
V_2S_4	90.33(9.49)	72.66[58.47]	513.53	98.21(9.90)	4.25
SE (M) ±	0.002	0.237	4.313	0.014	0.073
CD (5%)	0.007	0.721	13.085	0.044	0.221

Figures in parenthesis are square root transformation values; Figures in square bracket are arc-sin transformation values

It was observed that the germination percentage of 22 kV electrode voltage treated seed have about 9 to 12 per cent more than that of raw (untreated) seed in all the seed types. As the voltage was increased further to 25 kV, germination percentage was increased to about 1 to 3 per cent for all seed types. This may be due to increase in more viable seeds collected at the

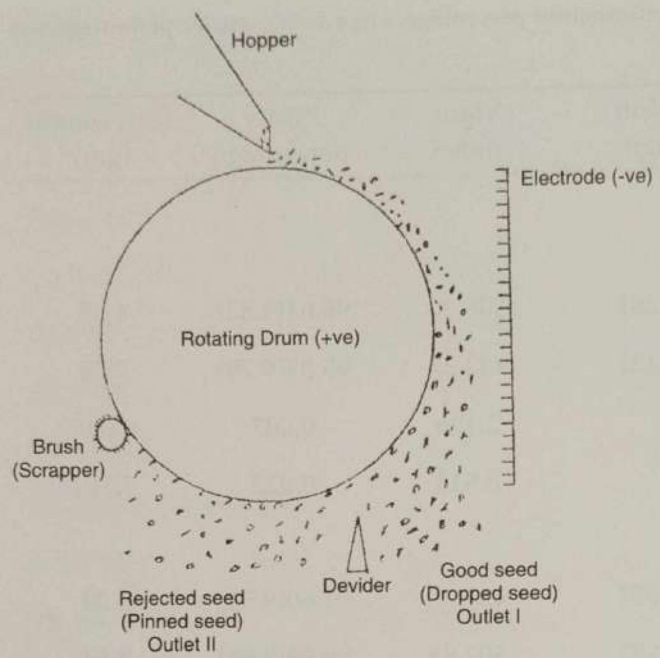

Fig. 1. Schematic diagram of Electrostatic Separator

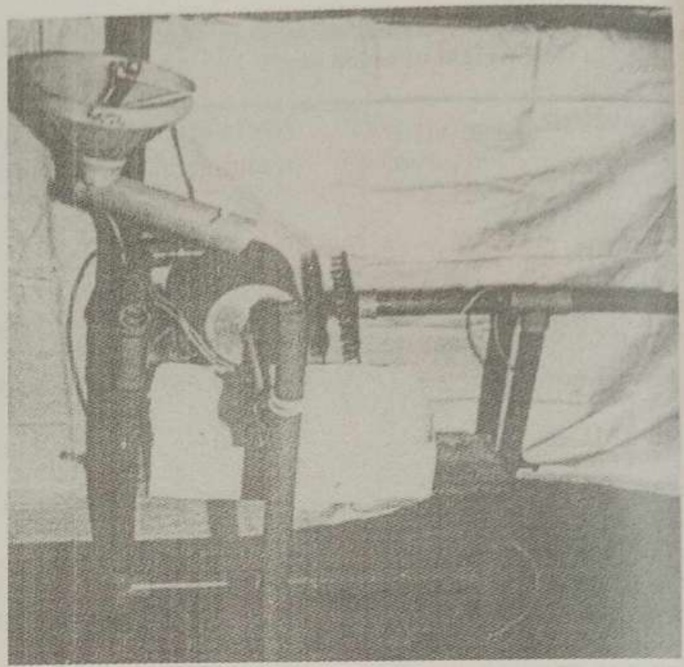

Fig. 2. Experimental Electrostatic Separator

outlet with increase in voltage but with decrease in recovery as stated earlier. The maximum germination percentage i.e. about 14 to 15 per cent more than that of raw seed was found at 28 kV in all the seed types. Similar trends were reported by Matthes & Boyed [7], Krishnan *et al.* [8], Kerdonfag & Khanngern [9] and Kiatgamjorn *et al.* [10]. Also it was seen that vigor index was increased with increase in electrode voltage which leads to increase in germination also and it was maximum for 28 kV electrode voltage in all the seed types.

The purity percentage of seed lot separated by 22 kV was about 95 to 97 per cent in all seed types. When electrode voltage was increased from 22 kV, increase in purity percentage was observed which may be due to holding the charge by inert matter and other contaminating material. At 28 kV electrode voltage, maximum purity percentage was obtained which was above the minimum prescribed standard. Thus effective removal of inert matter and other contaminating material occurs at increasingly higher voltage. Also maximum test weight in all seed types was noticed in seeds separated at 28 kV, which may be due to collection of more viable and healthy seeds at outlet with increase in electrode voltage. About 0.35 to 0.95 per cent increase in test weight was noticed in all seed types with increase in electrode voltage. Similar trends were reported by Savin *et al.* [11].

All the results obtained were comparatively better than results obtained with size separation by sieves for all the seed types [12]. Also by considering the seed quality parameters like germination, purity and vigor, an electrode voltage of 28 kV D.C. was found to be adequate for effective separation of good viable seed from bulk mass of brinjal, chilli and onion seeds with minimum prescribed standard.

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