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Effect of Electrocultre on seed germination and growth of *Raphanus sativus* (L)

Mukundraj B. Patil

Department of Botany, Late Ramesh Warpudkar College, Sonpeth, Dist. Parbhani (MS) -431 516, India.

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Experiments were carried out to study the effect of electricity on the seed germination and growth of the *Raphanus sativus*. For the experiment, twelve pots were grouped into four sets, each containing three pots. In each pot, 20 seeds were sowed. While keeping all the parameters constant 3V, 6V and 9V electricity was supplied for 10 min daily to three groups only, while one set of three pots were not supplied with the electricity and called as control. Number of seedlings that emerged from soil were counted and percentage germination was calculated. The highest percentage of germination (95%) was recorded in pots supplied with 9V electricity, followed by 90% in the pots supplied with 6V electricity. It was 85% in Control and Pots supplied with 3V electricity. Supply of electricity has significant effect of electricity to increase length of root, diameter of root and weight of root and biomass. Supply of 9V electricity was most effective to affect the growth parameters of *R. sativus*.

Key words: Electricity, growth parameters, percentage germination.

INTRODUCTION

The application of electricity for plant growth is known as Electro-culture. Experimental study of electricity on the plant growth was started late back in the 18th century but their results were contradictory. Different researches have proved that Electro-culture enhance germination of seed (Morar et al., 1999; Palov et al., 2003; Palov and Sirakov, 2004; Patwardhan and Gandhare, 2013; Gui et al., 2013) and growth rates (Murry, 1965; Batchman and Reichmanis, 1973; Clestino et al., 2000; Ahmet, 2003; Rotcharoen et al., 2002; Kiatgamjorn et al., 2002). It is also helpful to increase the yield of the crops (Pittman, 1977; Morar et al., 1999).

Recently, it is also mentioned that Electro-culture can protect plants from diseases, insects and frost. It also can reduce the requirements for fertilizer or pesticides (Morar et al., 1999; Nelson, 2011). Present investigation was carried out to study the effect of 3V, 6V and 9V electricity on the germination as well as on the growth of the *Raphanus sativus*.

MATERIALS AND METHODS

Experiments were carried out during 1 January 2017 to 15 February 2017. For this experiment, twelve pots were taken in the four sets each containing three pots. Three sets were supplied with 3V, 6V and 9V electricity respectively while fourth set was kept as control. Twenty radish seeds were then planted at equal distance (7cm) from each 5cm away from Copper rod. All the factors (Food, Water,

E-mail- mukundrajbpatil@gmail.com.

Table 1. Effect of electricity on germination of *R. sativus* seeds.

DAI	Control	3volt	6volt	9volt
1	0	0	0	0
2	0	0	6.7	28.33
3	30	33.33	50	65
4	65	70	80	83.33
5	81.67	80	88.33	93.33
6	85	85	90	95

Source	df	SS	MSS	F	
Treatments	3	1191.57	397.19	11.82	**
Days	6	35517.26	5919.54	176.13	**
Error	18	604.96	33.61		
Total	27	37313.79			

DAI: Days After Incubation
Statistical Analysis: ANNOVA.

Table 2. Effect of electricity on growth of *R. sativus*.

Character	Control	3 V	6 V	9 V	Mean	S.D.	CD 5%	CD 1%
Root Length (cm)	17.25	14.9**	19.16^{NS}	20.61^{NS}	17.98	2.47	3.93	7.22
Thickness of Root (cm)	1.19	1.53*	1.54*	1.85*	1.53	0.23	0.37	0.68
Weight of Root (gm)	9.96	10.44^{NS}	10.87^{NS}	14.99*	11.56	2	3.19	5.85
Weight of aerial part in gm (Biomass)	4.15	4.8*	5.95*	6.52*	5.36	0.93	1.48	2.71

NS - Non-Significant; * - Significant at 5% CD; ** - Significant at 1% CD.

and Sunlight) were kept constant except electricity. For electric supply, two copper rods were buried in the soil at opposite sides of the pots in such a way that they could not touch each other. The DC 3V, 6V and 9V was supplied daily for 10 min. Germination was observed daily after sowing until the germination value remains same. Observations were recorded and Mean value of percent germination was calculated (Table 1). One pot from each group containing 10 seedlings each were retained for further study. Supply of electricity was continued daily for 10 min. After 45 days, various growth parameters were studied. Root length was measured with the help of Centimeter scale. Thickness of root was measured (in centimeter) using Vernier caliber exactly at the center of root. The weight of root and weight of aerial parts (Biomass) was measured with the help of electric balance. All values were recorded and mean values were tabulated in Table 2.

RESULTS AND DISCUSSION

The pots not receiving electricity and the pots receiving 3V electricity shows emergence of seedling three days after sowing while pots receiving electricity 6V and 9V electricity shows germination on second day of sowing. Thus, it is clear that external application of the electricity to the *R. sativus* seeds induces earlier germination of seeds.

Maximum germination was recorded on six days after sowing in control and pots supplied with 3V electricity. However, the Experimental pot supplied with 3V electricity and 9V electricity was 90% and 95% respectively. Thus, percentage germination of the *R. sativus* seeds was increased due to the supply of 6V and 9V electricity to the pots. Analysis of Variation shows that there is significant variation in percentage seed germination as well as germination rate. It significantly increased with the increase in days of germination as well as increasing voltage. Different researchers (Labes, 1993; Pozeliene and Lynekine, 2009; Gandhare and Patwardhan, 2014; Rotcharoen, et al., 2002) recorded such type of positive effect of electrical field on seed germination. Such type of increased germination rate and germination percentage due to application of electricity is attributed to the physiological and biochemical changes (Putincev and Platonova, 1997), such as free radical excitement, increase in the activity of protein and enzymes to increase seed vigor (Morar et al., 1999; Bai et al., 2003).

Growth parameters like root length, thickness of root, weight of root as well as biomass of the aerial parts increased considerably due to the application of electricity. In the control experiment, mean length of root was 17.25 cm; while it was 14.9, 19.16 and 20.61 cm respectively in the pots supplied with 3V, 6V and 9V

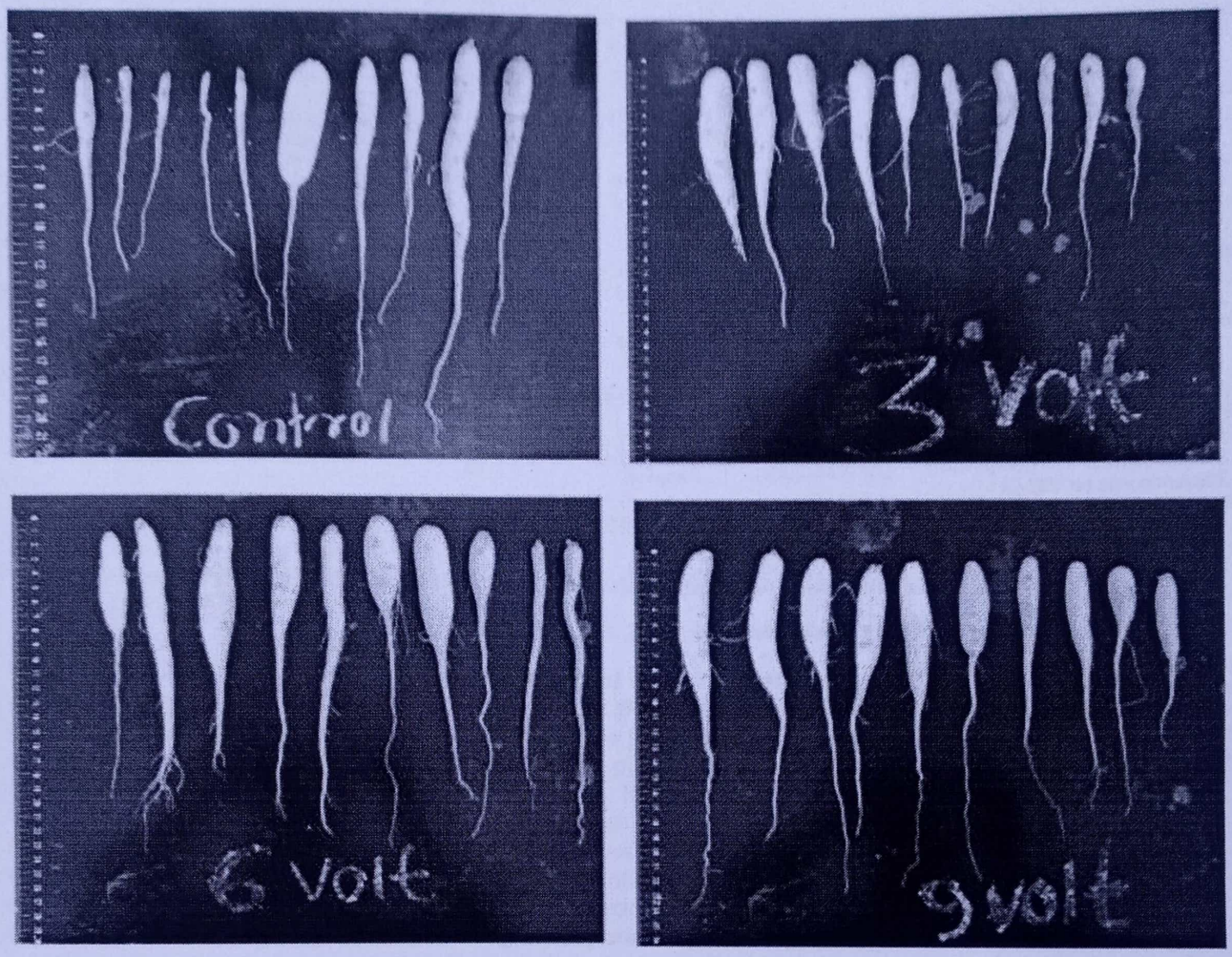

Plate 1. Showing effect of electricity on *R. sativus* root.

electricity respectively (Plate 1). Increase in the root length due to supply of 6V and 9V was non-significant; while decrease in root length in plants supplied with 3 Volts electricity was significant (CD = 1%).

There is increase in the thickness as well as weight of the *Raphanus* root. This increase in the thickness of *Raphanus* root due to application of electricity was statistically significant at CD = 5%. Maximum increase in the weight of root was found in pots supplied with 9V electricity, which was 14.99 g and it was 50.5% greater than the control which was 9.96 g. This increase in the weight was significant at CD = 5% in other cases. Thus, there is an increase in the yield of *R. sativus* due to application of electricity. Ozel (2003) recorded same results in wheat and (Kiatgamjorn et al., 2002) in beans.

This increase in the weight of *Raphanus* (Yield) is because electric field affects the ions in the soil or on the metabolism of electrons and ions (Celestino et al., 2000). This effect of electricity on plant growth may be due to impact of electric field on electron transport chain and the dark and light reactions of photosynthesis (Celestino et al., 2000; Bachman and Reichmanis, 1973)

Conclusion

The supply of Electricity increases germination rate as well as percentage germination of *Raphanus* seeds. It is also helpful to increase weight of the *Raphanus* root; thus, increasing the yield. Further research should be carried out in this field to provide an alternative for the chemical fertilizers at minimum cost.

CONFLICT OF INTERESTS

The authors have not declared any conflict of interests.

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