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MAGNETIC FIELD TREATMENT EFFECTS ON GROWTH OF OKRA (*ABELMOSCHUS ESCULENTUS* (L.) MOENCH)

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ABSTRACT

The present study was carried out at experimental vegetable area of Institute of Horticultural Sciences, University of Agriculture Faisalabad, Pakistan during crop season 2010. The seed was treated by magnetic field of 25mT, 50mT, 75mT, 100mT, 125mT, 150mT and 175mT. It was concluded that the germination percentage, mortality percentage, shoot length at first flowering stage, number of leaves per plant and number of branches per plant were greatly affected by applying magnetic treatments. It was found that the treatments T_3, T_4 and T_5 showed better results and it was suggested that magnetic treatment of seed before sowing may be helpful to improve the growth and yield of okra.

Keywords: Okra, *Abelmoschus esculentus*, Magnetic Field, Germination, Mortality, Pakistan

INTRODUCTION

Okra belongs to Malvacae family (along with such spices as cotton, cocoa and hibiscus). Okra (*Abelmoschus esculentus* (L.) Moench) is one of the imperative vegetable crops grown for its tender green fruits through out Pakistan, India, Turkey and other adjoining countries. It has high nutritive value and export potential. In Syria, Tunisia, Egypt,

Greece, Iran, Iraq, Jordan, Lebanon, Turkey, and Yemen **[1, 2]** and other parts of the eastern Mediterranean, including Cyprus and Israel, okra is widely used in a thick stew made with vegetables and meat. West Asian cuisine usually uses young okra pods, usually cooked whole. In India, the harvesting is done at a later stage, when the pods and seeds are larger. In Pakistan the total area under Okra is about 14.78 thousand ha and total production is about 0.112 million tones with average yield of about 7.55 tones ha^{-1} of green pods **[3]**. Okra is a nutritive vegetable having Energy129 kJ (31 kcal), Carbohydrates 7.03 g, Sugars 1.20 g, Dietary fiber 3.2 g, Fat 0.10 g, Protein 2.00 g, Water 90.17 g and Calcium 81 mg (8%) **[4]**. The products of the plant are mucilaginous, resulting in the characteristic "goo" or slime when the seed pods are cooked; the mucilage contains a usable form of soluble fiber. Some people cook okra this way, others prefer to minimize sliminess; keeping the pods intact, and brief cooking, for example stir-frying, help to achieve this. Cooking with acidic ingredients such as a few drops of lemon juice, tomatoes, or vinegar may help. Alternatively, the pods can be sliced thinly and cooked for a long time so the mucilage dissolves, as in gumbo. The cooked leaves can also be used as a powerful soup thickener. The immature pods may also be pickled. Current research work was an attempt for demonstration of ways to enhance okra germination rate under the magnetic field influence. Major goal of this research was to determine the effects of pre-sowing magnetic treatments on okra germination and growth during the vegetative and generative stages and to gain maximum vegetable and seed yield by agronomic practices.

MATERIALS AND METHODS

The present research work was conducted in the “Vegetable research area”, Institute of Horticultural Sciences, University of Agriculture, Faisalabad Pakistan, during the year of 2010 from 31st of March to 10th of July.

Plant Material

The plant material used for the research was collected from the Institute of Horticultural Sciences, University of Agriculture Faisalabad, Pakistan.

Magnetic Seed Stimulator

The apparatus used for pre-sowing magnetic treatment of okra seeds was magnetic seed stimulator also known as electromagnet which was constructed in the Department of Physics, University of Agriculture, Faisalabad Pakistan, on the same pattern as described by De Souza **[5]** which he used to treat tomato seeds. This consisted of two pairs of energizable, cylindrical coils, each formed by

4,026 turns of 0.41 mm enameled copper wire. Each pair of coils was wound 11 cm apart on an iron bar (dimensions 40><3.5cm). Two bars were placed 011c above the other, their ends held by metallic supports. The coils were connected in series and fed through a power source having full wave rectified sinusoidal voltage. These voltages were controlled by a variable transformer connected to main power voltage supply of 220 volts/50 Hz. When full wave rectified sinusoidal current passed through the coils, a non-uniform and dynamic magnetic field was generated in the air space between the two bars. The generated magnetic field can be varied by adjusting the voltage of variable transformer until the required working field strength was achieved. The fields generated in the air space between the two bars were measured manually by using a magnetic flux meter ELWF model no. 853396 with the help of probe. No magnetic filed other than that of the geomagnetic field was detected within the experimental electromagnet when switch off **[5]**.

Magnetic field treatment was applied on Okra seeds with different strength for different times as described in **Table 1**.

Field Conditions and Statistical Analysis

The experiment was carried out according to Randomized Complete Block Design (RCBD) with 8 treatments in which untreated seeds were considered as control (T_0). Each treatment was replicated for 3 times. Total area used for this experiment was 198.72m^2 and subplot size was 66.24m^2, plant to plant distance was 45.72cm and ridge to ridge distance was 76.2cm. Seeds were sown on both sides of the ridge with 25 seeds on each ridge. All appropriate agronomic practices were carried out during the experiment. The data was collected for germination percentage (%), mortality percentage (%), shoot length (cm), number of leaves per plant, number of branches per plant, root and shoot length ratio and root and shoot weights. The data was analyzed by using analysis of variance technique **[6]**.

RESULTS AND DISCUSSION

It is persuaded from the **Table 2** that the magnetic effect on okra seed showed significant differences in the seed germination. Maximum emergence was observed in four treatments T_3, T_4, T_1 and T_2 followed by T_5, T_6 and T_6. Minimum emergence was noted in control conditions. The maximum germination was probably due to mutation in the seeds that cause the seeds to germinate earlier as compared to the controlled conditions **[7, 8, 9]**. The germinated plants may be used to produce higher yielding okra genotypes in the heavy

industrial area. Maximum mortality was noted for four treatments T_0, T_6, T_7 and T_5 followed by T_2, T_1 and T_4. Minimum germination was noted in T_3. It showed the genetic behavior of okra seeds under uniform field conditions **[5]**. Seedling obtained from seeds treated with magnetic field revealed significant effect on seedling length as compared to T_5, T_2, T_6 and T_8 but non significant with other treatments. Maximum shoot length was noted with T_3, followed by T_7, whereas, minimum shoot length of okra seedlings was recorded for T_5. The low seedling length indicated that the treatment of strength of magnetic field showed adverse effect on seedling. The magnetic treatment positively influenced the plant growth irrespective of uncontrolled weather conditions **[6, 9]**. The mean values described that all treatment means showed significant increase in number of leaves per plant as compared to control. Treatment T_5 and T_4 have maximum mean value then other treatment means. It has been concluded that plants obtained after magnetic treatment produced more number of leaves per plant as compare to control conditions **[2, 8, 10]**. It persuaded from **Table 2** that all treatments showed significant increase in the number of branches per plant as compared to control conditions. Treatment T_5 and T_4 have maximum mean value then other treatment means. It was concluded that magnetic field has very high stimulating effect on cell multiplication, growth and development **[10]**.

Table 1: Magnetic Treatments Applied on Okra Seeds

Treatments	Magnetic Field Strength (mT)	Time of Exposure (Minutes)
T_0	Control	-
T_1	25	3
T_2	50	3
T_3	75	3
T_4	100	3
T_5	125	3
T_6	150	3
T_7	175	3

Table 2: Mean Values of Morphological Traits of Okra

Treatment/ parameters	Germination percentage	Mortality percentage	Shoot Length at 1st Flowering	Number of leaves per plant	Number of branches per plant
T_0	59.33h	40.66a	54.01c	14.00c	2.66c
T_1	71.33c	28.66f	68.49b	15.33bc	3.33bc
T_2	70.00d	30.00e	67.47b	15.66bc	3.66abc
T_3	74.00a	26.00h	76.99ab	17.66abc	4.33abc
T_4	72.66b	27.33g	83.34a	21.00a	5.33a
T_5	67.33e	32.66d	82.82a	22.33a	4.66ab
T_6	60.66g	39.33b	79.72a	20.33ab	4.66ab
T_7	66.66f	33.33c	82.97a	13.00c	3.66abc

CONCLUSIONS

It was concluded that the pre-sowing magnetic treatment of okra seed helps to enhance the growth of plant. Hence by using the magnetic treatment the plant growth and production can be increased.

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