Pak.J.Bot., 30(1): 141-144, 1998.

EFFECT OF A CONSTANT MAGNETIC FIELD TREATMENT OF DRY SEEDS OF WHEAT AND SUGARS ON THE GROWTH OF EXCISED COLEOPTILES

FARHAT AGHA AND M. ISHAQ KHAN

Department of Botany,
University of Karachi, Karachi-75270, Pakistan.

Abstract

Presowing treatment of dry wheat seeds to a constant magnetic field of 30 mT was found to promote the elongation of 24 hrs old wheat coleoptile tips. The growth of apical and basal segments of wheat coleoptiles were also promoted by 30 mT magnetized sucrose and maltose.

Introduction

Magnetic fields are known to penetrate all biological materials (Kaufman & Michaelson, 1974). The biological effects of artificial magnetic fields on the germination of apple, apricot and peach seeds (Chao & Walker, 1967), growth of corn, sunflower and sugarbeet (Leisle & Nikulin, 1967) and respiration of *Vicia faba* roots (Tarakanova *et al.*, 1972) have been reported. A strong constant magnetic field which stimulated protein synthesis in corn seedling during the first 2 days of growth was found to inhibit it on the third day (Dul'binskava, 1973). Metabolism and growth of *V. faba* which were enhanced by treating at a low magnetic field were inhibited by high magnetic field (Tarakanova *et al.*, 1972). In wheat, soyabean and sunflower, exposure to a presowing treatment with a constant magnetic field showed a marked effect on growth, respiration, photosynthesis, enzyme activity and nucleic acid contents (Lebedev *et al.*, 1975). The present paper describes the effect of a constant low magnetic field supplied to seeds and sugars for 24 hours on the early growth of excised wheat coleoptile segments.

Materials and Methods

Seeds of wheat (*Triticum aestivum* cv. TJ-83), sucrose and maltose were exposed to a constant magnetic field from a bipolar permanent magnet of 30 mT (measured by a guass meter) for 24 h. Untreated control and 30 mT treated seeds were surface sterilized with 5% sodium hypochlorite for 5 minutes, washed and then soaked in distilled water for 2 hrs. Seeds were placed with their embryos uppermost on moist filter paper in 9 cm diam., Petri dish, 50 seeds per dish. Petri dishes were incubated in the dark at $22 \pm 2^{\circ}C$. After 24 and 48 hrs, coleoptiles were excised in diffuse day light to get approximately 2 mm apical and 2 mm basal segments as shown in Fig.1. The excised coleoptiles were then dipped in water and left for 2 hrs. Ten coleoptiles with their enclosed primary leaves were placed on a 2 x 1 cm Whatman filter paper No.1 containing 0.5 ml of water or 2% magnetized sugar solution. Slides were kept in 9 cm Petri

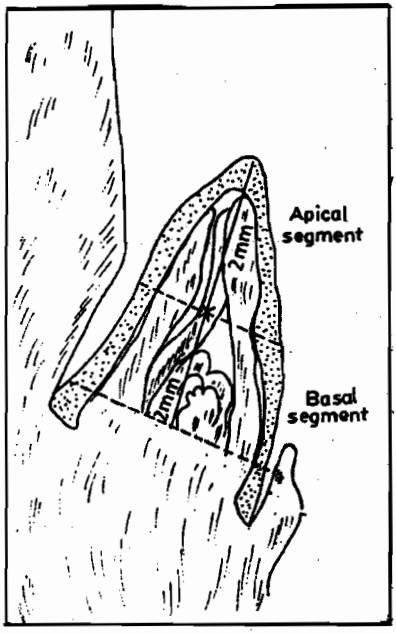

Fig.1. Exciscion of young wheat apical and basal segment of wheat coleoptile.

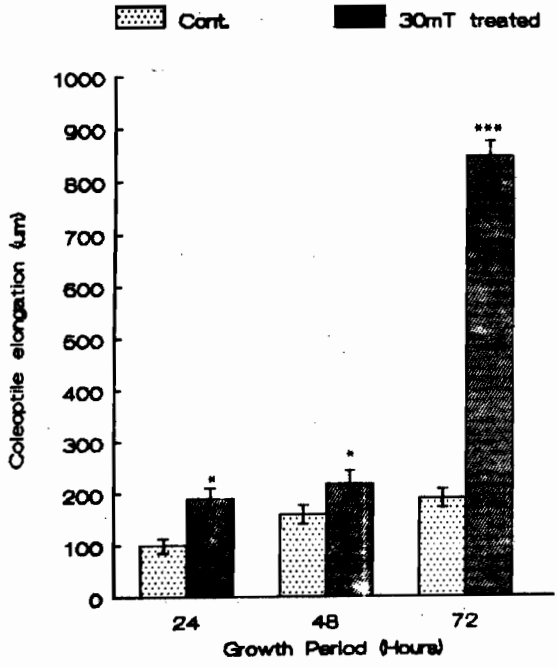

Fig.2. Effect of presowing treatment of dry seeds of wheat (*Triticum aestivum* cv. TJ-83) with 30 mT magnet for 24 hours on the *in vitro* growth of 2 mm apical segment of 24 h old young coleoptile of wheat grown for a further period of 24, 48 and 72 hours.

Significance level *P<0.05; ***P< 0.001

Table 1. Effect of 30 mT magnetized sugar on the growth of 48 hrs old 2 mm basal coleoptile segment of wheat.

Treatment	Coleoptile elongation (μm) After 24 hrs	% increase over control	After 48 hrs	% increase over control
Control	587.5 ±69.5	-	840.6 ±104.0	-
Sucrose (30 mT)	648.5$^{n.s.}$ ±59.9	10.4	1618.0** ±110.0	92.5
Maltose (30 mT)	829.0* ±72.1	41.1	1018.0$^{n.s.}$ ±145.0	21.1

n.s. = non-significant. * p = 0.05 **p = 0.01

dishes containing moist tissue paper lining and incubated at 22±2°C. Length of coleoptiles were recorded before and after the treatment using low power binocular microscope (X 20).

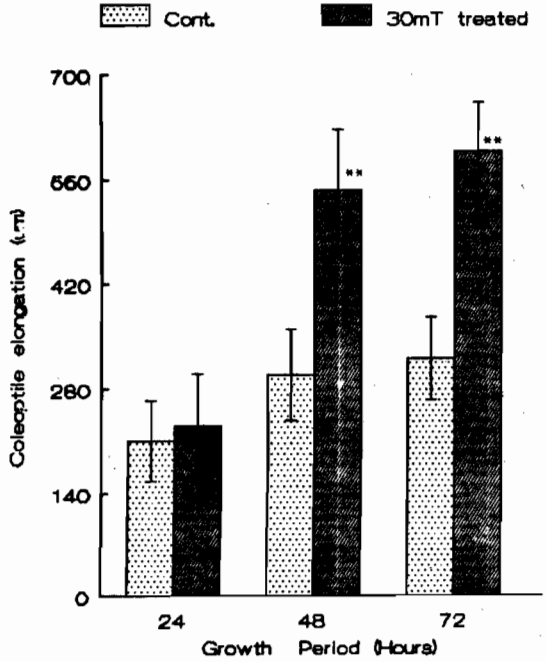

Fig.3. Effect of 30 mT magnetised sucrose for 24 hours on the *in vitro* growth of 48 h old 2 mm apical coleoptile segments of Wheat after a further growing period of 24, 48 and 72 hours.

Results and Discussion

Effect of presowing treatment of wheat seeds with 30 mT magnetic field for 24 h on the *in vitro* growth of 2 mm apical segments showed a significant growth stimulation in the treated material after 24, 48 and 72 hrs of growth (Fig.2). Similarly 30 mT magnetized sucrose was also found to enhance significantly the growth of apical and basal coleoptile segments (Fig.3, Table 1). Magnetized maltose also showed growth promotory effects. Similar to our studies the growth of excised corn roots was also stimulated by stationary magnetic field of 450 gauss after 120 minutes of treatment (Todorov *et al.*, 1972). The influence of 0.10 tesla magnetic field strength for 13-25 minutes resulted in 35,32 and 46% increase, respectively, in wheat, cotton and soybean crops (Phirke *et al.*, 1996). Agha (1990) also found an increase in the length of roots and shoots of mustard and wheat after 30 mT magnetized 24 hrs water treatment. This suggests that magnetic treatment of dry seeds, sugars and water may influence an early cell enlargement phase of plants similar to that of plant hormones.

References

Agha, F. 1990. *Effect of north and south magnetic poles on the growth of plants*. M.Sc. Thesis, University of Karachi.

Chao, L., and D.R. Walker. 1967. Effect of a magnetic field on the germination of apple, apricot and peach seeds. *Hort. Sci.*, 2: 152-153.

Dul'binskay, D.A. 1973. Effect of constant magnetic field on growth of corn seedlings. *Fiziol. Rast.*, 20: 183-186.

Kaufman, G.E. and S.M. Michaelson. 1974. Critical review of the biological effects of electric and magnetic fields. pp. 49-61. In:*Biological and clinical effects of low-frequency magnetic and electric fields* (Eds.) I.G. Llaurado, A. Sancro, Jr., and J.H. Battocletti, Thomas, Springfield, U.S.A.

Lebedev, S.I., P.I. Baranski, L.G. Litvinenko and L.T. Shiyan. 1975. Physiological and biochemical characteristics of plants after presowing treatment with a constant magnetic field. *Physiol. Rast.*, 22: 103-109.

Leisle, V.F. and A.V. Nikulin. 1967. The effect of low tension magnetic field on the growth processes of corn,sunflower and sugar beets. *Zap. Voronezh. Sel ' skokhoz. Inst.*, 34: 113-115.

Phirke, P.S., M.N. Patil, S.P. Umbarkav and Y.H. Dudhe. 1996. The application of magnetic treatment to seeds: Methods and responses. *Seed Sci. & Tech.*,24: 365-373.

Todorov, S.I., M.R. Racheva and M.S. Markow. 1972. A study of the effect of a constant magnetic field on isolated tissue sections from *Zea mays* roots. God Sofii, Univ. Biol. Fak. Kn. 2 Bot. *Mikrobiol. Fiziol. Biokhim. Rast.*, 64: 257-264.

Tarakanova, G. A., T.A. Borisova, B.I. Peisakhzon and V.N. Zholkevich. 1972. Effect of a constant magnetic field on the energy balance during respiration of *Vicia faba* L. roots. *Dokl. Akad, Nauk. SSSR. Ser. Biol.*, 207: 999-1001.

(Received for publication 5 June, 1997)