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# Biophysical and growth parameters in relation to yield in sunflower (*Helianthus annuus*)

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The effect of magnetic field on different crops particularly germination, root and shoot growth of plants have been studied by several researchers. Florez *et al.* (2007) reported that the germination and early growth of maize seedlings enhanced when seeds were exposed to stationary magnetic field. Vashisth and Nagarajan (2008a, 2008b, 2010) reported significant increase in germination, seedling vigour and shoot/root growth of one month old plants of maize chickpea and sunflower seeds exposed to static magnetic fields. In our earlier experiments, seeds of sunflower (*Helianthus annuus* L.) were exposed to different magnetic fields (50, 100, 150, 200 and 250 mT) and duration (1, 2, 3 and 4 hr). Treatment of sunflower seed in these magnetic field increased speed of germination, seedling length and seedling dry weight under laboratory germination tests. Over the check of the various treatments 200 mT for 2 hr exposure gave the peak performance in terms of shoot and root growth (Vashisth and Nagarajan 2010). The present studies were carried out to compare the effect of sunflower seeds exposed to standardized magnetic fields on growth parameter at different stage of growth and yield as compared to untreated control.

Field experiments were conducted at research farm of IARI, New Delhi. Seed of sunflower were exposed to 200 mT for 2 hr and sown in the IARI farm under three (seven, five and four) irrigations along with unexposed control. The crops were raised following the standard recommended agronomic practices with three replications in a randomized block design (RBD). Growth parameters were taken at different growth stages. The data was analysed using the software SPSS 10.0.

Field emergence index, which is an index of the speed of seedling emergence in the field, increased by 7% in 200 mT for 2 hr (Fig 1). Similar positive effect of the magnetic treatment on the germination and emergence of both broad bean and pea cultivars were confirmed by Podlesny *et al.* (2004, 2005). During the crop growing period the maximum leaf area index in different irrigations were found to be peak value at 70 days after sowing. The peak value of LAI was found 4.42 and 3.46 for plant raised from magnetically treated and untreated seeds in seven irrigations while the peak value of LAI was 3.96, 3.21 and 3.53, 3.20 for plant raised from magnetically treated and untreated seeds in five and four irrigations. The peak value of LAI was 19%, 23% and 10% higher in plant raised from magnetically treated as compared to untreated seeds in seven, five and four irrigations respectively (Fig 2). The maximum above ground biomass was observed to be highest in the seven irrigations in plant raised from magnetically treated seeds. The value of maximum above ground biomass was found to be 1 814 g/m$^2$ and 1 589 g/m$^2$ in plant raised from magnetically treated and untreated seeds in seven irrigations while maximum above ground biomass was found to be 1 353 g/m$^2$, 1 240 g/m$^2$ and 1 258 g/m$^2$, 910 g/m$^2$ for plant raised from magnetically treated and untreated seeds in five and four irrigations (Fig 3). The value of biomass was 12 to 21% more in plant raised from magnetically treated as compared to untreated seeds at different phenological stage under seven irrigations while in

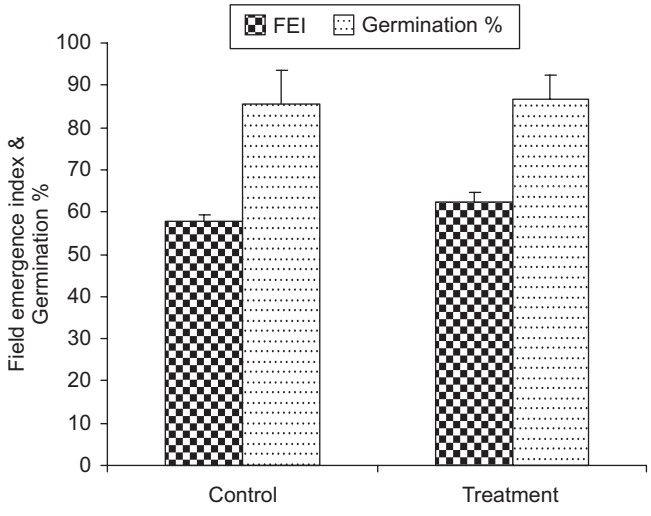


Fig. 1

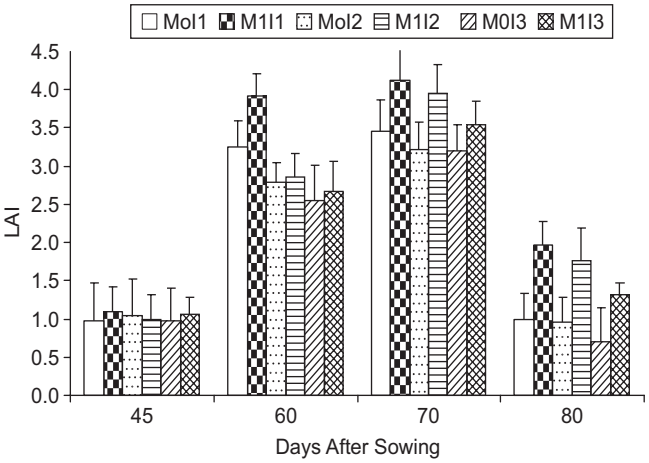


Fig. 2

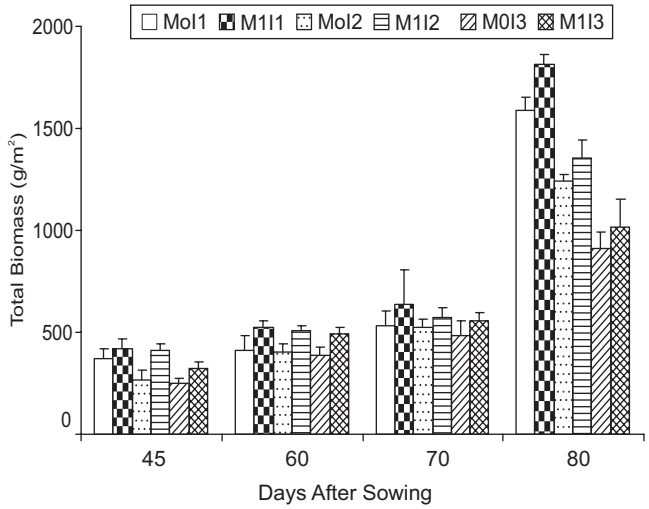


Fig. 3

five and four irrigations the value of biomass was 8 to 51 % and 13 to 38 % more in plant raised from magnetically treated and untreated seeds respectively. The seed yield was found to be 1 836, 1 371, 1 110 kg/ha and 1 783, 1 260, 1 092 kg/ha for plant raised from magnetically treated and untreated

Effect of magnetic treatment on head of sunflower


Effect of magnetic treatment on plant growth

seeds in seven, five and four irrigations. The plant raised from magnetically treated seeds had 3, 8 and 2% more seed yield as compared to untreated control in seven, five and four irrigations (Table 1). The weight of 1 000 seed harvested from plant raised from magnetically treated and untreated seeds was found to be 39.7, 36.4, 42 g and 36.2, 34.8, 39.6 g in seven, five and four irrigations.

The weight of 1 000 seed harvested from plant raised from magnetic treatment had 9, 4 and 6% more value as compared to untreated in seven, five and four irrigations (Table 1). The value of total biomass at harvest was 261.1, 194, 144.3 g/plant and 222.5, 174.6, 123.8 g/plant in plant raised from magnetically treated and untreated seeds in seven, five and four irrigations. The plant raised from seeds treated by magnetic field had 15, 10 and 14% more value of biomass at harvest as compared to untreated in seven, five and four irrigations (Table 1). The percentage oil content was found to

Table 1 Effect of magnetic field on yield, 1 000 seed weight, protein and oil content of sunflower

| Treatment | Yield (kg/ha) | 1000 seed weight (g) | Protein (%) | Oil (%) | Biomass at harvest (g/plant) |
|---|---|---|---|---|---|
| MoI1 | 1783 ± 8.74 | 36.15 ± 1.75 | 20.7 ± .617 | 47.16 ± 8.05 | 222.54 ± 4.74 |
| M1I1 | 1836 ± 2.28 | 39.73 ± 3.42 | 22.5 ± 1.35 | 45.00 ± 5.06 | 261.14 ± 4.35 |
| MoI2 | 1260 ± 2.28 | 34.75 ± 2.71 | 22.6 ± .162 | 40.95 ± 4.50 | 174.58 ± 5.48 |
| M1I2 | 1371 ± 6.30 | 36.37 ± 2.29 | 19.7 ± .405 | 40.89 ± 4.69 | 194.01 ± 4.48 |
| M0I3 | 1092 ± 2.38 | 39.60 ± 1.05 | 20.83 ± .232 | 39.60 ± 3.32 | 123.79 ± 4.10 |
| M1I3 | 1110 ± 5.43 | 42.00 ± .754 | 24.4 ± .230 | 40.68 ± 8.05 | 144.29 ± 5.49 |
| LSD (5%) | 531.8 | 5.33 | 2.30 | 2.52 | 4.86 |

$M_0I_1$, Untreated control with seven irrigation; M1I1, Magnetic treated with seven irrigation; M0I2, Untreated control with five irrigation; M1I2, Magnetic treated with five irrigation; M0I3, Untreated control with four irrigation; M1I3, Magnetic treated with four irrigation

be 45, 40.9, 40.7 and 47.2, 41, 39.6 for seeds harvested from the plant raised from magnetically treated and untreated seeds in seven, five and four irrigations (Table 1). The value of protein was found to be 22.5, 19.7, 24.4 and 20.7, 22.6, 20.8 for harvested seeds from plant raised from magnetically treated and untreated seeds in seven, five and four irrigations. The magnetic treatment has 8 and 15% more value of seed protein as compared to untreated in seven and four irrigations respectively while in five irrigations untreated control has 12% more value of seed protein corresponding to magnetic treatment (Table 1). Faqenabi *et al.* (2009) showed similar type of result in safflower. He observed that the yield of safflower plants produced from seeds treated by magnetic field was four times of control yield and the difference between oil and protein percentage of treated seeds were significant. They reported that magnetic field treatment might be suitable for safflower as compared with other treatment under condition similar to the experiment. Podlesny *et al.* (2004, 2005) also reported the gain in seed yield resulting from the pre-sowing treatment of seeds with a magnetic field for both broad bean and pea. Exposure of dry sunflower seeds to static magnetic field increased field emergence index, leaf area index, total biomass and yield. The obtained results in this study indicate that seed exposure by 200 mT magnetic field for 2 hr might be suitable for sunflower as compared with untreated under condition similar to the experiment.

## SUMMARY

Field experiments were conducted at research farm of IARI, New Delhi, during 2010 with an aim to study the effect of pre sowing seed treatment by magnetic field on crop growth, seed yield quality as well as quantity under different irrigation level. Sunflower (*Helianthus annuus* L.) seeds (Var. Sun bred -275) were exposed to static magnetic fields of strength 200 mT for 2hr and sown in IARI farm under different irrigations showed higher field emergence index, leaf area index, biomass and yield as compared to plants raised from untreated control under similar conditions.

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**CORRIGENDUM**

In article "Qualitative and quantitive changes in lipids of cowpea (*Vigna unguiculata*): Impact of changes in seed vigour", published in *The Indian Journal of Agricultural Sciences* **83**(1): 87–92 first author Reshma Shaheen is Ph D Scholar, Department of Botany, Jamia Hamdard, New Delhi 110 062.