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EFFECT OF DIFFERENT PARAMETERS ON BARLEY YIELD AND LEAF SPOTTING DISEASE CAUSED BY *NIGROSPORA SPHAERICA*

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ABSTRACT : The research was conducted for the 2018 growing season in one of the barley fields in the province of Najaf. The experiment was factorial according to RCBD with three replicates to study the effect of using magnetized water (at intensity of 800 Gauss) for irrigation and/or dilution herbicides Granstar and Topicat full and half dose on the barley yield and disease severity of barley leaf spot caused by the pathogenic fungus *Nigrospora sphaerica*. The results showed that treatment of Topic at half the dose diluted with magnetized water was more effective against the weeds and significantly reduced *Nigrospora* infection than the dilution with regular water of the same herbicide at full dose. While, it was found that the effectiveness of Granstar was decreased when diluted with magnetic water, regardless of concentration. The findings showed that irrigation with magnetized water throughout the growth period led to a 100% reduction in spotting, as well as a significant increase in the yield of barley compared to watering with regular water.

Key words : Herbicides, magnetized water, Najaf, barley, *Nigrospora*.

INTRODUCTION

Barley *Hordeum vulgare* is an economically important annual crop used mainly as animal feed (green or dry feed). In addition to the use of barley grains to produce barley flour, which makes best bread for diabetics,it is the main source to produce of molt and beer. Barley is generally a component of healthy food and is involved in the preparation of soups and breads of barley in various cultures from Scotland to Africa. In 2017, barley was considered the fourth grain crop in terms of production amounted to 136 million tons from cultivated area of 566,000 km^2 (FAO, 2017).

Barley is classified on the basis of the success of the crop at certain temperatures to the winter barley, whose seedlings need to be exposed to low temperatures (Vernalized), which are necessary to stimulate the plant to form spikes and give regular cereals (Newton *et al*, 2011). Winter barley is usually grown in the autumn to face the cold of winter and develops and matures during the spring and summer. Spring barley, grown in Iraq, does not require low temperatures for growth and seed production (Comadran *et al*, 2012).

It is known that population increase is often accompanied by a persistent food deficit for humans and animals, prompting many researchers to search modern methods or technologies to increase production and reduce this gap. Nowadays, the concept of using magnetically treated water technologies in agriculture, or magnetic bio-stimulation to raise crop yields has emerged (Abdul Qados and Hozayn, 2010). This is done by creating desired stimuli such as accelerating plant metabolism and changes in the properties of living membranes depending on the role of the magnetic field in making biochemical and physical changes and physiological changes in cell structure (Hozayn and Abdul Qados, 2010; Al-Bayati *et al,* 2019). Thereby improving cell membrane and cellular metabolism, influencing cell division, mRNA function and gene expression, as well as protein synthesis, enzyme activity and function at tissue and cell level (Vasilevski, 2003).

Fungi are important pathogens that cause various diseases on barley. Some of these fungi infect the plant and are in the field such as *Fusarium solani* and *F. moniliforme*, which cause seedling death, root rot and lower leg contract. Barley leaf stains caused by fungi *Bipolaris* spp. (Mizher, 2005). Environmental changes in general in Iraq have led to the emergence of uncommon plant diseases. Barley leaf spot due to the pathogenic fungus *Nigrospora* spp. is one of these diseases.The disease appears on infected barley leaves in the form of reddish brown circular spots surrounded by a yellow halo.

The disease develops when these spots widen, combine and become a smear called Nigrospora batch. These barley infections have occurred in Iraq for the past three years, often before the spikes were formed. Therefore, the aim of the study was to identify the fungus Nigrospora isolated from infected barley leaves, investigate the effect of using magnetic water as irrigation treatment in reduce infection compared to two conventional pesticides, as well as to evaluate magnetic water effects on effectiveness of thesetwo pesticides.

MATERIALS AND METHODS

The experiment was conducted during the winter season of 2018 in Al-Azamiya area, Najaf province. The experiment was according to Randomized Complete Block Design (RCBD) with three replications. All the crop services were operated including tillage, soil softening and leveling and pre-planting fertilization with NPK fertilizer (18-18-18) by 25 kg/dunum. The field was divided into experimental units with dimensions of 4 × 4 m, leaving a distance of 1 m between each two treatments. The seeds were planted at 35 kg/dunum (14 g /m^2). Irrigation, fertilization and pest control were performed as needed. The experiment included two main parts (sections) based on type of water used for irrigation (regular untreated river water or magnetized water). The treatments included two types of conventional pesticides (Granstar and Topic) in full (100%) and half (50%) the recommended dose, diluted with ordinary water or magnetized water in addition to the control treatment. Magnetized water was used at 900 kaos. Magnetrons of ½1ang diameter were calibrated by Gauss meter. A water pump is attached to the rubber tubing and ends with magnetic treatment devices placed at the entrance of each pilot unit to facilitate the flow of water. After 45 days of planting, the second batch of fertilizer was added at the same level as before. At the same time, the plants were sprayed with the pesticides after dilution with regular water or magnetized water according to the treatments.

At 90 day post planting, a three plant samples were randomly taken from eachexperimental unit showed leaf spotting. Infection rate (percentage) and severity were calculated. A disease index of 5 degrees was used according to William (1997) based on the leaf area infected, where 0 = no infection, 1 = 1-25%, 2= 26-50%, 3=51-75% and 4 = 76-100% dead plant. Based on this index, percent disease severity.

Detection and diagnostic of the pathogenic fungus *Nigrospora sphaerica*

Samples from infected plant leaves then were taken and cultured on growth media for further morphological (Ellis, 1971) and molecular diagnosis in the graduate plant pathology laboratory at the College of Agriculture, University of Kufa. For isolation of the pathogenic fungus, two culture media were used including, Potato Dextrose Agar medium PDA and hot water extract of barley leaves dextrose agar BLDA. Each liter of the BLDA contained hot water extract of 200 g barley leaves, 20 g dextrose and 17 g agar. The experiment ended at the end of the growing season and yield (ton.h^{-1}) was recorded and compared among treatments.

RESULTS AND DISCUSSION

The effect of magnetized water on *Nigrospora oryzae* percent of infection and severity, results in Table 1 shows that all treatments irrigated with regular water showed infection with leaf spotting disease caused by *Nigrospora oryzae*. The highest rate of infection was recorded in the treated control treatment (96.63%) and disease index of 3 compared to plants irrigated with magnetized water which did not show any leaf spot symptoms. The infection rate in pesticide topic treatments ranged from (40.77 to 80.37%) was higher than that recorded with the Granstar which ranged from (37.53 to 68.53)%. The lowest infection rate in case of Granstar was in full dose dissolved in regular water, whereas with Topic was in the half dose dissolved in magnetized water. The infection was not detected in case of magnetized water irrigation regardless the type of treatment.The results of the severity of infection were consistent with the infection rate (Table 1). The highest infection severity (41.47%) was recorded in the untreated weedy control irrigated with regular water. Similarly, the lowest infection severity (25.10%) was recorded in the full dose treatment of Granstar solved in regular water.

The results also showed that the barley leaf extract medium was more favorable for the pathogenic fungus

Table 1 : Effect of magnetized water and pesticides Granstar and Topic on infection rate and severity of barley leaves spotting caused by *Nigrospora sphaerica* 90 DPP.

Treatments	%	
	Infection	Severity
Full dose Granstar in RW/RW for irrigation	37.53	25.1
Full dose Granstar in MW/RW for irrigation	68.53	32.8
Half dose Granstar in MW/RW for irrigation	66.8	31.47
Full dose Topic in RW/RW for irrigation	80.37	33.8
Full dose Topic in MW/RW for irrigation	70.33	31.5
Half dose Topic in MW/RW for irrigation	40.77	30.5
Weedy control/ RW for irrigation	96.63	41.47
Untreated control/MW for irrigation	0.00	0.00

L.S.D. (P≤0.05) infection = 10.426, severity = 3.018

growth than the standard PDA medium (Table 2). Fungal radial growth on the other hand was increased on the barley leaf extract medium (BLDA) inoculated with pathogenic fungus reaching 6.6 cm at 7 days of incubation compared to radial growth of 4.2 cm resulted from the inoculated standard P.D.A. medium for the same period of incubation (Table 2). The BLDA medium also resulted in higher fungal reproduction where number of produced conidia was 1.12×10^6 compared to 1.03×10^6 from the fungal grown on the standard P.D.A. medium (Table 2).

Table 2 : Effect of culture medium type on growth and reproduction of *Nigrospora sphaerica* after 7 days of incubation at 25±2°C.

Growth medium	Fungal radial growth (cm)	Fungal reproductive units (conidia)
P.D.A.	4.2	1.03×10^6
B.L.D.A.	6.6	1.12×10^6

Effect of Topic, Granstar and Magnetic field on Barley productivity (Tons h^{-1})

It is clear from the results (Table 3) that the treatment with Topic gave the highest cereal yield (5.285 tons h^{-1}) compared to the controlled control treatment that resulted in the lowest cereal yield (2.558 tons h^{-1}). The results showed that the interaction between the type of water and the pesticide Topic led to a significant effect on barley yield components. The highest yield was recorded in the interaction treatment of Topic and magnetized water resulting in 7.635 tons h^{-1}, compared to the lowest yield (0.575 tons h^{-1}) in the control irrigated with regular water.

Table 3 : Effect of magnetic field application and herbicides Granstar and Topic on barley yield (tons.h^{-1}).

Treatments	Type of irrigation water		Average
	Magnetized	Regular	
Full dose Granstar in RW	5.904	1.677	3.791
Full dose Granstar in MW	6.089	1.824	3.957
Half dose Granstar in MW	6.192	2.027	4.110
Full dose Topic in RW	6.812	2.492	4.652
Full dose Topic in MW	7.171	2.691	4.931
Half dose Topic in MW	7.635	2.935	5.285
Untreated control/ RW for irrigation	4.541	0.575	2.558
Average	6.335	2.032	

L.S.D. (P≤0.05) for treatments= 0.328, type of irrigation water = 0.175, interaction = 0.464

DISCUSSION

It was indicated (Rao, 2002) that the mechanism of action of magnetic water in aquatic organisms, including algae is by charging water molecules, increasing the attraction force between water molecules and food minerals. This reduces the ability of the organism to feed and grow, thereby reducing the numbers of its reproductive units produced. The effect of exposure to the magnetic field depends on the physiological state of the target organism (Ruzic, 1996; Ruzic, 2000). Other environmental and biological factors involved with the magnetic field (Ruzic, 1998).

Sadauskas (1987) also showed that exposing fungi farms to two magnetic fields, one fixed at 200 mm Tesla and the other strongly discontinuous, 29 mm tesla, led to morphological changes in colony color and conidia formed. The use of a fixed magnetic field at a frequency of 50 Hz reduced the growth rate of fungi by 10-15% (Nagy, 2003).

The effect of magnetized water on the plant may be directly through induction of the host's defenses. This was confirmed by Mozaffer (2006), which indicated that exposing red cabbage seeds to a magnetic field increased the plant's content of phenolic and anthocyanin. It was also observed (Desouza, 2006) that the magnetization of tomato seeds using a magnetic field of 100 milli-tesla for 10 minutes and 176 milli-tesla for 3 minutes led to significant delay in viral infection symptoms of the Geminiviruses and also reduced the incidence of early blight disease.

The higher growth of the fungus over the barley leaf extract compared to the standard PDA is often attributed to the nutritional preference for the fungus *N. oryzae* over media similar to the normal (host) medium growing on the fungus in the field. This applies to other fungi, as thorns found that *Alternaria alternata* easily grew on the medium from, which it was isolated, which is the leguminous plant, while its growth was slow on the medium P.D.A.

This increase is attributed to the effectiveness of Topic in controlling weeds and reducing its competitiveness with the crop on growth requirements. This allowed the crop to grow without environmental

stress and high performance for its vital /activities, including photosynthesis, which was reflected in the yield of the crop compared to the rest of the transactions. This finding was consistent with that of Webster (2008) and Mussavi (2009), who explained that the use of pesticides in combating barley bushes significantly increased grain yield due to the control of most bushes that compete with the crop.

The treatment of watering with magnetic water resulted in the highest yield of grains amounting to 6.335 tons.h^{-1} compared to the treatment with watering with regular water that gave the lowest yield of grains amounting to 2.032 tons.h^{-1}. The increase in the barley yield in water magnetization treatments may be due to the effect of magnetized water on improving the different growth criteria for the plant, including plant height and other growth indicators, which allowed the plant to perform vital activities better and thus, increase the yield components. This is consistent with AbdulQados and Hozayn (2010), who indicated that the use of magnetic water caused an increase in the yield of wheat grains.

CONCLUSION

The results of the study showed the possibility of using Topic in half-dose and with high efficiency against barley grasses when diluted with magnetized water. It also led to reducing the prevalence of infection with Nigrospora compared to the full dose diluted with plain water. Interestingly, the research found that the efficacy of Granstar was reduced when diluted with magnetic water even at high concentrations. Irrigation with magnetic water throughout the growth period led to a clear reduction in the incidence of spotting and a significant increase in the barley yield compared to irrigation with regular water.

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