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Effectiveness of Hydrogen Peroxide on Reducing Irrigation Water Quantities, Pests and Enhancing Kohlrabi Production

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Abstract
This study was carried out at Faculty of Agricultural - Suez Canal University which located in north eastern Egypt, within the Governorate of Ismailia. The experiment was conducted to assess the influence of hydrogen peroxide on reducing irrigation water quantities, Mite infestation and kohlrabi Production. Thus; the aim of this study is to monitoring the influence of three treatments hydrogen peroxide (G1, G2 and G3) with average (5mL/plant, 10mL/plant and 0mL/plant [without hydrogen peroxide]) respectively, and three treatments for irrigation water quantity [Q1, Q2 and Q3] with average amount of water (180, 270 and 360mm) respectively on yield production, growth parameters, leaf area index, mites, insects density, and irrigation water uses efficiency. The highest yield value has recorded with Treatment (G1) by (5427.3 Kg.Fed-1). Which is a significant value comparing with other treatment (G2 and G3) which obtained a low value by (3721.7 and 4325.07 Kg.Fed-1) respectively. In addition; the result of irrigation water use efficiency recorded a best value with (G1) by 5.62, 3.25and 4.16(Kg.m^{-3}) under Q1, Q2 and Q3 respectively. Thus; the irrigation water use efficiency obtains a highest mean value by (4.43 Kg.m^{-3}) with using hydrogen peroxide treatment (G1). data indicated that there is a significant influence for hydrogen peroxide with (G1) treatment on *Euseius scutalis* mite which recorded a highest dentistry by (3.78 N/in^2) but the lowest value obtained with (G3) by (1.36 N/in^2). In contrary; there is not any significant impact on *Euseius scutalis* density with other treatment (Q1 and Q3) which got (2.2 and 2.07 N/in^2) respectively. Moreover; hydrogen peroxide treatments (G1and G2) did not have a significant influence on the other mite (*Amblyseius swirskii)* comparing with (G3) treatment. Further; using one doses from (5mL/plant) hydrogen peroxide reducing the density of insects (*Aphis gossypii and Thrips tabaci)* by 50 % comparing with the other value which did not adding a hydrogen peroxide. In addition; the insects increased when reducing the amount of water from 360mm to 270mm by 50% for *Aphis gossypii* and 75% for *Thrips tabaci.*
Keywords: Hydrogen Peroxide, water quantities; mite & insects densities; Irrigation water use efficiency and kohlrabi production.
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1. Introduction
Hydrogen peroxide is environment friendly, does not contaminate the soil, does not harm the aquifer, and indirectly makes more oxygen available for soil and plants. Oxidation reaction is quick, so the hydrogen peroxide is consumed immediately upon contact with the irrigation water, and is biodegradable. Thus; hydrogen peroxide uses as oxidation and disinfection for the water source.

The phenomenon of oxygen deficiency is particularly intense in fine-textured, clayey (heavy) soils, which drain slowly (Glinski and Stepniewski,1985). Furthermore, irrigation with treated waste water or saline water may also exacerbate oxygen deficiencies (Assouline and Narkis, 2013), mainly due to the increased irrigation volumes used to ensure the leaching of salts. High temperatures are also known to contribute to soil oxygen deficiencies (Ityel et al., 2014).

Low soil oxygen content can damage a root tissue, inhibition of the vegetative, reproductive growth, changes in plant anatomy and morphology (i.e., development of hypertrophic stem lenticels, adventitious roots or root and stem parenchyma, and alterations in the relationship between xylem and phloem), premature senescence, and plant mortality (Schaffer et al., 1992; Drew, 1997). Moreover; when the oxygen diffusion rate (ODR) in the soil was lower than 0.17 µg cm^{-2} min^{-1}, there occurred 44 to 100% damage to roots (Stolzy et al. 1967). Thus; Daily oxygen demand under normal conditions is estimated to be about 15g-O_2 m^{-2} (Friedman and Naftaliev, 2012).

Root anoxia or hypoxia often results in increased concentrations of amino cyclo-propane, carboxylic acid (ACC), and ethylene and abscise acid (ABA) in leaves (Bradford and Yang, 1980; Kozlowski, 1997). Injecting hydrogen peroxide H_2O_2 into the soil significantly increased the biomass of the aerial portions of the plant and water use efficiency (plant biomass per water applied [WUE_b]), (Pilar et al 2009). Moreover; injecting Hydrogen peroxide Hydrogen peroxide (H_2O_2) through the irrigation system into a heavy clay soil, which saturated or at field capacity, increased biomass, yield of zucchini, soybean, and cotton (Bhattarai et al. 2004).

In addition; H_2O_2 treatment improved growth, photosynthesis, metabolic state of the plants which provided tolerance and helped the plants to cope well under Cu stress (Faroza et al., 2019). In *Cucumis sativus,* exogenous application of H_2O_2 promoted photosynthesis and antioxidant metabolism leading to an efficient reduction of the harmful effects of drought stress (Sun et al., 2016).consequently;an efficient means of oxygenation could improve the yield of crops in fine-texture, clay soils and, consequently, increase the diversity of crops that can be grown in these soils.

Hydrogen peroxide (H_2O_2) was first used in agricultural practice for the sterilization of seeds (Massee, 1913). Later, it was found to also induce germination (Ching, 1959).Today, it is used for various agricultural purposes. For instance cleaning drippers (https://www.netafim.com/article/water_recycling) or controlling pests those are sensitive to oxidation, such as nematodes (Blum and Fridovich, 1982), H2O2 affected lettuce seed germination, but were able to reduce the presence of adult flies.(Vanessa et al.,2018)

On the other hand; Water requirement is a vital factor which effect more than other on the development crops (Yamaguchi-Shinozaki et al., 2002). Growth and photosynthesis were partially or completely suppressed by water stress (Kramer and Boyer, 1995), and that mostly led to limiting of crop yield. Plant damage caused by drought stress is variable depending on the level and duration of the stress and other environmental factors (Glantz, 1994) Thus; Plants have evolved mechanisms for adaptation and survival during water deficit (Cruz, 2008). In addition; Adding calcium peroxide (110ppm) to the soil and H_2O_2 to the irrigation solution (300 ppm) was found to increase the yield of sugar beets (Beta vulgaris) by 60% in loamy sand, but did not affect sugar beet yields in a clay soil (Wiersma and Mortland,1952).

The present study examined the effects of irrigating with H_2O_2 solution, as well as the ability of the oxygation technique proposed in this manuscript to improve aeration in soil, improve Kohlrabi crop yields, pests and irrigation water management.

2. Material and Methods

The experiment was carried out over the 2018 and 2019 growing seasons in the farm at faculty of agricultural – Suez Canal university – Ismailia governorate. The study site, established in early of February (2018, 2019), (30° 37' 10.91"N - 32° 16'1.33"E). The site of experiment falls into an arid area with a Mediterranean climate. The site is about 30 m above sea level with an annual rainfall of 29 mm/year. The average climate characteristics for temperatures, relative humidity, wind speed and evapotranspiration (ETo) represented at table (1).

Table 1: Climatic characteristics at Ismailia governorate for growing season (2018-2019)

Month	Prc.	Tem. max	Tem min.	Hum.	Sun shine	Wind (2m)	ETo
	mm/m	°C	°C	%	%	km/h	mm/d
Feb	1.68	22.7	13.5	57.2	70.6	15.5	3.49
March	0.9	26.9	15.2	50.9	73.5	15.0	4.7
April	0	28.8	19.2	48.7	77.6	17.8	5.9

(*Prc*. = Precipitation; *Tmp. min*/*max* = minimum/maximum temperature; *hum*. = relative humidity; *Sun shine* = Sun shine as percentage of day length; *Wind* (*2m*) = wind speed at 2m; *ETo*= Reference evapotranspiration).

The soil of the experimental site is sandy texture, none saline, and none calcareous. Silt and clay content are quite low (3.2% and 1.2% respectively) thus; both field capacity and available water are very low (5.6 % and 4.5 %) with soil conductivity 1.37dS/m. Water samples were analyzed by standard analytical methods for pH, electrical conductivity and ion composition (APHA, 1992). Average values of the analyzed parameters in irrigation water are given in [table (2)]

Table 2. Some chemical characteristic for the different irrigation water type.

Ph	EC	Soluble Cations (meq/L)				Soluble Anions(meq/L)				SAR
	(dS/m)	Ca^{++}	Mg^{++}	Na^{+}	K^{+}	CO^{-2}_3	HCO^{-3}	CL^{-1}	SO^{-2}_4	
7.34	1.18	2.8	0.6	8.2	0.2	0	2.92	6.83	2.05	6.3

The total water applied calculated related to the (Richard et al, 1998)"Irrigation and Drainage Paper #56: Crop Evapo-transpiration: Guidelines for Computing Crop Water Requirements." Further; Crop water requirement and total water applied. Using an average Reference Evapotranspiration (ETo) and the Crop coefficients (Kc) [table (3).] by the following equations.

$$ETc = ETo * KC \quad (1)$$

Where;
Etc Crop Evapotranspiration, (mm/day).
ETo Reference Evapotranspiration, (mm/day).
Kc Crop coefficients.

$$IRn = ETc – Peff \quad (2)$$

where;
IRn Net irrigation requirement, (mm/day).
Etc Crop evapotranspiration,(mm/day).
Peff Effective rainfall, (mm/day).

$$IRt= IRn/Ea \quad (3)$$

where;
IRt Total water applied (mm/day).
IRn Net irrigation requirement, (mm/day).
Ea Overall irrigation efficiency for modern irrigation system (drip. Approximately (90%). [(Vermeiren and Jobling, 1984 ; Phocaides, 2007)].

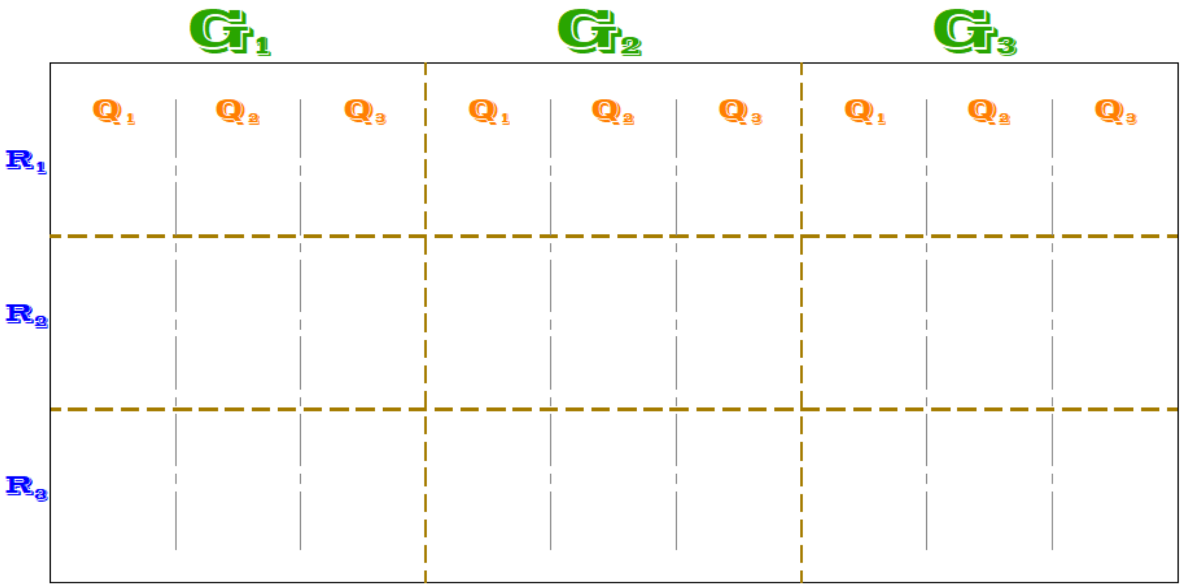
Table 3. The average crop coefficients (Kc) for Kohlrabi

Item	Init.	Dev.	Mid.	Late.	Total.
Days	20	30	15	10	75
KC	0.7	1.05	1.05	0.95	

Subsequently; the total water applied for Kohlrabi is 360 mm. further; Used a drip irrigation system [drip (using GR 4L/50cm/h – 1.2bar] with three amounts of water (Q1, Q2and Q3) (50%,75% and 100%) respectively from total water applied for Kohlrabi.

In addition; Seeds of kohlrabi (S.N) were grown in trays for two weeks and irrigated regularly in the greenhouse until plants reach appropriate size. Posterior; seedlings were transplanted to field at 2nd February.

The there are two treatments for Hydrogen peroxide (H_2O_2). First treatment is (G1) one dose (5mL) per plant and second treatments is (G2) two doses by total (10mL). H_2O_2 (50%) solution was injected two times into the soil through irrigation system at the end of the irrigation period. The first dose was injected at the begging of plantation and the second dose after 45 days. The H_2O_2 concentration was chosen following the methodology described by (Bhattarai et al., 2004). H_2O_2 was delivered from a 1^{-m3} supply tank.



G1 = one dose for (H_2O_2) with 5mL per plant; G2 = two doses for (H_2O_2) with total 10mL per plant; G3 = control without doses for (H_2O_2). Q1= 180mm; Q2= 270mm; Q3= 360mm. with three Replicates (R1, R2and R3)

Figure 1. Layout of experiments and treatments distribution

Counting Mite and insect.

The proportional susceptibility of kohlrabi crop to some piercing sucking pests and some predator mites was estimated. The population of phytophagous insects (Aphis gossypii and thrips tabaci) & predaceous mites (*Amblyseius swirskii* (Athias-Henriot) and *Euseius scutalis* (Athias-Henriot) was conducted on kohlrabi crop at Faculty of Agriculture Farm, Suez Canal University in Ismailia Governorate in 2018. Monthly leaf samples (contain thirty leaves) was taken from each treatment were recorded, while other species of mite and insect pests have been neglected due to their occurrence by few numbers. After that the leaves were conveyed to the laboratory in separate polythene bags to be examined under a stereo-binocular microscope. According to (Kumar et al., 2015).

Leaf area index (LAI):

Leaf area index (LAI) was estimated using one method By multiplying the plant population by the leaf area per plant as described in (Kar *et al.*,2006). Area of the leaf was measured manually using the following equation:-

$$LAI = 0.75\ x\ \rho\ x \left(\frac{\sum_{i=1}^{m} \sum_{j=1}^{n} (L_{iJ} x B_{iJ})}{m} \right) \quad (4)$$

Where:-
LAI = Leaf area index ($m^2.m^{-2}$).

p = plant density (plant. m^{-2}).
m = the number of measured plants.
N = the number of leaves for plant.
Lij = Leaf length (m).
Bij = Leaf width (m).

Irrigation water use efficiency using the (Bos, 1979) equation (5).

$$IWUE = [Y_{gi} - Y_{gd}] / IRR_i \qquad (5)$$

Where:

IWUE = Irrigation water use efficiency (kg / m^3).
Y_{gi} = The economic yield (kg/fed).
Y_{gd} = The dry yield (kg/fed). (Actually, the crop yield without Irrigation).
IRR_i = The irrigation water applied (m^3 / fed)

* Often, in most semiarid to arid locations, Y_{gd} may be zero.

Statistical analysis for modelling:

The data were analyzed using the two way ANOVA split plot procedure with Duncan's HSD test at $p<0.05$ using the COSTAT 3.03 System software.

The simple regression models with predictor variables $X_1; \ldots ; X_p$ can be describe by equation (6).

$$y = B_0 + B_1X_1 + \ldots\ldots\ldots\ldots + B_pX_p + k \qquad (6)$$

Where:

Variable y, called a response or dependent variable, depends on another variables $X_{(1..p)}$ which is called the independent or predictor variable (also called the regress or variable), B_0 is intercept, $B_{1\text{-}P}$ is the slope parameters and the variability of the error (k) is constant for all values of the repressor.

3. Result and Discussion

Crop growth parameters:-

At table (4) data indicated that there are significant impacts for hydrogen peroxide on plant length (PL), No. of leafs and root length (RL) especially with one dose (G1). However; with two doses (G2) data did not recorded any significant influence comparing with (G1) or without any doses (G3). For instance; the data observed a high significant value for (PL), (RL) and No. of leafs by (36cm, 23.1cm and 19.2) respectively under (G1) treatment. this result appropriate with (Pilar et al 2009) who found that Injecting hydrogen peroxide H_2O_2 into the soil significantly increased the biomass of the aerial portions of the plant and water use efficiency. In addition; the data obtained a low mean value with (G2) by (28.8 cm) for (PL) and by 17.3 for No. of leafs but recorded a high value for (RL) by (24.2 cm). On the other hand; the highest mean value for (PL) recorded with low amount of water Q1 comparing with other treatments (Q2 and Q3) by (34 cm) and by (21.5 cm) for Root length (RL) respectively. Exogenous application of H_2O_2 promoted photosynthesis and antioxidant metabolism leading to an efficient reduction of the harmful effects of drought stress (Sun et al., 2016).

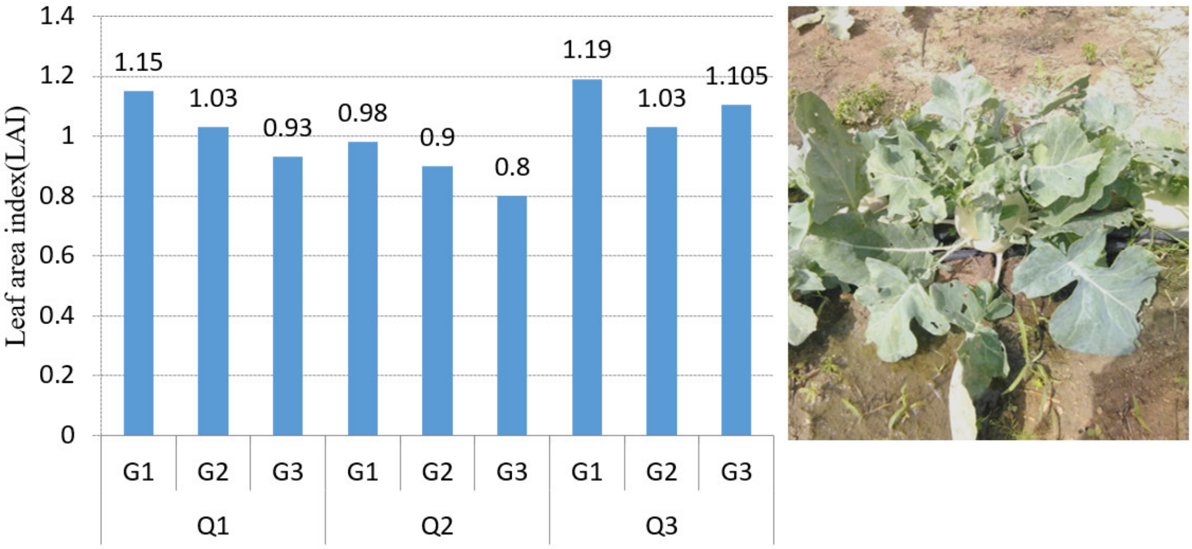
Table 4. Influence of Hydrogen peroxide and water treatments on some crop growth parameters.

ITEMS	Treatments					
	Q1	Q2	Q3	G1	G2	G3
Plant length (cm)	34a	34.2a	31.2b	36a	28.8b	34.5a
LSD0.05		2.57			3.51	
No. of leafs	18.6b	20.4a	18.5b	19.2ab	17.3b	21.1a
LSD0.05		1.11			2.63	
Root length (cm)	21.5a	21.53a	23.7a	23.1a	24.2a	19.53a
LSD0.05		4.72			4.53	

G1 = one dose for (H_2O_2) with 5mL per plant; G2 = two doses for (H_2O_2) with total 10mL per plant; G3 = control without doses for (H_2O_2). Q1= 180mm; Q2= 270mm; Q3= 360mm

Leaf area index.

Moreover; Fig.2 illustrates the interlaced influence of hydrogen peroxide and water treatments on leaf area index. Data represented that there are a variations on the values (LAI) related to the different treatments. For instance; the highest values for (LAI) has recorded with (H_2o_2) treatment (G1) comparing with other treatments G2 and G3 whatever the amounts of water. However; the treatment of water Q1 and Q3 obtained a highest value for (LAI) by 1.15 and 1.19($m^2.m^{-2}$) respectively under (G1). Noticeable; that the (G3) has a different influence on (LAI) under Q2 comparing with Q1 and Q3. Thence; the value of (LAI) under Q3 obtained 1.105 ($m^2.m^{-2}$) as mean value and (0.9 and 0.8) with Q2 and Q1 respectively under (G3). Obviously; that the LAI values have a good behaviour with G1 and low amount of water (Q1) because that the low concentrations of (H_2o_2) would act as a signal molecule to improve ant oxidative defence system as well as the highest growth and yield were obtained. Thus, it could be concluded that the application of low concentration of hydrogen peroxide can help plants to resist drought stress (Salwa et al.,2018).

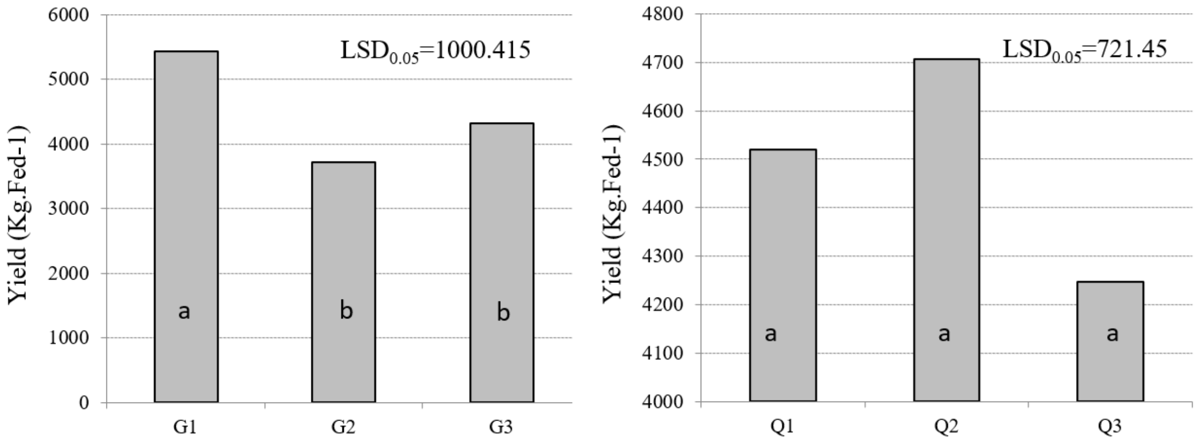


G1 = one dose for (H_2O_2) with 5mL per plant; G2 = two doses for (H_2O_2) with total 10mL per plant; G3 = control without doses for (H_2O_2). Q1= 180mm; Q2= 270mm; Q3= 360mm

Figure2. Interaction impacts between hydrogen peroxide and water treatments on Leaf area index (LAI).

Yield and irrigation water efficiency:

At fig. (3) Data represented that there are a variations on yield values related to the different treatments. For instance; the highest yield value has recorded with Treatment (G1) by (5427.3 Kg.Fed-1). Which is a significant value comparing with other treatment (G2 and G3) which obtained a low value by (3721.7 and 4325.07 Kg.Fed-1) respectively. Meaning that the first dose (G1) from hydrogen peroxide improve yield of kohlrabi by 25.4% comparing with crop yield which did not treated by hydrogen peroxide. This agrees with (Melsted et al., 1949) which reported that the yield increases of 50% for corn and 20%for soybean following the application of a solution of about 1,000ppm H_2O_2. (Bhattarai et al., 2004) reported yield increases of 82% in soybean and 14% for cotton following the application of a500 ppm H_2O_2 solution to potted plants.



G1 = one dose for (H_2O_2) with 5mL per plant; G2 = two doses for (H_2O_2) with total 10mL per plant; G3 = control without doses for (H_2O_2). Q1= 180mm; Q2= 270mm; Q3= 360mm.

Figure 3. Influence hydrogen peroxide and water treatments on crop yield.

The most important indices for determining optimal water management practices is irrigation water use efficiency (IWUE). The obtained results for IWUE was given in Table 5 Further; the lower IWUE value was observed for treatment [(G2)*(Q3)] while the higher value was observed with treatment [(G1)*Q1]. Thence; too much irrigation led to a decrease of IWUE and effective deficient irrigation may result in a higher production and IWUE (Jin *et al.*, 1999). In addition; the result of IWUE under treatments were recorded a best value with (G1) by 5.62, 3.25and 4.16($Kg.m^{-3}$) under Q1, Q2 and Q3 respectively. On the other hand; with (G2) treatment the value of IWUE was 4.18 ($Kg.m^{-3}$) with Q1, 2.9 ($Kg.m^{-3}$) with Q2 and 1.66($Kg.m^{-3}$) with Q3. Consequently; decreased the amount of water by 50% from total water applied for Kohlrabi can acquired an effective and economical irrigation water unit specially with (H_2O_2) treatment. In addition; using hydrogen peroxide by adding low concentration and one dose at the begging of plantation with ideal water requirement (Q3) increase the (IWUE) by 200% comparing with the same amount of water without hydrogen peroxide. This appropriate with (Pilar et al 2009) which indicated that Injecting hydrogen peroxide H_2O_2 into the soil significantly increased the biomass of the aerial portions of the plant and water use efficiency (plant biomass per water applied [WUE_b]).

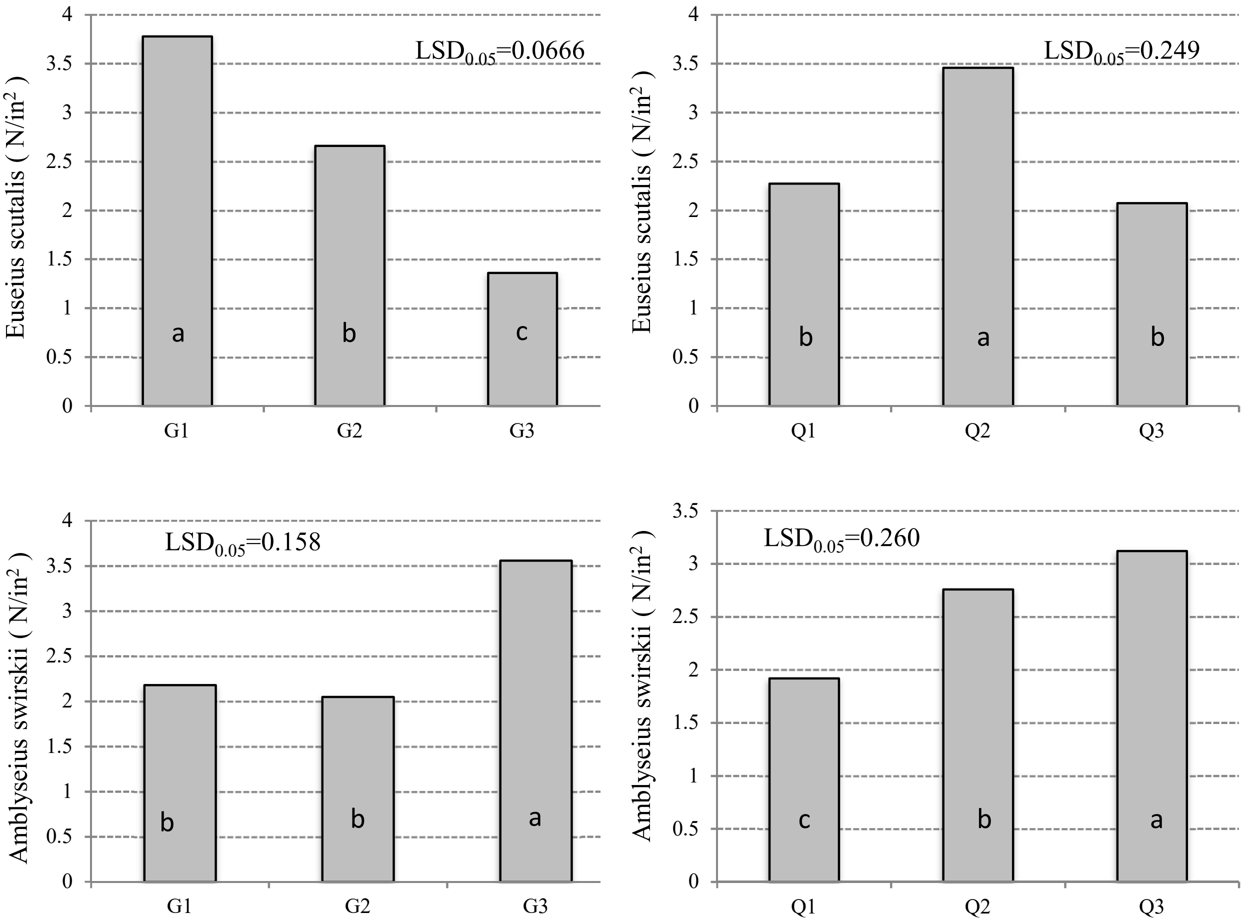
Table 5. Irrigation water use efficiency (IWUE) for Kohlrabi under hydrogen peroxide and water treatments.

Treatments		IWUE ($Kg.m^{-3}$)	**Average ($Kg.m^{-3}$**
(G1)	**Q1**	5.62	4.34
	Q2	3.25	
	Q3	4.16	
(G2)	**Q1**	4.18	2.91
	Q2	2.9	
	Q3	1.66	
(G3)	**Q1**	5.05	3.6
	Q2	3.74	
	Q3	2.01	

G1 = one dose for (H_2O_2) with 5mL per plant; G2 = two doses for (H_2O_2) with total 10mL per plant; G3 = control without doses for (H_2O_2). Q1= 180mm; Q2= 270mm; Q3= 360mm

Mites and insects

It was observed that the hydrogen peroxide and amounts of water have a significant influence on mite density especially for both *Euseius scutalis* and *Amblyseius swirskii* mites as shown in fig.(4).

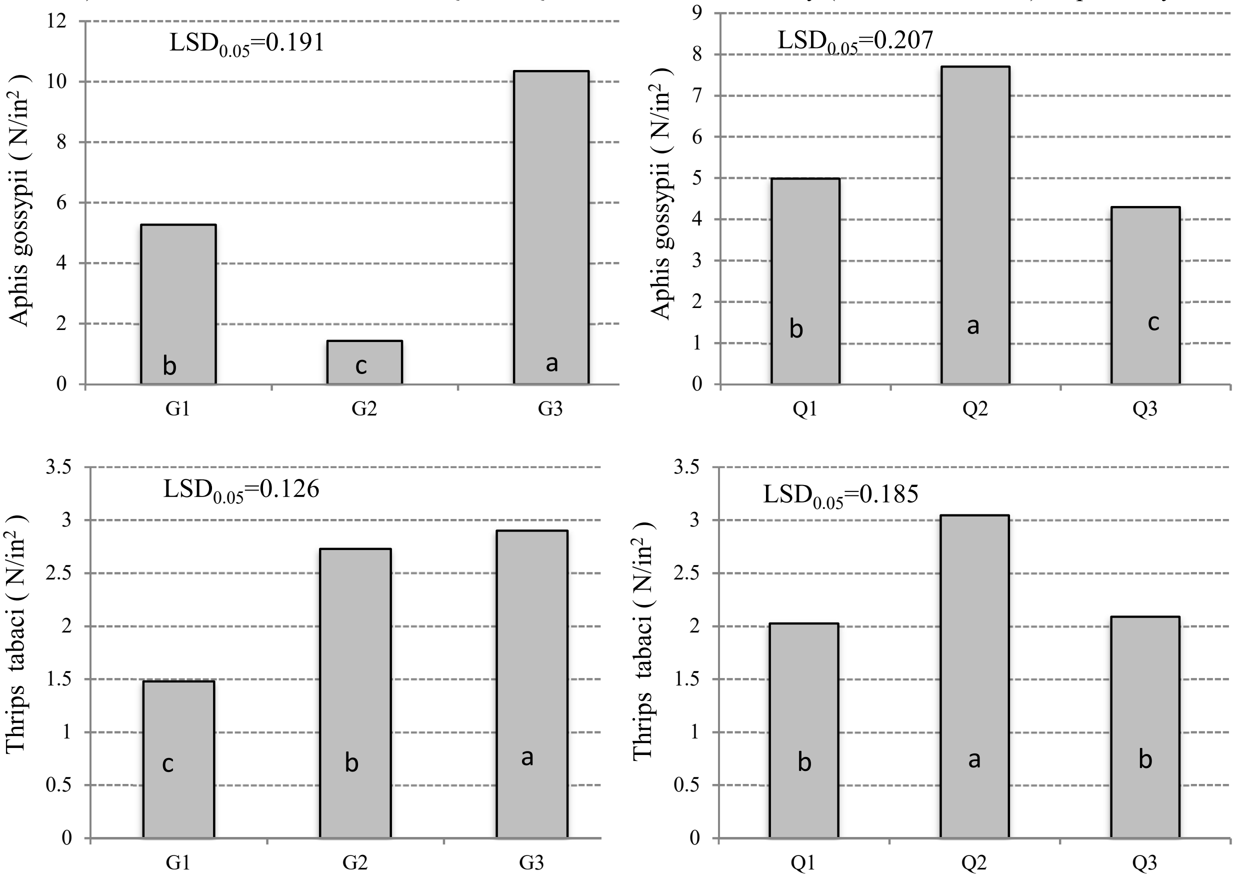


G1 = one dose for (H_2O_2) with 5mL per plant; G2 = two doses for (H_2O_2) with total 10mL per plant; G3 = control without doses for (H_2O_2). Q1= 180mm; Q2= 270mm; Q3= 360mm.

Figure 4. Influence hydrogen peroxide and water treatments on mites (*Euseius scutalis and Amblyseius swirskii)*

Furthermore; data indicated that there is a significant influence for hydrogen peroxide with (G1) treatment on *Euseius scutalis* comparing with other treatments (G2 and G3) which recorded a highest dentistry by (3.78 N/in^2) but the lowest value obtained with (G3) by (1.36 N/in^2). On the other hand; with water treatments the *Euseius* *scutalis* recorded a high significant value by (3.46 N/in^2) under a (Q2) however; there is not any significant impact on *Euseius scutalis* density with other treatment (Q1 and Q3) which got (2.2 and 2.07 N/in^2) respectively. On a contrary; the hydrogen peroxide treatments (G1and G2) did not have a significant influence on the other mite (*Amblyseius swirskii)* comparing with (G3) treatment. On the other word; the observed value for *Amblyseius swirskii* density was (2.18 and 2.05 N/in^2) with (G1 and G2) respectively but under (G3) the density recorded a highest value by (3.56 N/in^2). In addition; the effect of water treatment on *Amblyseius swirskii* density observed a dynamic influence meaning that the ideal amount of water (Q3) recorded a significant impact *Amblyseius swirskii* density by(3.12 N/in^2) and the other treatment of water (Q1 and Q2) obtained (1.92 and 2.76 N/in^2) respectively. Notable, that the *Amblyseius swirskii* has a positive linear relation between density and amount of water which the density increased by the amount of water increased. This appropriate with (Oloumi et al., 1988) which indicated that water stress lead to reduce the density of mites and especially to affect the density of females and eggs. Moreover; this type of mites are effective for plant where feeding on the insects specially the *Euseius scutalis* predaceous mite.

On the other hand; the behaviour of insects was different related to the various treatments. For instance, there are a significant influence for hydrogen peroxide treatments (G1 and G2) comparing with (G3) on *Aphis gossypii* insect density as shown at fig. (5). The data recorded a high significant density under (G3) treatment by (10.53 N/in^2) however with hydrogen peroxide treatments (G1 and G2) obtained (5.27 and 1.43 N/in^2) respectively. Further; with different water quantities the density of *Aphis gossypii* increased significantly with (Q2) by (7.7 N/in^2) but with other water treatments Q1 and Q2 obtained a low value by (4.99 and 4.3 N/in^2) respectively.



G1 = one dose for (H_2O_2) with 5mL per plant; G2 = two doses for (H_2O_2) with total 10mL per plant; G3 = control without doses for (H_2O_2). Q1= 180mm; Q2= 270mm; Q3= 360mm.

Figure 5. Influence hydrogen peroxide and water treatments on insects (*Aphis gossypii and Thrips tabaci*).

Clearly; that the *Aphis gossypii* density decreased linearly by adding or increasing the rate of hydrogen peroxide. Moreover; by decreased amount of water 25% from the total water applied the density of *Aphis gossypii* increased by 50%.

In contrary; the manner of *Thrips tabaci* was different react toward the hydrogen peroxide treatments. The density of *Thrips tabaci* recorded a low value with (G1) treatment by (1.48 N/in^2) but a high significant value obtained under (G3) by (2.9 N/in^2). Furthermore; there are significant effects for different water quantities on *Thrips tabaci* density. The data represent that the high insect density observed with Q2 by average mean value (3.04 N/in^2) however with other water treatments (Q1 and Q3) recorded an almost the same average mean value by (2 N/in²). Generally; using one doses from (5mL/plant) hydrogen peroxide reducing the density of insects (*Aphis gossypii and Thrips tabaci)* by 50 % comparing with the other value which did not adding a hydrogen peroxide. In addition; the insects increased when reducing the amount of water from 360mm to 270mm by 50% for *Aphis gossypii* and 75% for *Thrips tabaci.*

4. Conclusion

Hydrogen peroxide is environment friendly, does not contaminate the soil, does not harm the aquifer, and indirectly makes more oxygen available for soil and plants. Hence, hydrogen peroxide uses as oxidation and disinfection for the water source. From the previous data indicated that there are significant impacts for hydrogen peroxide on plant length (PL), No. of leafs and root length (RL) especially with one dose (G1). The data observed a high significant value for (PL), (RL) and No. of leafs by (36cm, 23.1cm and 19.2) respectively under (G1) treatment. In addition; the Leaf area index values have a good behaviour with G1 and low amount of water (Q1).consequently; that the first dose (G1) from hydrogen peroxide improve yield of kohlrabi by 25.4% comparing with crop yield which did not treated by hydrogen peroxide. The highest yield value was (5427.3 $Kg.Fed^{-1}$) with Treatment (G1). In addition; irrigation water use efficiency recorded a best value with (G1) by 5.62, 3.25and 4.16($Kg.m^{-3}$) under Q1, Q2 and Q3 respectively. Thus; the irrigation water use efficiency obtains a highest mean value by (4.43 $Kg.m^{-3}$) with using hydrogen peroxide treatment (G1). Finally; data indicated that there is a significant influence for hydrogen peroxide with (G1) treatment on *Euseius scutalis* comparing with other treatments (G2 and G3) which recorded a highest dentistry by (3.78 N/in^2) but the lowest value obtained with (G3) by (1.36 N/in^2). On a contrary; the hydrogen peroxide treatments (G1and G2) did not have a significant influence on the other mite (*Amblyseius swirskii)* comparing with (G3) treatment. Further; using one doses from (5mL/plant) hydrogen peroxide reducing the density of insects (*Aphis gossypii and Thrips tabaci)* by 50 % comparing with the other value which did not adding a hydrogen peroxide. In addition; the insects increased when reducing the amount of water from 360mm to 270mm by 50% for *Aphis gossypii* and 75% for *Thrips tabaci.*

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