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EFFECT OF SEED STIMULATION AND SPRAYING OF SALICYLIC ACID IN GERMINATION, GROWTH AND YIELD OF OATS (*AVENA SATIVA* L.) IN GYPSUM SOILS

Labed Shareef Mohammed

Department of Field Crops, Collage of Agriculture, University of Tikrit, Iraq.

Abstract

Two laboratory and field experiments were conducted to study the effect of soaking oat seeds and spraying plants with different solutions of salicylic acid in germination, growth and yield of oats. The laboratory experiment was carried out according to the design of the full randomization and the field experiment with the design of the complete random segments in three replicates in the experimental system in two factors for each experiment. The first included four varieties of experimentation and the second concentration of soaking solution before planting (0, 50, 75 and 100) mg For the laboratory experiment and concentration of the spray solution (0, 100 and 200 mg L^{-1}) for the field experiment. The results showed the superiority of Icarda Tall in response to seed soaking and spraying on the vegetable part of the salicylic acid and recorded an increase in germination rate, seedling growth characteristics, plants and yield and its components in the experiments. The yield of the seeds at 50 mg / L^{-1} was significantly increased by 5.54% in germination rate, 15.4% and 16.3% in the length of the shoot system and root system, 15.6% and 12.08% in their dry weights and the concentration of the soaking solution increased to 75 and 100 mg / L to significantly reduce the properties of the concentration of the solution. The spraying of salicylic acid resulted in continuous increase in the concentration of plant height, leaf area and yield components, which led to the increase of grain yield from 3.232 tons h^{-1} in the treatment of water spraying to 4.27 tons h^{-1} with spray treatment at 200 mg / L^{-1}.

Key words: Oats - Salicylic acid - Germination - Grain holder .

Introduction

Oats A crop of high nutritional value so used as food for humans and animal feed, especially for poultry and horses. Its high nutritional value includes high protein content of more than 15% and 65% carbohydrate as well as fiber and fat (USDA, 2018). It has been classified as the first medical plant in 2017 for its medicinal and therapeutic benefits and its use in folk medicine without side effects. In many cases, as well as containing glucan-β antioxidant useful for lowering cholesterol, heart health and diabetes treatment (Gray, 2015), t is therefore used for children's food and the work of protein-rich, starchy and high-value chips used in breakfast preparations (Ahmad *et al*., 2014). This crop is not widespread in agriculture in Iraq and is limited to work on research and studies. Therefore, the introduction of genetic structures is of great importance for the dissemination of this crop through the evaluation under the weather conditions prevailing in the country and cultivation in different geographical areas, especially gypsum soils occupy large areas of agricultural land, With more than 8 million hectares, characterized by weak physiochemical and chemical construction and low fertility for low nutrient content (Khairo, 2016), With the introduction of some practices and treatments that improve germination and the growth and yield of oats in these soils and these practices soak seeds and spray the vegetable part with salicylic acid. Salicylic acid is a vegetarian hormone of a phenolic nature that regulates biological processes, especially absorption of nutrients, opening of stomata and carbon metabolism and helps balance hormones within the plant as well as improving the tolerance of water stress (Hayat and Ahmad, 2007). Such stress can occur in gypsum soils As a result of rapid loss of water and not keep it for a long time. Al-Juboori and Hassan, (2017) found that salicylic acid activates the transfer of ions and lengthens green leaves by reducing the build-up of Abscisic acid, reducing transpiration and reducing consumption by breathing in the leaves. Ghassemi *et al*., (2006); Maghsoudi and Arvin, (2010); Canakci *et al*.,

(2007) found high efficacy of salicylic acid in improving germination and plant growth by improving the suturing process and minimizing damage to membranes and nucleic acids. Yanik and others, (2018) stimulated germination, root formation, cell respiration and enzyme efficiency when grown with a nutrient solution containing 10 µM salicylic acid. Therefore, the aim of this research is to determine the extent of improvement of germination and growth of seedlings and plants of rye yield in gypsum soils by the effect of soaking seeds and spraying the shoot system part with concentrations of salicylic acid.

Materials and Methods

A laboratory and field experiment was conducted in the laboratories and fields of the Faculty of Agriculture, University of Tikrit in the 2017-2018 season:

Laboratory Experiment The laboratory experiment was conducted to determine the best concentration of salicylic acid to stimulate oat seed germination and to improve plant growth using the seeds of four varieties of oats (Icarda Tall, Icarda Short, Kangaroo and Mitika), which originated from the joint agriculture program between the Ministry of Agriculture, Mosul University, For the agricultural research in the dry areas (ICARDA), the concentrations of Salicylic acid 50, 75 and 100 mg were prepared. 1 Liter 1 gram of the acid powder in the ethyl alcohol and complete the solution to 1 liter by adding distilled water and dilution solution Mainly to concentrations Required formula:

$N1 \times V1 = N2 \times V2$

N1: concentration of solution

N2: concentration of the solution required

V1: The size of the solution

V2: the size of the solution required

The seeds of the varieties were sown in sterile glass containers with sufficient capacity to drink the seeds with solutions for 24 hours, soak the comparison with distilled water and complete the soaking period under dark conditions. The seeds then washed the distilled water and dried to the initial humidity at 25°C under laboratory conditions (Besra *et al.*, 2002 and Al-Juboori and Hassan, 2016). 25 seeds of each treatment were planted in a 13 cm diameter Petri dish and between 2 moisturizing filter papers and the distilled water was added to moisten the seeds and shoot the seedlings for 14 days at 22°C. The number of seeds was calculated and recorded as a percentage and the shoot system separation was separated from the root of ten seedlings and the average length A 65-hour electric oven was heated for 48 hours and its average dry weight was recorded. The experiment was carried out with the full design of the Global Experiment System with three replicates.

Field Experiment

The field experiment was conducted with the aim of determining the best concentration of salicylic acid spray on the shoot system part and its effect on the growth and yield of oats in gypsum soil (17% Gypsum) in the design of the complete random sections of RCBD in a global experience of the four factors (Icarda Tall, Icarda Short, Kangaroo, Mitika). The second was represented by concentrations of Salicylic acid 0, 100 and 200 $mg.l^{-1}$, which was added to the shoot system fraction at the first salinity elongation phase of the main branch. The experiment was carried out with a seed quantity of 120 $kg\ h^{-1}$. The seeds were planted in 6 lines per experimental unit length of 2 m and the distance between them is 0.3 m. The average area of the leaf of the flag of the main leg was recorded at the stage of completion of the dendritic eruption according to Thomas, (1975) Plant height as an average of ten plants and at maturity, harvest 1 square meter of each experimental unit, including the number of grains and the number of $grains.duration^{-1}$ and the weight of one thousand grams (gram) and the grain yield on the basis of $tons.h^{-1}$.

Results and Discussion

Laboratory Experiment table 1, shows the mean of the traits studied under the influence of the genetic structure of the varieties of the laboratory experiment. It is noted that Icarda Tall recorded the best values and significantly exceeded the other varieties in all the traits. The highest germination rate was 84.67%, an increase of 9.5% (77.32%) recorded by Mitika. The highest values were recorded for the lengths of the shoot system and root system (7.23 and 8.13 cm) and their dry weights (161.45 and 181.29 mg) respectively. The difference between the varieties in the values of these characteristics is due to the difference

Table 1: Average germination ratio, length of shoot system and root system and dry weights of the studied species.

Root weight (mg)	Plant weight (mg)	Length Root total (cm)	Length of total Vegetation (cm)	Plant germination %	Varieties
181.29	161.45	8.13	7.23	84.67	Icarda Tall
166.50	145.60	7.65	6.98	80.20	Icarda Short
172.10	153.10	7.83	7.16	81.97	Gangaroo
148.75	126.72	7.37	6.92	77.32	Mitika
11.3	7.07	0.13	0.09	1.41	LSD 0.05

Table 2: Average rate of germination and length of shoot system and root system and their dry weights by acid concentration effect Salicylic.

Root weight (mg)	Plant weight (mg)	Length Root total (cm)	Length of total Vegetation (cm)	Plant germination %	Acid concentrate mg.L^{-1}
161.3	144.5	7.35	6.71	83.00	0
180.8	167.1	8.55	7.75	87.60	50
176.1	152.3	8.01	7.41	81.80	75
150.4	122.9	7.09	6.43	71.77	100
9.78	11.08	0.31	0.22	1.13	LSD 0.05

Table 3: Average rate of germination and length of the shoot system and root system and their dry weights due to the interaction between Varieties and Salicylic acid concentration.

Root weight (mg)	Plant weight (mg)	Length Root total (cm)	Length of total Vegetation (cm)	Plant germination %	Overlap between varieties and concentrate
175.2	155.4	7.71	6.91	84.3	X0 Icarda Tall ×0
193.4	179.5	8.91	7.97	91.5	IcardaTall X50
189.7	170.7	8.32	7.51	86.2	Icarda Tall X75
166.7	140.2	7.61	6.55	76.7	Icarda Tall X100
158.4	140.2	7.30	6.55	82.7	Icarda Short x0
180.9	169.9	8.61	7.62	86.5	Icarda Short x50
174.6	150.1	7.81	7.40	81.1	Icarda Short x75
152.1	122.2	6.91	6.36	70.5	Icarda short x100
163.2	150.3	7.40	6.85	83.6	Kangaroo x0
187.2	174.3	8.75	7.89	88.1	Kangaroo x50
180.7	157.4	8.07	7.42	83.4	Kangaroo x75
157.3	130.4	7.11	6.49	72.8	Kangaroo x100
148.4	132.1	6.99	6.53	81.4	Mitika x0
161.7	144.7	7.93	7.52	84.3	Mitika x50
159.4	131.3	7.84	7.31	76.5	Mitika x75
125.5	98.8	6.73	6.32	67.1	Mitika x100
17.5	14.9	0.61	0.44	4.83	LSD 0.05

Table 4: Average growth, yield and composition characteristics of the cultivars studied in the field experiment.

Yield of grain. ton.h^{-1}	Weight of 1000 cereal (gm)	Number of cereals. Duration $^{-1}$	Number of durations. M^{-2}	Area of the flag leaf (cm ^{2})	Plant height (cm)	Varieties
4.16	32.61	35.1	401.6	26.63	65.70	Icarda Tall
3.50	30.01	34.7	374.6	23.56	57.60	Icarda Short
3.77	31.08	35.0	385.3	25.03	54.46	Gangaroo
3.33	28.31	34.5	381.3	23.60	53.80	Mitika
0.211	0.83	NS	10.8	1.13	1.93	LSD 0.05

in the genetic structure of them and the difference in response of these varieties of salicylic acid concentrations during seed germination stage and the growth of seedling and the difference in the amount of acid stimulation of these varieties, The difference between the cultivars in the salicylic acid susceptibility in germination and initiatory stages was found by Al-Juboori and Hassan, (2017).

The result was a significant increase in the growth of the shoot system and root system, which resulted in an increase in the lengths of the two groups and their dry weights by an increase of 5.54% In the proportion of germination and 15.4, 16.3, 15.6 and 12.08% for the lengths and dry weights of the two groups respectively in relation to the treatment of water soaking, but the increased concentration of acid solution used to soak to 75 and 100 mg L^{-1} caused the inhibition of the collection of qualities and reduce the values of attributes to the values of values Treatment of water soaking in all qualities when soaking the highest concentration, This behavior is due to the role of Salicylic acid in dilute solutions in activating the biological transformation processes inside the seed when drinking with water, stimulating the work of hydrolysis enzymes, especially Amylase-α and building metabolism catalysts to build protein and amino acids (Al-Tayeb, 2005). These results were pointed out by Maghsoudik & Arvin, (2010), Vicente and Plasencio, (2011) who confirmed that the use of salicylic acid regulates germination and increases seedling growth, while increasing the concentration of acid soaking solution may lead to imbalance of osmosis and drinking and lead to P M hormone balance is important for germination, causing inhibition of germination and seedling growth (Al-Guboori and Hassan, 2017 and Yanik and others, 2018).

It is noted from table 3, that the seeds of all cultivars were stimulated at a concentration of 50 mg L^{-1}. The germination rates and the shoot system and root system and their dry weights increased significantly, while the concentration of the salicylic acid soaking solution to inhibit and reduce germination and seedling growth in all varieties (Deef, 2007; Fateh and others, 2012).

Therefore, it is noted that the highest values were recorded with all concentrations of 50 mg / L and Icarda

Table 5: Average characteristics of growth, yield and its components by the effect of Abscisic acid concentration in the field experiment.

Yield of grain. ton.h^{-1}	Weight of 1000 cereal (gm)	Number of cereals. Duration $^{-1}$	Number of durations. M^{-2}	Area of the flag leaf (cm ^{2})	Plant height (cm)	Acid Concentrate mg.L^{-1}
3.232	28.53	34.57	368.2	23.00	54.77	0
3.712	30.67	35.10	384.2	24.57	57.25	100
4.127	32.30	34.80	404.7	26.55	61.65	200
0.309	0.95	NS	12.6	0.92	1.93	L.S.D 0.05

Tall x 50 mg / l, with the highest percentage of germination (91.5%), shoot system and root (7.97 and 8.91 cm) and dry weight (179.5 and 193.4) Mg respectively. Moral difference between species and concentration indicates that the workers behaved differently by their effects with morphological variation in the degree of distortion of these traits. Field experience: The plants of the developing species in the field experiment differed significantly among all the traits except for the number of grains. (Table 4) This may be the reason for the growth of the best papers, especially the paper flag, which has an area of 26.63 cm^2 because the increase in plant height, the plant can grow more by allowing more time to expand the leaves and increase. The extent of this variation in these two characteristics may be due to the nature of the variety in terms of height and paper area found by Al-Hajoj, (2019) in the same varieties in the soil gypsum, as well as the variation of the response of these varieties spray treatments with salicylic acid concentrations, this difference between the varieties also appeared in the characteristics of the yield and its components, in addition to the effect of variance in the plant height and the area of the flag leaf, so Ickarda Tall shows superiority in tow Characteristic, Number of durations. And the weight of a thousand grains (32.61 g), which was reflected in the increase in grain yield (4.16 tons.h^{-1}), this variety has maintained the average number of grains in the varicose is close to other varieties despite its superiority in the number of grains.m^2, reflecting the high susceptibility of this variety to the production and maturity of saplings and a high rate of pollination of syphilis in these stencils, as well as the high mobility of manufactured and stored materials to grain, which made it recorded the highest value for the weight of 1000 tablets, which indicates the role of science paper superiority in the full grain in this category and these characteristics of this category reflects the preference for growth in the soil gypsum and response to spray with salicylic acid.

Table 5, shows the effect of salicylic acid concentration on the improvement of growth properties, yield and its components in the field experiment with gypsum soils. duration^{-1}, which was not significant and this increase was achieved when spraying with a concentration of 200 mg. L^{-1} -15%, 9.9%, 13.2 and 27.6% in the characteristics of the area of the science paper and the number of dialects. M^{-2} and the weight of 1000 grains and grain yield, respectively. Salicylic acid plays an important role in growth through improved division, elongation and elevated carbonification. Improved growth properties have increased plant susceptibility to reduced vegetable and fruit competition over nutrients during the emergence of saplings and syphilis, as well as during grain filling (Assuero and Tognetti, 2010) as well as de - acid in regulating the distribution of dry matter between the shoot system and fruit parts as well as among grains (Meena *et al*., 2013).

Table 6: The values of the overlap of the varieties with the concentration of ascorbic acid for the traits studied in the field experiment.

Yield of grain. ton.h^{-1}	Weight of 1000 cereal (gm)	Number of cereals. Duration $^{-1}$	Number of durations. M^{-2}	Area of the flag leaf (cm ^{2})	Plant height (cm)	Varieties
3.59	30.85	34.7	373	24.5	62.1	Icarda Tall X 0
4.28	33.16	36.2	395	26.3	65.7	Icarda Tall X 100
4.61	33.82	34.4	437	29.1	69.1	Icarda Tall X 200
2.97	27.10	34.6	360	22.2	54.6	Icarda Short X 0
3.44	29.53	34.9	375	23.2	56.4	Icarda Short X100
4.09	33.40	34.6	389	25.3	61.8	Icarda Short X200
3.39	29.18	35.2	369	23.7	52.3	Kangaroo X0
3.80	31.41	35.3	385	25.3	53.7	Kangaroo X100
4.12	32.65	34.5	402	26.1	57.4	Kangaroo X200
2.98	27.01	33.8	371	21.6	50.1	Mikita X0
3.33	28.59	35.1	382	23.5	53.2	Mikita X100
3.69	29.33	35.7	391	25.7	58.1	Mikita X200
0.377	1.36	NS	14.4	2.36	3.71	LSD 0.05

The effect of the contrast between the cultivars and the effect of the acid concentration on all the traits was significant, indicating the differences in the effect of the effect of the factors on the effect of the factors and the degree of response of the plants to these two factors. The acidic spray solution increased the concentration to raise the response level in all the traits. The plants of the

Icarda Tall treated with acid concentration of 200 mg L^{-1} showed the values in all the traits, which was reflected in the grain yield which exceeded the interference by 4.61 tons.h^{-1}.

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