Response of Maize to Salicylic Acid and Mechanical Cultivation in reducing Some of Biotic and Abiotic Stresses and Their Effect on Growth Characteristics and Yield.

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ABSTRACT

A field experiment was carried out during the autumn season of 2016 in the fields of Field Crop Sciences, Baghdad University, in order to determine the effect of different concentrations of salicylic acid, mechanical cultivation and their interactions on weed control and reducing some of biotic and abiotic stress effects on growth characters and yield of maize (synthetic variety,5018). The experiment was carried out according to the randomized complete block design (RCBD) in split block arrangement in three replicates. The main plots included four mechanical cultivation [control without cultivation), cultivation at 5 cm deep, 10 cm, and 10 cm with Triflane herbicide at [1L ha^{-1}) 4 weeks after seeding]. While secondary plots included salicylic acid spraying with four concentrations (0, 50, 100, 200 mg L^{-1}). The results showed that there was a significant effect of SA in reducing the biotic stresses of the weed and abiotic as the temperature rise. Salicylic acid spray increased the average vegetative growth characteristics of the plant. SA at 200 mg L^{-1} treatment gave the highest rate of plant height, stem diameter, leaf area, and dry weight of the vegetative system [186.16 cm. , 1.75 cm, (5965 cm^2), (174.95 gm $plant^{-1}$) respectively, while the control treatment gave the lowest rates in these characters (170.28cm), (1.49cm), (5018cm^2), (162.37 g $plant^{-1}$) respectively.. Salicylic acid treatment had no significant effect in the dry weight of the weed. Cultivation at 10 cm deep with triflan herbicides (W_3) treatment recorded the highest rate of plant height, stem diameter, leaf area, which reached (191.59 cm), (1.75 cm), (5996 cm^2), respectively, while the control gave the lowest rates in these characteristics, reaching (159.14 cm), (1.57 cm). Cultivation at 10 cm deep (W_2) treatment showed a higher mean of dry weight (176.22 g $plant^{-1}$), which did not differ to W_3 (175.74 g $plant^{-1}$), while (W_0) treatment gave the lowest rate (158.18 g $plant^{-1}$). (W_2) showed the lowest dry weight of weed plants (223.7 g m^{-2}), while the control treatment (W_0) recorded the highest rate (842.7 g m^{-2}). All of these effects have contributed to give high grain yield, for this (SA_2) gave the highest rate of grain (7.37 ton ha^{-1}), while SA_0 gave the lowest rate (5.89 ton ha^{-1}). (W_2) showed a higher mean yield of grain (8.39 ton ha^{-1}), while the control gave the lowest yield (3.64 ton ha^{-1}). Here we can conclude that growth regulator (salicylic acid) has improved most of the growth characteristics and biological environment of the roots, which works to raise the plant viability in competition of weed plants and increase the efficiency of roots in the absorption and transfer the nutrients from the soil into the plant, thus increase the efficiency of photosynthesis and increase dry matter. It also showed a role of increasing most of vegetative growth and yield due encourage the plant to withstand the stresses which caused by the weed.

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إستجابة الذرة الصفراء إلى حامض السالسليك و العزق الميكانيكي لخفض الشدود الحيوية واللاحيوية وتأثيرهما على صفات النمو و الحاصل

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المستخلص:-

نفذت تجربة حقلية خلال الموسم الخريفي للعام 2016 في حقول قسم علوم المحاصيل الحقلية – جامعة بغداد الجادرية , بهدف معرفة تأثير تراكيز من الرش بحامض السالسليك ومستويات العزق الميكانيكي في صفات النمو و الحاصل للذرة الصفراء للصنف التركيبي (5018), و في مكافحة الأدغال المرافقة, وتقليل بعض آثار الاجتهادات الحيوية وغير الحيوية.

نفذت التجربة وفق تصميم القطاعات الكاملة المعشاة (RCBD) بترتيب القطاعات المنشقة (Split Plock Design)و بثلاث مكررات , تضمنت الألواح الرئيسة معاملة العزق الميكانيكي بالعازقة النابضية بأربعة مستويات وهي(معاملة المقارنة (من دون عزق), و العزق بأعماق 5 سم و 10سم و 10 سم مع المكافحة بمبيد الأدغال الترفلان (1لتر هـ$^{-1}$) بعد أربعة أسابيع من الزراعة). بينما تضمنت الألواح الثانوية معاملة رش حامض السالسليك بأربعة تراكيز هي, (0,50 ,100 , 200 ملغم لتر$^{-1}$).

بينت النتائج أن هناك تأثيرا معنويا لـ(SA) في تقليل الشدود الحيوية المتمثلة في الأدغال واللاحيوية كإرتفاع درجات الحرارة. أدى الرش بحامض السالسليك الى زيادة متوسطات صفات النمو الخضري للنبات, إذ أعطت المعاملة (SA_3) أعلى معدلاً في صفة أرتفاع النبات و قطر الساق و المساحة الورقية و الوزن الجاف للمجموع الخضري أذ بلغت معدلاتها (186.16سم),(1.75 سم) ,(5965 سم^2), (174.95غم نبات$^{-1}$) بالتتابع, في حين أعطت معاملة المقارنة أدنى المعدلات في هذه الصفات إذ بلغت (170.28سم) ,(1.49 سم), (5018 سم^2), (162.37غم نبات$^{-1}$) بالتتابع, في حين لم تؤد المعاملة بحامض السالسليك الى حدوث أي فروق معنوية في صفة الوزن الجاف للأدغال. أما معاملات العزق فقد تفوقت المعاملة (W_3) في إعطاء أعلى معدل في صفة أرتفاع النبات و قطر الساق و المساحة الورقية, و, أذ بلغت معدلاتها (191.59سم), (1.74سم), (5996 سم^2) بالتتابع, في حين أن معاملة المقارنة أعطت أدنى المعدلات في هذه الصفات إذ بلغت (159.14سم), (1.57 سم), (4680سم^2) بالتتابع, في حين أعطت معاملة العزق (W_2) أعلى معدلاً لصفة الوزن الجاف للمجموع الخضري أذ بلغ (176.22 غم نبات$^{-1}$), والتي لم يكن بينها وبين المعاملة (W_3) أية فروق معنوية إذ أعطت (175.74غم نبات$^{-1}$) , في حين سجلت معاملة العزق (W_0) أدنى معدل لهذه الصفة إذ بلغ (158.18 غم نبات$^{-1}$). تفوقت المعاملة (W_2) في إعطاء أدنى معدل للوزن الجاف لنباتات الأدغال إذ بلغت (223.7 غم م$^{-2}$), في حين سجلت معاملة المقارنة (من دون عزق) (W_0) أعلى معدلاً في هذه الصفة إذ بلغت (842.7 غم م$^{-2}$). كل هذه التأثيرات أسهمت في زيادة الحاصل حيث أعطت المعاملة (SA_3) أعلى معدل بلغ (7.39طن هـ$^{-1}$) في حين أعطت معاملة المقارنة (SA_0) أدنى معدلآ بلغ (5.89طن هـ$^{-1}$), كذلك أعطت معاملة العزق (W_2) أعلى معدلاً في حاصل الحبوب بلغ (8.39 طن هـ$^{-1}$) , في حين أعطت معاملة المقارنة (من دون عزق) أدنى معل إذ بلغ (3.64طن هـ$^{-1}$), وهنا نستطيع أن نستنتج أن منظم النمو حامض السالسليك أدى الى تحسين أغلب صفات النمو و تحسين البيئة الحيوية للجذور الأمر الذي يعمل على رفع قابلية النبات في منافسة نباتات الأدغال و زيادة كفاءة الجذور في إمتصاص ونقل المغذيات من التربة الى داخل النبات و بالتالي زيادة كفاءة عملية البناء الضوئي وزيادة المادة الجافة. كذلك أظهر العزق دورا في زيادة أغلب صفات النمو الخضري و الحاصل بسبب مساعدة النبات على التخلص من الإجهادات التي تسببها الأدغال.

كلمات مفتاحيه: العزق الميكانيكي, , SA, الذرة الصفراء

*** البحث مستل من رسالة ماجستير للباحث الثاني**

Introduction:

Most of the field crop plants are exposed to a lot of biotic and abiotic stresses that effect on their growth, yield and quality due to high temperature, poor irrigation water and low rainfall. Maize. is the third strategic crop in terms of food importance Worldwide, after wheat and rice, in the Arab world and Iraq, this crop has a great importance, it is one of the main crops that feed in large animals and poultry, in the manufacture of plant oils and other uses. It follows the Poaceae family. Maize is the first crop by the productivity in the world which gave 963 million tons of total world cereal production in area reached 166 million hectares [1].

One of the biotic stresses are pests, including insects, fungal, bacterium and weed for which, maize is sensitive at first growth stages, and a biotic stresses such as saline, hydrothermal, and thermal stress, which lead to damage growth and yield characteristics of cultivated plants. Maize yield rate in Iraq is low compared to other countries such as the United States, Canada and Australia, for many reasons, including low productivity of varieties, poor soil and crop management,. The mechanization process, as one of the important crop service operations, was chosen to remove the biotic stress of the weed, which shares the plant in many growth requirements, including its competition for water, light, and nutrients. The weed is a good place for the presence of other pests, like, insect , bacterial and fungal. The process of cultivation leads to improve root biological environment, and reduce the loss of water from the soil, especially in the warm seasons of the year. Cultivation process leads to soil fragmentation, improved physical properties, and increased ventilation, so it leads to increase efficiency of soil microorganisms increasing the availability of macro and micro nutrients for plants. Plant growth regulators is an important tool that

helps plants withstand stress by altering the physiological reactions of the plant, leading to rapid adaptation to adverse environment conditions, depend on concentrations and time application to obtain the required response [2], [3]. Plant growth regulators are known as organic compounds that naturally originate in a specific part of the plant and are transferred to other parts with their physiological activity, in very low concentrations, and are promoted as chemical messengers [4]. One of such regulators is salicylic acid, which consider an internal growth regulator. Salicylic acid helps plants to withstand the biotic stress of various bacterial, fungal, insect, weedy, and abiotic stress , including drought, heat, salinity and other stresses [5]. It increases the absorption of water and nutrients from soil by improving root-vegetative communication [6]. Salicylic acid has an important role in controlling the transpiration process, which is responsible for closing and opening the stomata in proportion to the temperature rise. SA is an important component in the protection of Osmosis. It contributes to stimulating the increase of the production of proline which increasing plant tolerance to a biotic stresses like, thermal, and water stresses.

The aim of the research was to determine the response of maize (synthetic verity, 5018) to different levels of SA to increase tolerance environmental stresses in the autumn , and to determine the best fit treatment in reducing the effects of weed, as a part of the biological stress on maize crop.

-Materials and Methods:-

The field experiment was applied during the Autumn season on 2016 in the Experimental Fields of the Agriculture collage , University of Baghdad-Jadriya, soil analysis was done in Soil and Water Science Laboratories, Agriculture collage of Al-Qassim green University. The soil was prepared by disk harrows. The field was divided into three replicates with a distance of 2 m between replicates , 2 m between the main treatments and a distance of 1 m between the secondary treatments. Each replicate was divided into 16 experimental units with dimensions of (3m * 4 m). Each Experimental unit consist of five lines, with 75 cm between lines. The seeds were planted at 0.20 m between them, and two seeds were planted in each hole. After planting, the plant density reached 66,666 plants per hectare . The seeds planted on 2016/7/23 than the irrigation was given. After the emergence was completed, the failed cultivars were replanted, and the dilution process was carried out in the fourth leaf stage with the survival of one plant in hole. The soil of the experiment is irrigated whenever needed (approximately every 7 days). *Sesamia certica Led* was controlled by Diazinon herbicides was sprayed with 4-liter per hectare . In the two steps after 15 days of germination and the second after two weeks of the first spraying [7]. Urea fertilizer (46% N) was used at a rate of 300 (kg h^{-1}) on three batches at planting , after one month of planting and flowering. Superphosphate fertilizer (19-21%) of P2O5 was used at 200 kg h^{-1}. Potassium sulfate fertilizer (21% K2O) was used at 120 (kg h^{-1}) [8]. The experiment was carried out according to the Randomized Complete Block Design (RCBD) in split block arrangement in three replicates. The main plots included four mechanical cultivation (control without cultivation), cultivation at 5 cm deep, 10 cm, and 10 cm with Triflane herbicide at (1L ha^{-1}) 4 weeks after seeding]. While secondary plots included salicylic acid ($C_7H_6O_3$) spraying with four concentrations (0, 50, 100, 200 mg L^{-1}). Plants were sprayed with salicylic acid until complete wetness using the hand pump with a capacity of 15 liters and used as a liquid detergent spreader to increase the adhesion of solutions on the leaf surface.

Characters Studied:

At flowering maize, ten plants were randomly selected from each experimental unit, and the following measurements were made:

1. Plant height (cm). The plant height was measured from the first node over the soil surface until the last node of the stem under the spike by tape [9].

2. The stem diameter (cm). The stem diameter after the second node of the stem

from the soil surface was measured by the Verna [9].

3. The leaf area (cm^2). Plant leaf area was calculated according to the following equation [10].

leaf area per plant = $(\text{leaf length})^2 * 0.75$.

4. Plant biological yield. (g $plant^{-1}$).

From ten plant all aril parts (stem, leaves, female covers) were cut off from the soil surface level and dried airborne and then dried by an electric oven at 70 ° C until the weight was stability [11].

5. Weed dry weight (g m^{-2}).

Weeds were cut from the level of the soil surface, and it was dried naturally in the field for a week, then placed in leaf bags perforated to dry in an electric oven at a temperature of (70) until the stability of weight [12].

6. Total grain yield (tons ha^{-1}).

It was calculated by taking the weight of the grains from ten plants in the experimental unit after adjusting the weight of the moisture content to (15.5%) [9].

- Results and Discussion:-

1- Plant height (cm).

Plant height is an important characteristic of many researchers because it directly affects the yield and its components, as well as subsequent harvesting processes [9]. The results of Table (1) indicate that SA and the levels of cultivation treatments and their interaction caused a significant effect in plant height. Addition of (SA) significantly increased plant height (Table 1). 200 mg L^{-1} of (SA) caused the highest plant height of 186.16 cm.. while control treatment gave the lowest plant height of 170.28 cm. The increases in plant height by increasing the concentrations of SA was due to its role in improving the vegetative growth characteristics by increasing the pigments of chlorophyll, anthocyanins and carotene, thus increasing the efficiency of photosynthesis. It also increases stem length as it stimulates splitting and elongation of its cells [13], [14]. W_3 gave the highest plant height of 191.59 cm, while the control treatment gave the lowest rate of 159.14 cm . Cultivation caused a reduction in weed competition to the basic growth requirements such as light, water, and nutrients, which reduces the inhibition on maize plant growth [15]. Weed control gave the highest length of maize plants. This is in agreement with the findings of [16], that weed control leads to increase most indicators of vegetative growth, including plant height. Table (1) showed that there was a significant interaction between (SA) and the cultivation treatments. The combination of (SA_3W_3) gave the highest rate of plant height of 201.33 cm which did not differ significantly from the SA_1W_3 which gave a rate of 195. 07 cm while the lowest rate in plant height was 148.87 cm in the control (SA_0W_0).

Table 1. Effect of spray (SA) and cultivation levels and interaction in the plant height (cm).

Average	Cultivation levels				Salicylic acid levels (ppm)
	W_3	W_2	W_1	W_0	
170.28	179.00	176.34	176.93	148.87	SA_0 (0)
179.66	195.07	185.27	186.64	151.67	SA_1 (50)
180.61	190.98	188.62	178.87	163.98	SA_2 (100)
186.16	201.33	187.00	184.27	172.05	SA_3 (200)
4.25	9.41				LSD 0.05
	191.59	184.31	181.68	159.14	Average
	5.73				LSD 0.05

2- stem diameter (cm).

The results of Table (2) showed significant differences in the levels of SA spray and the levels of mechanical processing, and their interaction on stem diameter. SA_3 gave higher stem diameter of 1.75 cm, while the control treatment gave the lowest rate of stem diameter of 1.49 cm. This increase was attributed to the role of the SA in promoting and stimulating photochemical processes in plants such as accelerating the uptake and transfer of nutrients ions, protein synthesis and increased cell division [17]. [18], [19] conclude that SA contributes to increased processing, acceleration of nutrient transfer from source to sink, and increased division and preservation of organelles from harmful effects. (W_3) gave the highest rate of 1.74 cm, while the control treatment gave the lowest value of 1.57 cm. This increases was attributed to the role of weed control in increasing photosynthesis rates after elimination of weed competition. [20] This is in line with the findings of [21]. The interaction caused a significant effect, and the combination (SA_3W_3) gave the highest rate of stem diameter of 1.84 cm, while lower average in the stem diameter was 1.49 cm in control (combination of SA_0W_0).

Table 2 . Effect of spray (SA) and cultivation levels and interaction in the stem diameter (cm).

Average	Cultivation levels				Salicylic acid levels (ppm)
	W_3	W_2	W_1	W_0	
1.58	**1.63**	**1.61**	**1.60**	**1.49**	**SA_0 (0)**
1.60	**1.77**	**1.62**	**1.58**	**1.48**	**SA_1 (50)**
1.67	**1.74**	**1.68**	**1.64**	**1.61**	**SA_2 (100)**
1.75	**1.84**	**1.76**	**1.71**	**1.69**	**SA_3 (200)**
0.04	**0.07**				**LSD 0.05**
	1.74	**1.67**	**1.63**	**1.57**	**Average**
	0.05				**LSD 0.05**

3- Leaf area (cm^2).

The results of Table (3) indicate that there is a significant effect of the SA concentrations and the levels of cultivation on the rate of maize leaf area .

The results of Table (3) showed that the external addition (SA) caused a significant increase in the leaf area. The treatment (SA_3) gave the highest rate in this character, reaching 5965 cm^2, which did not differ significantly from the treatment (SA_2) which gave a rate of 5796 cm^2, while the control treatment gave the lowest level of leaf area of 5018 cm^2. This was attributed to that SA inhibits the ethylene production, which improves the effectiveness of the antioxidant enzymes, which are important compounds in plant protection from ROS generated by stress [22], These result was according to [23], [24], that leaf spraying with SA increases the rate of photosynthesis, thus increasing the production of the cytosol with the central plate, which maintains water content Relative to the leaf, and increased pigment in the leaves, causing better growth Leaf plant.

Cultivation treatments caused a significant increase in plant leaf area. The W_3 treatment gave the highest rate reached 5996 cm^2, which did not differ significantly from the W_1 and W_2 treatment, while the control treatment gave of 4680 cm^2. The increase in leaf area in the treatments which the weed plants were removed could provide more growth requirements and increased photosynthesis. [20]. This results was consistent with the findings of [21], that the cultivation process leads to increase degradation of organic matter in the soil, then increase the availability of nutrients, including nitrogen, phosphorus and potassium, then support the physiological

processes in the plant , increase the rates of food metabolism , increase the rates of plant growth and increase the leaf area. The interaction between the factors had no significant effect.

Table 3. Effect of spray (SA) and cultivation levels and interaction in the Leaf area (cm^2).

Average	Cultivation levels				Salicylic acid levels (ppm)
	W_3	W_2	W_1	W_0	
5018	**5593**	**5136**	**5155**	**4190**	**SA_0 (0)**
5557	**5927**	**6262**	**5579**	**4460**	**SA_1 (50)**
5796	**6260**	**6138**	**5987**	**4798**	**SA_2 (100)**
5965	**6206**	**6324**	**6059**	**5271**	**SA_3 (200)**
315.1	**NS**				**LSD 0.05**
	5996.	**5965.**	**5695.**	**4680.**	**Average**
	430.4				**LSD 0.05**

4 - Plant biological yield. (g plant^{-1}).

The results of Table (4) indicate that SA and cultivation treatment levels, and their interaction caused a significant effect on the dry weight of the plant aerial part.

(SA) showed a significant increase and SA_3 gave a higher rate of 174.95 (g plant^{-1}), while the control treatment gave the lowest rate 160.37 g plant^{-1}. This increase was due to the increases the chlorophyll content, photosynthesis, which were reflected in increasing total dry matter in the plant [19]. This is because SA improves plant growth by regulating physiological processes and reducing oxidation levels [25], These findings are consistent with [26] , [27] and [17] that SA is working to increase the dry plant weight. The treatment W_2 gave the highest rate of 176.22 g plant^{-1}, while the control treatment gave the lowest rate, reaching 158.18 g plant^{-1}. This increase can be attributed to the superiority of the dry matter weight of the crop at the weed control. The rate of photosynthesis of vegetative part and the composition of dry matter depends on the amount of sunlight exposed to the plant canopy, and the representative efficiency of the plant. Thus, the removal of weed plants increases the exposure of crop plants to solar radiation, and increased photosynthesis. (SA_3W_2) gave the highest rate of 184.73 g plant^{-1}, which did not differ significantly from the combination (SA_2W_3), which gave a rate of 181.23 g plant^{-1}, while (SA_0W_0) gave the lowest rate of 153.87 g plant^{-1}.

Table 4. Effect of spray (SA) and cultivation levels and interaction in the dry weight of the total vegetative (g plant^{-1}).

Average	Cultivation levels				Salicylic acid levels (ppm)
	W_3	W_2	W_1	W_0	
160.37	**162.50**	**166.60**	**158.53**	**153.87**	**SA_0 (0)**
167.61	**178.47**	**173.23**	**162.13**	**156.60**	**SA_1 (50)**
173.72	**181.23**	**180.33**	**174.90**	**158.43**	**SA_2 (100)**
174.95	**180.77**	**184.73**	**170.47**	**163.83**	**SA_3 (200)**
4.09	**6.77**				**LSD 0.05**
	175.74	**176.22**	**166.51**	**158.18**	**Average**
	5.00				**LSD 0.05**

5- dry weight of weed plants (g m^{-2}).

The results of Table (5) showed that there was no significant effect on the concentrations of SA and the interaction between the factors on the dry weight of the weed. Cultivation treatments caused a significant effect in increasing weed dry weight (W_1) and (W_3) did not differ significant in this status, (262.7 g m^{-2} and 227.6 g m^{-2} respectively), while control treatment gave the highest rate of weed dry weight (842.7 g m^{-2}), It may be due to the elimination of the weed in the early stages of growth and then formation of good vegetative growth of crop plants which shade and block light that the prevent weed emerging and then reduce their growth rates and reduce their dry weight [28] , This is agreed with [29]. The interaction between factors had no significant effect on this traits.

Table 5. Effect of SA and Cultivation levels and their interaction in the dry weight of the weed(g m^{-2}).

Average	Cultivation levels				Salicylic acid levels (ppm)
	W_3	W_2	W_1	W_0	
397.9	231.1	255.8	252.7	851.9	SA_0 (0)
389.5	247.2	219.8	284.1	806.8	SA_1 (50)
393.6	227.8	227.3	224.1	895.3	SA_2 (100)
375.0	204.1	189.1	289.1	816.8	SA_3 (200)
NS	NS				LSD 0.05
	227.6	223.0	262.7	842.7	Average
	60.75				LSD 0.05

6 - grain yield (ton ha^{-1}).

The results of Table (6) indicate that SA caused a significant effect on increasing maize grain yield. SA_3 gave the highest rate of 7.39 tons ha^{-1}, which did not differ significantly from the SA_2 and SA_1, which gave a rate of 7.37 and 7.10 tons h^{-1} respectively, while the control treatment gave the lowest rate reached 5.89 ton ha^{-1}. This increase in the rate of this character can be attributed to positive effect of this growth regulator in raising the efficiency of photosynthesis, improving plant growth, increasing accumulation of dry matter, and thus increase the rate of grain yield [30] and [31]. SA effect on the sink size by increasing the number of grains, and increasing the transport of photosynthesis products from source to the sink [32]. This is consistent with [19] and [33] who found that Leaf treatment with SA contributes to an increase in grain yield. (W_2) recorded the highest rate in this character, which reached 8.39 tons ha^{-1}, without differ to (W_3) which gave a rate of (7.95 ton ha^{-1}), while the control treatment gave the lowest rate of grain yield of 3.64 tons ha^{-1}. The interaction between SA and the cultivation treatments caused a significant effect. The combination of (SA_3W_2) gave the highest rate in this character of (8.93 ton ha^{-1}) , while the lowest rate of grain yield was 3.48 ton ha^{-1} in (SA_0W_0). It was due to different effect of cultivation treatment in the dry weight of the weed , which resulted in a different degree of competition of maize plants with the weed, which helped the crop to show its ability to increase the dry matter content and increase grain weight . This result was consistent with the findings of [34] that weed is one of the major problems identified the production of crops in many regions of the world. The presence of competition leads to reduce the amount of grain in sorghum.

Table 6. Effect of spray (SA) and cultivation levels and interaction in grain yield (ton ha^{-1}).

Average	Cultivation levels				Salicylic acid levels (ppm)
	W_3	W_2	W_1	W_0	
5.89	**6.01**	**7.42**	**6.66**	**3.48**	**SA_0 (0)**
7.10	**8.47**	**8.30**	**7.75**	**3.87**	**SA_1 (50)**
7.37	**8.89**	**8.85**	**8.32**	**3.53**	**SA_2 (100)**
7.39	**8.47**	**8.93**	**8.38**	**3.70**	**SA_3 (200)**
0.34	**0.68**				**LSD 0.05**
	7.96	**8.38**	**7.78**	**3.64**	**Av**erage
	0.49				**LSD 0.05**

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