Nat. Volatiles & Essent. Oils, 2021; 8(6): 1923-1933

Effect Of Spraying Potassium Silicate, Boron And Vitamin C In Some Chemical Composition Of French Black Grape Vine Vitis Vinifera L

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Abstract

The research was conducted in one of the private orchards in Al-Musayyib District / Babylon province for the seasons 2020 and 2021 to study the effect of spraying with potassium silicate, boron and vitamin C on some vine traits of the French black grape cultivar and bred on wire mesh arbour. the experiment was conducted according to The randomized complete block design (RCBD)as a factorial experiment, the L.S.D. test was used at a probability level of 0.05 to compare the averages. The spraying treatments were as follows: 1- Spraying with potassium silicate K2SiO3 (35% potassium silicate, which contains 12% potassium oxide K2O, in two concentrations (250 and 500 mg. L^{-1}). 2- Spraying with boron in the form of boric acid H_3BO_3 (B 17%) before flowering opens with two concentrations (50 and 100 mg. L^{-1}). 3- Spraying with vitamin (C) in the form of ascorbic acid at a concentration of (50 mg. L^{-1}). 4- Spraying with distilled water only as a control treatment. The results showed that the spray treatment with potassium silicate concentration of 500 mg. L^{-1} with boron at a concentration of 50 mg. L^{-1} with vitamin C at a concentration of 50 mg. L^{-1} led to a significant increase in the leaves content of nitrogen, phosphorous, potassium, boron, calcium and zinc for the two seasons, respectively, while the lowest readings were in the treatments that were not sprayed with potassium silicate. The percentage of total carbohydrates in leaves and canes was also affected by spraying treatments, as the spraying treatment resulted in potassium silicate at a concentration of 500 mg. L^{-1}+ boron and vitamin C at a concentration of 50 mg. $L^{-1}$of each of them significantly increased the percentage of carbohydrates in leaves and for both seasons compared to the rest of the treatments.

Keywords: potassium silicate, boron, vitamin C, French black grape vine, Vitis vinifera L.

Introduction

Grapes belong to the genus Vitis, and it is one of the fourteen genera of the Vitaceae family. The Sumerians knew the vine since human settlement in Mesopotamia at the end of the fifth millennium BC (Al-Rawi and Narrator, 2000).Grapes are characterized by nutritional and medical value because of the nutrients they contain. Each 100 gm of fresh grapes contains 81% water, 67 calories, 0.6 g protein, 0.3 g fat, 18 g carbohydrates, 100 international units of vitamin A, 15 mg vitamin B1, 20 mg vitamin B2, 50 mg vitamin B6, 7 mg vitamin C, 170 mg potassium, 3 mg sodium, 18 mg iron, 20 mg phosphorous and 12 mg calcium (Mitra, 1997). Grapes are used as a stimulant for brain cells and heart muscles, tonic for the liver and kidneys, and reduce the incidence of stomach, intestine and urinary system diseases (Jamal Al-Din, 2010). The French black grape cultivar is one of the cultivars spread in the central regions and very desirable in Iraq, which is characterized by early pregnancy as well as the long production period that extends from July to November (Abbas, 2016).One of the important indicators in the development of agriculture is the use of foliar nutrition, where research and experiments have proven the possibility of supplying plants with various nutrients by spraying them with solutions of these elements, which are absorbed by the leaves and other plant parts that appear above the surface of the soil, such as fruits (Al-Sahhaf, 1989).The element silicon (Si) is one of the most important and essential elements for plant growth, where it has important roles in many physiological processes, the most important of which are increasing the effectiveness of roots to absorb nutrients necessary for plant growth and development, improving the efficiency of photosynthesis and increasing the effectiveness of antioxidant enzymes. Reducing the toxicity of heavy metals (Adrees, 2015).Potassium is an activator of enzymes related to photosynthesis and the representation of carbohydrates and proteins in plants. Potassium also helps to transfer carbohydrates from the areas of their synthesis to other parts of plants, and maintains the building of proteins, membrane permeability and cell PH control, and potassium helps to regulate the work of opening stomata Havlin. and others, 2005). Potassium also facilitates the transfer of nitrates from the leaves to the roots and regulates the osmotic effort between cells (Al-Sahhaf, 1989a).Boron plays a major role in the exchange of proteins, carbohydrates and nucleic acids, where the lack of boron leads to a halt in growth, low production and low quality, as well as to the accumulation of sugars in the leaves and the process of photosynthesis decreases, and the provision of sugars to the roots decreases and their growth inhibits, which impedes the absorption of nutrients from the soil (Toshan, 1990, Sangh). 1995 and Saenz, 2011).Boron also has an important role in stimulating pollen germination and pollen tube growth, thus increasing the rate of fertilization and then increasing the number of berries s in the cluster (Abu Dahi, 1978).At the level of global research, vitamins have been used, including vitamin Ascorbic acid C because of its role in the metabolic activities that it performs, including its regulation of plant growth (although the conditions of growth regulator do not apply to it), including improving reproductive growth, which is reflected in increasing the yield and improving its quality, 2008, Musallam and Ali, 2006, Tullio and Barth). It is one of the basic components in plants and you need it to maintain normal growth, as it has several important functions within plant tissues and increases plant resistance to inappropriate conditions. It also preserves chloroplast from oxidation because it is an antioxidant factor (Oertli, 1987 and Palaniswamy et al., 2003).It also has a role in encouraging vegetative growth because its effect is similar to that of growth regulators that encourage growth (Ahmed et al., 1997).

The Research aim

Potassium silicate, boron and vitamin C spray test on quantitative yield of French black grape cultivar

Materials and methods

The research was conducted in one of the private orchards in the Abu Al-Jassem area in the Musayyib district / Babylon province during the growing seasons 2020 and 2021 to study the effect of spraying with potassium silicate, boron and vitamin C on some traits of the quantitative yield of the black French grape cultivar and bred on wireframes. An analysis of the orchard soil was conducted to know the physical and chemical properties of the soil (Table 1).The analysis was conducted in the laboratories of the College of Science - University of Baghdad

Table (1) some chemical and physical properties of orchard soil

traits	units	values
pH reaction degree	-----	**8.0**
Electrical conductivity (EC) 1:1 dsm-1	$DS.m^{-1}$	**5.0**
Clay	$g.kg^{-1}$	**415**
sand	$g.kg^{-1}$	**186**
silt	$g.kg^{-1}$	**399**
Organic matter O.M	$g.kg^{-1}$	**3.6%**
total nitrogen	$g.kg^{-1}$	**2.17**
availability phosphorous	**m** $g.kg^{-1}$	**0.31**
availability potassium	**m** $g.kg^{-1}$	**36**
Boron	**m** $g.kg^{-1}$	**1.0**
soil texture		**silty clay**

The analysis was conducted in the laboratories of the College of Science - University of Baghdad

This experiment included the following treatments and the interaction between them:

1- Spraying with potassium silicate K2SiO3 at two concentrations (250 and 500 mg. L^{-1}).

2- Spraying with boron (B 17%) at two concentrations (50 and 100 mg. L^{-1}).

3- Spraying with vitamin (C) ascorbic acid at a concentration of (50 mg. L^{-1}).

4- Spraying with distilled water as a control treatment.

Table (2) shows the treatments and their symbols in each replicate

Treatment code	Treatment
A1B1C1	control treatment (distilled water only)
A1B1C2	Vitamin C Concentration 50 $mg.L^{-1}$
A1B2C1	Boron concentration 50 $mg.L^{-1}$
A1B2C2	Vitamin C at a concentration of 50 $mg.L^{-1}$. + boron at a concentration of 50 $mg.L^{-1}$
A1B3C1	Boron concentration 100 $mg.L^{-1}$
A1B3C2	Vitamin C concentration of 50 $mg.L^{-1}$+ boron concentration of 100 $mg.L^{-1}$
A2B1C1	Silicate concentration 250 $mg.L^{-1}$
A2B1C2	Silicate concentration 250 $mg.L^{-1}$+ Vitamin C Concentration 50 $mg.L^{-1}$
A2B2C1	Silicate concentration 250 $mg.L^{-1}$+ boron concentration 50 $mg.L^{-1}$
A2B2C2	Silicate concentration 250 $mg.L^{-1}$+ Vitamin C 50 $mg.L^{-1}$+ Boron 50 $mg.L^{-1}$
A2B3C1	Silicate concentration 250 $mg.L^{-1}$+ boron concentration 100 $mg.L^{-1}$
A2B3C2	Silicate concentration 250 $mg.L^{-1}$+ Boron 100 $mg.L^{-1}$+ Vitamin C 50 $mg.L^{-1}$
A3B1C1	Silicate concentration 500 $mg.L^{-1}$
A3B1C2	Silicate concentration 500 $mg.L^{-1}$+ Vitamin C Concentration 50 $mg.L^{-1}$
A3B2C1	Silicate concentration 500 $mg.L^{-1}$+ boron concentration 50 $mg.L^{-1}$
A3B2C2	Silicate concentration 500 $mg.L^{-1}$+ Boron 50 $mg.L^{-1}$+ Vitamin C 50 $mg.L^{-1}$
A3B3C1	Silicate concentration 500 $mg.L^{-1}$+ boron concentration 100 $mg.L^{-1}$
A3B3C2	Silicate concentration 500 $mg.L^{-1}$+ Boron 100 $mg.L^{-1}$+ Vitamin C 50 $mg.L^{-1}$

study traits:

These measurements were recorded at the end of the harvest on 7-12-2020 for the first season and 7-18-2021 for the second season

-1Leaves content of mineral elements (N,P,K,Zn,Ca,Mg,B,Si(

The adult leaves (the fifth leaf) corresponding to the clusters were taken from the fruiting branches and after washing the leaves with water to remove dust, they were dried in an electric oven (Oven) at a temperature of 65 °C, until the weight was established, then they were ground and sieved and a wet digestion process was conducted using sulfuric and perchloric acid, as Al-Sahhaf mentioned. (1989) then estimated the elements as follows:

A- Nitrogen N %: the element nitrogen was estimated by Microkjeldahl device (Jackson, 1958(

b- Phosphorous P %: It was estimated by the ammonium molybdate method and the samples were measured in a Spectrophotometer at a wavelength of 620 nanometers. (Al-Sahhaf, 1989(

C- Potassium K%: element K was determined by a Flame Photometer (Al-Sahhaf, 1989.(

D- Calcium Ca %: Calcium element was estimated by Flame Photometer (Al-Sahhaf, 1989.(

E-Magnesium Mg%: Measured by stroking with (EDTA Na2) (Etheylene diamine tetra acetic acid disodium) (Rhein et al., 2003(

F-Silicon Si%:

It was estimated by taking 100 mg of dry ground material of the leaves and placing them in a tube with a cap, adding 0.5% of sodium hydroxide 50% and mixing slowly and then sterilizing it with an autoclave device at a temperature of 200°C for 30 minutes.After cooling the tube, 0.2 ml of hydrogen peroxide H2O2 at a concentration of 50% was added to it, then the sterilization process was repeated again for 30 minutes, then cooled and completed the volume to 50 ml with distilled water.

Determination of silicon concentration according to the method of Elliot and Synder (1991)

- Take 1 ml of the previously digested material and add 0.25 of HCL to it with 0.5 ml of ammonium molybdate.

(ammonium molybdate) then mix the mixture and leave for 5 minutes

Then 0.5 ml of tartaric acid was added with 0.8 ml of sodium bisulphate.

The sample was read by a Spectrophotometer at a wavelength of 650 nanometers

A standard curve for silicon to estimate its concentration with known silicon concentrations

g- Boron B mg. L^{-1}: measured using Carmin dye (1965, Black .).

H-Zn, mg.kg-1: It was estimated using the spectrophotometer as mentioned in Houba and Timminghoff, (2004).

2- Percentage of total carbohydrates in canes and leaves.

The total carbohydrates in canes and leaves were estimated after drying, grinding and digesting, and total sugars were estimated according to Joslyn's (1970) method using a spectrophotometer with a wavelength of 490 nm.

- Percentage of nitrogen in canes

Woody samples were collected from the mature canes from the middle and length (5 cm) and cut into small pieces, dried and ground and followed the same steps of estimating the percentage of total nitrogen in the leaves using the Microkjeldahl device (Microkjeldahl) and according to Bajracharya 1998.

Results and discussion :

1- Leaves content of elements (% K, P, N and B mg. L^{-1})

It is noted from the results in Table (3) that the treatment of spraying grape vines with potassium silicate at a concentration of 500 mg. L^{-1}+ boron concentration of 50 mg. L^{-1}+ Vitamin C at a concentration of 50 mg. L^{-1} (A3B2C2) led to a significant increase in the leaf content of nutrients, where the average nitrogen content in the leaves was 1.77% and 1.86% for the two seasons, respectively, and the percentage of phosphorous was 0.370% and 0.183% for the two seasons, respectively, and potassium was 1.97% and 2. 06 % for the two seasons, respectively, and boron 33.46 and 34.26 mg. L^{-1} for the two seasons, respectively, compared to the lowest readings in the control treatment (A1B1C1) and those that were not sprayed with potassium silicate.The increase in the nutrient content of the leaves may be due to the positive role of silicon in improving nutrient absorption (White, 2011).The effect of silicon may be due to the increased absorption of potassium (K+) and to its role in increasing the activity of the H+-ATPase transporter protein in the plasma membranes of the roots, which plays an important role in potassium ion transport.The reason for the increase in the concentration of boron is to spray it on the leaves, but perhaps silicon facilitates the process of its absorption and transmission between the plasma membranes (White, 2015).The increase in calcium may be due to the role of silicon in increasing the activity of the transporter protein H + -ATPase in the plasma membranes of the roots, which works to increase the transport of calcium ion (Liang et al., 2003).The increase in the percentage of nitrogen in the canes may be due to the role of the elements in the spray solution in increasing the efficiency of the photosynthesis process, activating the roots and increasing the absorption of the nutrient medium ions, which are stored in the stems, roots and canes (Hayat et al. 2007).The increase in the percentage of nitrogen in the canes may be due to the role of silicon, potassium, boron and vitamin C, which are related to photosynthesis, respiration and energy production, and this leads to an improvement in the growth of the vine, such as leaf area and chlorophyll. And activate the roots of the vine to absorb nitrogen to meet the requirements of the vine from this important element, so its accumulation in the plant increases in the form of proteins and amino acids that are stored in the stems and roots of the canes to benefit the vine from in the next growing season, where many amino acids such as Alanine and Arginine were found in the tears fluid (Al-Saeedi, 2000)The main form of nitrogen storage is in the form of arginine acid, which represents 50-70% of the dissolved nitrogen in the roots, stems and canes before the buds open in the spring, and there is a high consumption of Arginine when the buds open at the beginning of the growth stage despite the presence of abundant external preparation of Nitrogen ((1967, Kliewer.

Table (3) The effect of spraying with potassium silicate, boron and vitamin C and the interaction between them on the leaves content of mineral elements (B, K, P, N) for the black French grape cultivar for the two seasons 2021-2020.

Treatments	2021-2020				2021-2020			
	B(mg.L^{-1})	K%	P%	N%	B(mg.L^{-1})	K%	P%	N%
A1B1C1	28.12	1.83	0.145	1.56	26.97	1.75	0.210	1.40
A1B1C2	27.91	1.91	0.154	1.47	27.15	1.74	0.236	1.37
A1B2C1	28.84	1.81	0.154	1.38	28.99	1.76	0.233	1.29
A1B2C2	32.69	1.97	0.155	1.75	25.10	1.85	0.233	1.43
A1B3C1	27.38	1.92	0.155	1.40	26.71	1.84	0.203	1.31
A1B3C2	29.48	1.89	0.155	1.28	28.69	1.82	0.226	1.25
A2B1C1	27.33	1.93	0.177	1.42	26.60	1.85	0.216	1.60
A2B1C2	26.65	1.91	0.178	1.47	25.14	1.84	0.253	1.33
A2B2C1	30.15	1.91	0.182	1.31	29.46	1.79	0.216	1.27

A2B2C2	25.21	1.96	0.174	1.56	24.41	1.87	0.243	1.51
A2B3C1	33.09	1.93	0.177	1.46	32.32	1.85	0.226	1.38
A2B3C2	34.10	1.95	0.177	1.56	33.33	1.86	0.306	1.35
A3B1C1	33.07	2.05	0.176	1.46	32.12	1.96	0.263	1.61
A3B1C2	28.06	2.01	0.180	1.21	27.26	1.90	0.293	1.10
A3B2C1	28.56	1.92	0.178	1.46	27.77	1.86	0.256	1.50
A3B2C2	34.26	2.06	0.183	1.86	33.46	1.97	0.370	1.77
A3B3C1	32.53	2.00	0.171	1.51	31.71	1.89	0.220	1.43
A3B3C2	33.62	2.06	0.180	1.82	32.81	1.90	0.226	1.69
L.S.D 0.05	**0.68**	**0.032**	**0.004**	**0.043**	0.14	0.009	0.013	0.054

2- Leaves content of Zn, Ca, Mg, and Si elements %.

It is noted from the results in Table (4) that the treatment of spraying grape vines with potassium silicate at a concentration of 500 mg. L^{-1} + boron concentration of 50 mg. L^{-1}+ Vitamin C at a concentration of 50 mg. L^{-1} (A3B2C2)It led to an increase in the leaves content of the above elements, where the concentration of magnesium reached 14.90 and 14.93%, calcium 2.09 and 2.12%, and zinc 33.37 and 34.40 mg. kg $^{-1}$ for two seasons respectively. As for the silicon component, it was sprayed with potassium silicate at a concentration of 500 mg. L^{-1}+ Vitamin C at a concentration of 50 mg. L^{-1} (A3B1C2) by giving it the highest concentration of this element, which was 5.56 and 5.61% for the two seasons, respectively. Which did not differ from the treatment of (A3B2C1) significantly that the increase in the concentration of magnesium, calcium and zinc elements as a result of spraying with potassium silicate, boron and vitamin C is expected as long as silicon facilitates the absorption and movement of ions across cell membranes (White, 2011)As for the role of boron and vitamin C, it is through improving the photosynthesis activities and increasing the growth of the vine, that absorption increases, as well as in activating the activity of the calcium transporter protein H+-ATPase in the membranes of root cells, which leads to an increase in calcium entry and its transfer within the tissues (Liang et al., 2003).As for the increase in silicon, it is due to its presence in the spray solution, which increased its absorption and increased its concentration in the leaves.

Table (4) The effect of spraying with potassium silicate, boron, and vitamin C and the interaction between them on the leaves content of mineral elements (Zn, Ca, Mg, Si) for the black French grape cultivar for the two seasons 2021-2020.

Treatments	**2021-2020**				**2021-2020**			
	Zn mg.kg^{-1}	**Ca %**	**Mg %**	**Si %**	**Zn mg.kg^{-1}**	**Ca%**	**Mg%**	**Si%**
A1B1C1	25.30	1.69	1.387	3.91	26.70	1.65	1.384	3.35
A1B1C2	32.12	2.05	1.413	2.15	29.20	2.00	1.411	2.11
A1B2C1	26.95	2.11	1.550	3.74	24.88	1.94	1.548	3.62
A1B2C2	30.31	1.60	1.474	3.58	28.13	1.64	1.471	3.46

A1B3C1	32.56	1.94	1.429	4.19	32.55	1.88	1.427	4.13
A1B3C2	28.18	1.63	1.469	2.34	25.97	1.60	1.465	2.24
A2B1C1	28.89	1.77	1.519	4.21	24.13	1.72	1.516	3.53
A2B1C2	30.15	1.69	1.271	5.79	28.85	1.66	1.267	4.71
A2B2C1	31.10	1.59	1.316	5.03	27.13	1.56	1.312	4.47
A2B2C2	32.90	1.80	1.184	2.61	30.01	1.78	1.181	2.59
A2B3C1	31.80	1.64	1.242	5.54	28.47	1.61	1.240	4.32
A2B3C2	30.61	1.66	1.163	5.28	27.34	1.64	1.160	4.53
A3B1C1	28.40	1.80	1.222	4.02	31.20	1.74	1.219	3.81
A3B1C2	32.22	1.67	1.309	5.61	25.18	1.63	1.305	5.56
A3B2C1	30.09	1.73	1.136	5.61	26.73	1.69	1.134	5.46
A3B2C2	34.40	2.12	1.493	3.29	33.37	2.09	1.490	3.26
A3B3C1	31.13	1.59	1.358	4.33	28.15	1.55	1.355	4.31
A3B3C2	37.18	2.08	1.478	2.18	28.91	2.05	1.476	2.14
L.S.D 0.05	**0.15**	**0.13**	**0.05**	**0.01**	0.030	0.042	0.052	0.46

- Percentage of carbohydrates in the leaves

It is noted from the results in Table (5) that the treatment of spraying grape vines with potassium silicate at a concentration of 500 mg. L^{-1}+ boron concentration of 50 mg. L^{-1} + Vitamin C at a concentration of 50 mg. L^{-1} (A3B2C2) led to a significant increase in the carbohydrate content of leaves, which amounted to 2.92 and 3.53% for the two seasons, respectively. As for the lowest percentage, it was in the comparison treatment (A1B1C1) which was 1.80 and 2.06% for the two seasons, respectively.

-4 percentage of carbohydrates in canes

The results in Table (5) show that the spray treatment with potassium silicate at a concentration of 500 mg. L^{-1}+ boron concentration of 50 mg. L^{-1} + Vitamin C at a concentration of 50 mg. L^{-1} (A3B2C2) gave the highest carbohydrate content in the canes, amounting to 14.33 and 14.82%, compared to the non-spray treatment (A1B1C1) which gave 11.72 and 12.73% for the two seasons, respectively. The increase in the carbohydrate content of leaves and stalks may be attributed to the role of silicon in stimulating the absorption of elements and activating photosynthesis activities and the role of potassium activating a large number of enzymes, including photosynthesis enzymes and to the role of boron in the exchange of proteins, carbohydrates and nucleic acids, whose deficiency leads to a decrease in photosynthesis activities (Toshan, 1990) As for the positive role of vitamin C in the accumulation of carbohydrates, it preserves the photosynthetic pigments from photooxidation, as well as devours free radicals, and thus improves the activities of photosynthesis (Tullio and Barth, 2006).Which led to an increase in the outcomes of this process and the accumulation of carbohydrates in the leaves and canes, and that the accumulation of carbohydrates in the canes has an important role in the opening and growth of buds in the following season (Al-Saeedi, 2000).

-3-1 Nitrogen percentage in canes

The results in Table (5) indicate that spraying with potassium silicate at a concentration of 500 mg. L^{-1}+ boron concentration of 50 mg. L^{-1}+ Vitamin C at a concentration of 50 mg. L^{-1} (A3B2C2) gave the highest nitrogen concentration in canes, which was 0.823 and 0.936 % for the two seasons, respectively. Compared with the control treatment (A1B1C1), which gave a concentration of nitrogen in the bronchi amounted to 0.715 and 0.724 % for the two seasons, respectively. Perhaps the increase in the percentage of nitrogen in canes is due to the role of the elements in the spray solution in increasing the efficiency of the photosynthesis process and increasing the absorption of ions in the food medium (Hayat et al. 2007).The increase in the percentage of nitrogen in the stalks may be due to the role of silicon, potassium, boron and vitamin C, which are related to photosynthesis, respiration and energy production. In the form of proteins and amino acids that are stored in the stems and roots of the stalks to benefit the vine in the next growing season, where many amino acids such as Alanine and Arginine were found in the bloodstream (Al-Saeedi, 2000),The high nitrogen concentration in canes is of great importance in the differentiation of buds for the second season, especially since this nitrogen is in the form of amino acids, so the number of flower buds increases, which increases the yield in the following season (Al-Saeedi, 2000).

Table (5) The effect of spraying with potassium silicate, boron and vitamin C and the interaction between them on the percentage of carbohydrates in leaves and canes and the percentage of nitrogen in canes for the French black grape cultivar for the two seasons 2021-2020.

Treatments	2021-2020			2021-2020		
	Nitrogen in canes	carbohydrates in canes	carbohydrates in leaves	Nitrogen in canes	carbohydrates in canes	carbohydrates in leaves
A1B1C1	0.724	12.73	2.06	0.715	11.72	1.80
A1B1C2	0.735	14.00	3.07	0.722	13.48	2.52
A1B2C1	0.737	14.44	2.84	0.730	13.82	2.60
A1B2C2	0.725	14.06	3.02	0.716	13.94	2.87
A1B3C1	0.748	13.62	2.55	0.713	13.35	2.28
A1B3C2	0.731	14.04	3.18	0.723	13.88	2.71
A2B1C1	0.791	14.53	2.96	0.767	14.05	2.90
A2B1C2	0.744	14.09	2.55	0.730	13.93	2.33
A2B2C1	0.730	13.49	2.30	0.721	13.24	2.11
A2B2C2	0.744	13.60	2.20	0.684	12.77	1.82
A2B3C1	0.744	13.71	2.7	0.726	13.67	2.52
A2B3C2	0.746	13.52	2.52	0.727	13.24	2.21
A3B1C1	0.811	14.68	3.17	0.783	14.18	2.88
A3B1C2	0.737	13.81	2.91	0.725	13.54	2.50
A3B2C1	0.731	13.24	2.23	0.710	12.95	1.91
A3B2C2	0.936	14.82	3.53	0.823	14.33	2.92
A3B3C1	0.768	13.36	2.67	0.736	13.09	2.39

A3B3C2	0.870	13.63	3.18	0.783	13.45	2.92
L.S.D 0.05	**0.084**	**0.63**	**0.41**	0.055	0.54	0.10

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