Original Article

Effect Of Adding Polymer (Sap) Levels, Spraying Kaolin Anti-Transpiration, And Bread Yeast Suspension On Some Qualitative Traits In Fruits Of Carica Papaya L.

Noor Jabbar Hussein Al-Saidy[1] And Manal Z. Sabti AL-Mayahi[2]

[1]College Of Agriculture _ University Of Basrah.
[2]Department Of Horticultur _ College Of Agriculture _ University Of Basrah.
Nooralsaidy44@Gmail.Com
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Abstract

The experiment was conducted at the research station of the College of Agriculture and Marshes, Thi-Qar University, on papaya plants during the growing season 2021 in order to know the effect of adding different levels of SAP agricultural polymer, which are (0, 50, 100) $g.m^{-2}$. Kaolin anti-transpiration levels (0, 1, 3) $g.L^{-1}$ and baking yeast with two levels (0, 20) $g.L^{-1}$ in some qualitative traits in papaya fruits, A complete random block design with three replicates was used to bring the number of experimental units to 54 experimental units. It is clear from the results that the polymer addition treatment excelled to 100 $g.m^{-2}$.The treatment of anti-transpiration 3 $g.L^{-1}$ and yeast spray 20 $g.L^{-1}$ had the highest percentage of protein, vitamin C and carotene pigment in papaya fruits, while it was the lowest value when the control treatment.

Keywords: polymer, yeast, protein percentage, vitamin C, carotenoid pigment

Introduction:

The papaya plant, Carica papaya L., is one of the evergreen tropical fruit plants. The original home of this plant is the tropical regions of America, possibly southern Mexico, Costa Rica or Central America. It grows successfully in the tropical and temperate regions.The papaya plant is a strong-growing, fast-fruiting plant whose fruits are eaten fresh or preserved or used in making juice, jams or sauces and are used in the manufacture of many pharmaceutical and cosmetic preparations.Likewise, the papaya plant has a role in treating many diseases that affect humans and for different age groups, using different parts of the papaya plant (Al-Saadi, 2003, Ramal, 2005, and Kala, 2012).Perhaps one of the main reasons leading to the deterioration of agricultural production is the problem of drought and water scarcity, which is one of the most important factors affecting the growth and production of plants. Therefore, most of the physiological processes are directly related to the availability of water. Therefore, water is the first determinant of production, and it is the main reason for the decrease in production by 18 percent. - 10% in arid and semi-arid regions (Chaves, et.al, 2002). Superabsorbent Polymers (SAPs), defined as three-dimensional hydrophilic polymer networks, are lightly cross-linked and permeable in water. These materials can absorb large amounts of water, up to 1000 times or more of their net mass. It can retain water even if it is subjected to a certain pressure. The use of environmentally friendly and safe antitranspirants is an effective way to reduce plant water loss and increase the yield of the crop and its components. A group of researchers showed that the use of anti-transpiration agents had a positive effect on increasing the growth and yield of different plant species (IISR, 2012, Iriti, et.al 2009, and Ouda, et.al 2007)and since the amount of water actually consumed by the plant is less than 10% of the irrigation water, and 90% of the water is lost through transpiration (Mackay, et.al, 2003), especially in areas with high temperatures that cause stress to the plant. Numerous physiological damages lead to a decrease in plant size, leafy area, and yield (etal., Gu, 1998). To reduce this stress, the researchers resorted to several methods, including spraying the plants with anti-transpiration agents and achieving a better water content for the plants (Goreta, etal. 2007), which reduces the rate of the transpiration process to a greater extent than the decrease in the photosynthesis process. It also activates the metabolism process that supports the rate of growth and production of dry matter. The materials that make up anti-transpiration are distinguished by preventing the permeation of water vapor from the surface of the leaves, thus reducing water loss and wilting of plant leaves (et.al, 2011 Song,)As it contains substances that work to partially close the stomata, thus reducing the water lost through transpiration. Saccharomyces cerevisiae is an important source of biofertilization due to its ability to store phosphate and store many amino acids (Agamy, at al. 2013)and it has the ability to produce essential substances for growth, such as auxins, gibberellins, cytokinins, amino acids, and sugars, as well as being a natural source of some nutrients such as nitrogen, phosphorus, potassium, magnesium, iron, chlorine, sodium, and others (Mohamed and Hesham.2011).

Materials and methods:

The current study was conducted at the research station of the College of Agriculture and Marshes, Thi-Qar University, on papaya plant during the growing season 2021 in order to know the effect of adding different levels of agricultural polymer SAP and Kaolin anti-transpiration and baking yeast suspension in some qualitative traits in the fruits of the papaya plant, 54 papaya Shrubs were selected and the plants were marked by numerical markings on them and it was planted in poles with dimensions of 50 cm x 50 cm and grown in the soil (Table 1). The soil of the field and irrigation water were analyzed in the laboratories of the Research Center of the College of Agriculture and Marshes affiliated to the University of Thi-Qar. Table (1) shows some physical and chemical properties of field soil. All servicing operations were conducted for papaya , including hoeing and weeding, as well as adding decomposed organic fertilizer to the trees at the beginning of winter.Then the process of adding chemical fertilizer to the shrubs, which is the compound fertilizer NPK, and the amount added was according to the age stage.

Table (1) Some of the primary properties of soil and irrigation water used in the study

Soil layer depth (cm)	particle size			texture	BD	Porosity	pH	EC	O**M**	Na	Ca
	Clay (%)	Silt (%)	Sand (%)		g cm^{-3}	%		dsm^{-1}	%	meq l^{-1}	
0 - 30	20.8	23.6	55.6	Loam	1.28	50.76	8.20	3.64	2.43	24.17	3.76

Studied traits:

1- Percentage of protein in fruits (%)

The total protein in fruits was calculated based on its nitrogen content according to the method (Cresser and Parson (1979) and according to the following relationship:

The percentage of protein in the fruits = the percentage of nitrogen in the fruits x 6.25

2- The amount of vitamin C in the fruits

Take 10 gm of the fresh vegetable sample with 10 ml of oxalic acid, concentration of 6%, and mix with an electric mixer for 2-5 minutes until the solution becomes homogeneous, then filter the extract with filter paper, take 4 ml of the filtrate, and add 6 ml of oxalic acid, concentration of 3%. and the color of the juice is intense, dilutions are taken, then the juice is wiped using 2,6-dilorophenol indo-phenol dye until a pale pink color appears, according to what was stated in A.O.A.C. (1980).

3- Concentration of carotene pigment in fruits:

The content of the fresh fruits of carotene was estimated according to the method (Howertiz, 1975), where 3 g of the fruits were taken and cut into small pieces and mashed in a ceramic mortar with 30 ml of acetone, concentration of 80%. Then the filtrate was separated from the precipitate by a centrifuge at a speed of 1600 cycles for 10 minutes and the extraction process was repeated until the color of the precipitate became free of dye. Then the extract was collected in test tubes covered with cellophane paper in order to block the light to prevent photo-oxidation of the pigment and complete the volume to 15 ml by adding acetone.The optical density and absorbance of the leachate were measured by a spectrophotometer at wavelengths (480) nanometers, and using the following equation, the concentration of carotene pigment in the fruits was calculated on the basis of 100 g.1 - fresh weight.

statistical analysis:

The experiment was carried out statistically in a factorial experiment with three factors, the first factor represents (the effect of adding the polymer type SAP, which is at three levels (100,50,0) g / m 2 .

The second factor is the effect of Kaolin anti-transpiration concentration at three levels (0, 1, and 3) $g.L^{-1}$. The third factor represents bread yeast with two levels (0, 20) $g.L^{-1}$.The experiment was carried out according to a randomized complete block design (R.C.B.D) with three replications.The statistical analysis of the experiment data was conducted using the Genstst statistical program, and the means of the treatments were compared using the least significant difference at the probability level of 0.05.

Results:

The results of the statistical analysis of the F test, Table 5, indicate that there is a highly significant effect of adding the polymer on the values of protein percentage (%), vitamin C, and carotenoid pigment in papaya fruits. Tables (3, 4, and 5) show that there are significant differences between all the polymer addition treatments in the values of the percentage of protein, vitamin C, and carotene pigment in the fruits. The treatment of 100 $g.m^{-2}$ gave the highest values of 0.751% and (64.38 and 5.89) mg $100g^{-1}$, respectively, while the lowest values were 0.485% and (31.42 and 2.32) mg $100g^{-1,}$ respectively, for the treatment the control. The results of the statistical analysis of the F test, Table 5, also indicate that there is a highly significant effect of anti-transpiration spray on the values of protein (%), vitamin C and carotenoid pigment in papaya fruits.As we note from tables (3, 4 and 5) a significantly excelled of the anti-transpiration spray treatment with a concentration of 3 $g.L^{-1}$ on the rest of the treatments and gave the highest values by 0.659% and (55.08 and 5.13) mg 100 g^{-1} respectively, while the control treatment gave the lowest values They were 0.573% and (41.71 and 3.10) mg $100g^{-1}$, respectively. As for the effect of spraying the yeast suspension, the results of the statistical analysis of the F test in Table 5 show that there is a highly significant effect of spraying the yeast suspension on the values of protein percentage (%), vitamin C and carotene pigment in papaya fruits. It was observed from tables (3, 4 and 5) that the differences were significant between the two treatments of the yeast suspension, the treatment of 20 $g.L^{-1}$ excelled and gave the highest values of 0.679% and (51.93 and 4.84) mg 100 g^{-1} respectively, while the lowest values were at Control treatment of 0.539% and (44.47 and 3.40) mg $100g^{-1}$, respectively.As for the interactions between the factors, the data of tables (2, 3, and 4) show that there are significant differences between the two factors of polymer addition and anti-transpiration in the values of the percentage of protein, the amount of vitamin C, and the concentration of carotene pigment in the fruits.The combination treatment (100 $g.m^{-2}$ and 3 $g.L^{-1}$) was significantly excelled on the rest of the treatments and gave the highest values of 0.881% and (72.22 and 7.62) mg 100 g^{-1}, respectively, while the overlap treatment gave the addition of polymer 0 $g.m^{-2}$ Anti-transpiration sprays 0 g L^{-1} were the lowest values by 0.466% and (26.69 and 1.77) mg 100 gm^{-1}, respectively.As for the interaction between the two factors of adding the polymer and spraying the yeast suspension in the values of the percentage of protein, the amount of vitamin C, and the concentration of carotene pigment in the fruits.Tables (2, 3, and 4) show that the increase was significant in the values of the percentage of protein, the amount of vitamin C, and the concentration of carotene pigment in the fruits by increasing the addition of the polymer and spraying the yeast suspension and gave the highest values of 0.872% and (66.81 and 7.00) mg $100g^{-1}$, respectively .While the interaction treatment gave the addition of the polymer 0 g L^{-1} and the yeast suspension 0 gm L^{-1} the lowest values by 0.454% and (28.08 and 2.03) mg 100 gm^{-1}, respectively .As for the interaction between anti-transpiration agents and yeast spraying in the values of the percentage of protein and the concentration of carotene pigment in the fruits. Tables (2, 3 and 4) show that the increase was significant in the values of the percentage of protein and the concentration of carotene pigment in the fruits by increasing spraying of anti-transpiration and yeast suspension.The interaction treatment excelled with spraying anti-transpiration, 3 $g.L^{-1}$ and yeast suspension at a concentration of 20 gm L^{-1}, and gave the highest values of 0.727% and 6.06 mg 100 gm^{-1}, respectively.While the interaction treatment gave anti-transpiration spray

0 g.L^{-1} and yeast suspension 0 g.L^{-1} the lowest values by 0.509% and 2.63 mg 100 g^{-1}, respectively. As for vitamin C, the interaction between anti-transpiration spray and yeast suspension had no significant effect (Table 5).As for the triple interaction between the factors, it is clear from the results of the statistical analysis of the F test, Table 5, that there is a highly significant effect of the triple interaction between the factors of adding the polymer, the anti-transpiration spray, and the yeast suspension in the percentage of protein, the amount of vitamin C, and the concentration of carotene pigment in the fruits.There was a significant difference in the percentage of protein, the amount of vitamin C, and the concentration of carotene pigment in the fruits (Tables 2, 3, and 4) when the overlap between the treatments of adding the polymer 100 gm-2 and spraying anti-transpiration with a concentration of 3 g.L^{-1}for all treatments of spraying yeast suspension 0 and 20 g.L^{-1}compared to the rest of the corresponding interactions, The interaction treatment was excelled to adding the polymer 100 g.L^{-1}and spraying anti-transpiration at a concentration of 3 g.L^{-1}and the yeast suspension at a concentration of 20 gm L^{-1} and recorded the highest values of 1.015% and (73.93 and 8.80) mg 100 gm^{-1}, respectively. While the treatment recorded the addition of the polymer 0 g.m $^{-2}$ and spraying anti-transpiration at a concentration of 0 g L^{-1} and the yeast suspension at a concentration of 0 g L-1 the lowest values by 0.441% and (25.35 and 1.66) mg 100 gm$^{-1.}$

Discussion:

The increase in the amount of protein in the fruits of the papaya plant is due to the polymer containing potassium, which affects the efficiency of nitrogen, as the potassium ion acts as a carrier for nitrates from the roots to the leaves.Where proteins are synthesized, as well as a movable potassium ion within the plant, thus enhancing the uptake of nitrates by the root, which is reflected in the increase in the synthesis of proteins within the fruits (El-Shenawi and Moursy, 2010). The increase in the amount of vitamin C in the fruits of the papaya plant is attributed to the ability of the polymer to reduce the activity of the oxidase enzyme in girls by providing large quantities of water and nutrients, especially in the drought stage, as this enzyme works to reduce vitamin C in the plant content (Ahmed and Fahmy, 2019),This is in line with (Hosny et. al., 2020) who observed an increase in vitamin C in mango fruits when polymer was added compared to the control treatment. The increase in the concentration of carotene pigment in the fruits of the papaya plant is due to the increase in the addition of the polymer to the absorption of large amounts of water during the irrigation process, which leads to an increase in the moisture content in the root zone, especially at a depth of 20-60 cm, which is the most common area for the roots, which leads to an increase in the uptake. water, The polymer also works to increase CEC, the cation exchange capacity in the soil, and thus the availability of nutrients in the soil solution, which increases their uptake by the plant through the roots, and thus is reflected in improving the quality of fruits, including pigments, especially carotene (Chehab et. al., 2017). The increase in the amount of vitamin C in the fruits of the papaya plant when spraying with anti-transpiration (kaolin) may be due to the action of kaolin, visible films on the leaf surfaces that reflect harmful ultraviolet and infrared radiation from the leaves (Zaky, 2018). In addition to increasing the leaf area and the volume of shading on the leaves resulting from the spraying process, this stimulated the photosynthesis process, which was reflected in the chemical characteristics of the fruits, including an increase in vitamin C in the fruits (Hamdy et. al., 2022). The amount of protein in the fruits of the papaya plant, as a result of spraying with yeast, may be attributed to the fact that it contains various nutrients such as N, p, K, and some common amino acids, which are considered a growth stimulator and basic materials for protein synthesis, in addition to being important enzymes in activating the photosynthesis process, which leads to an increase in protein production. Synthesis of proteins in fruits (Barakat et. al., 2012). In addition, yeast contains a high percentage of protein, reaching 47%. The reason for the increase in the amount of vitamin C in the fruits of the papaya plant as a result of spraying with yeast may be due to the increase in the efficiency of the photosynthesis process, which enhances the increase in the size of the fruits. Yeast also contains a high amount of the amino acid tryptophan, which contributes to the production of auxin IAA, which is directly responsible for cell division and increasing the size of divided cells, which improves the specific characteristics of fruits, including vitamin C (Dababo, 2018). The reason for the concentration of carotene pigment in the fruits of the papaya plant as a result of spraying with yeast may be attributed to the fact that yeast is a natural source of cytokines that stimulate the plant to manufacture plant pigments, including carotene (Bakry and Wanas, 2003). Yeast also contains vitamin A, which activates the formation of carotene and B, which leads to an increase in anthocyanins, which stimulates the enzyme chlorophyllase, which means the conversion of chlorophyll into colored pigments, the proportions of which vary according to the stages of maturity (Alldredge and Dasgupta, 2003).

Table (2) Effect of levels of SAP addition, Kaolin anti-transpiration and yeast suspension and the interactions between them on the percentage of protein in the fruits (%) of papaya plant Red Lady cultivar

	(Kaolin anti-transpiration (g.L-1	**polymer**	

Interaction of yeast and SAP polymer	3	1	0	SAP (g. m-2)	bread yeast (g.L-1)
0.454	0.465	0.455	0.441	0	
0.532	0.553	0.521	0.522	50	**0**
0.630	0.747	0.593	0.551	100	
0.517	0.551	0.539	0.492	0	
0.647	0.652	0.666	0.623	50	**20**
0.872	1.015	0.832	0.769	100	
	0.659	0.594	0.573	**Kaolin anti-transpiration average**	
yeast average	**Kaolin anti-transpiration**			**yeast**	
0.539	0.588	0.519	0.509	0	
0.679	0.729	0.679	0.628	20	
polymer SAP average	**Kaolin anti-transpiration**			**SAP POLYMER**	
0.485	0.497	0.493	0.466	0	
0.589	0.602	0.594	0.573	50	
0.751	0.881	0.692	0.681	100	
L.S.D P ≤ 0.05					

+ yeast +polymer SAP anti-transpiration	**polymer SAP + anti-transpiration**	**yeast + anti-transpiration**	**+ yeast polymer SAP**	**yeast**	**Kaolin anti-transpiration**	**polymer SAP**
0.0292	**0.0207**	**0.0169**	**0.0169**	**0.0097**	**0.0119**	**0.0119**

Table (3) Effect of polymer SAP addition levels, Kaolin anti-transpiration and yeast suspension and the interactions between them on the amount of vitamin C in the fruits (mg.100gm-1) of papaya plant Red Lady cultivar

Interaction of yeast and SAP polymer	**(Kaolin anti-transpiration (g.L-1**			**polymer SAP (g. m-2)**	**bread yeast (g.L-1)**
	3	1	0		
28.08	31.57	27.33	25.35	0	
43.38	51.75	41.44	36.95	50	**0**
61.95	70.52	62.81	52.52	100	
34.75	42.01	34.22	28.02	0	
54.22	60.71	55.87	46.08	50	**20**
66.81	73.93	65.20	61.31	100	
	55.08	47.81	41.71	**Kaolin anti-transpiration average**	
yeast average	**Kaolin anti-transpiration**			**yeast**	
44.47	51.28	43.86	38.28	0	
51.93	58.88	51.76	45.14	20	

polymer SAP average	Kaolin anti-transpiration			SAP POLYMER
31.42	36.79	30.77	26.69	0
48.80	56.23	48.66	41.52	50
64.38	72.22	64.00	56.91	100
L.S.D P ≤ 0.05				

+ yeast polymer SAP anti- + transpiration	polymer SAP + anti-transpiration	yeast + anti-transpiration	+ yeast polymer SAP	yeast	Kaolin anti-transpiration	polymer SAP
2.845	**2.011**	**N.S.**	**1.642**	**0.948**	**1.161**	**1.161**

Table (4) Effect of polymer SAP addition levels, Kaolin anti-transpiration and yeast suspension and the interactions between them on the concentration of carotenoid pigment in fruits (mg.100g-1) of papaya plant Red Lady cultivar

Interaction of yeast and SAP polymer	**(Kaolin anti-transpiration (g.L-1**			**polymer SAP (g. m-2)**	**bread yeast (g.L-1)**
	3	1	0		
2.03	2.35	2.09	1.66	0	
3.39	3.75	3.32	3.11	50	**0**
4.77	6.45	4.75	3.13	100	
2.60	3.63	2.29	1.88	0	
4.91	5.83	5.14	3.75	50	**20**
7.00	8.80	7.12	5.08	100	
	5.13	4.12	3.10	**Kaolin anti-transpiration average**	

yeast average	**Kaolin anti-transpiration**			**yeast**
3.40	4.18	3.38	2.63	0
4.84	6.09	4.85	3.57	20

polymer SAP average	**Kaolin anti-transpiration**			**SAP POLYMER**
2.32	2.99	2.19	1.77	0
4.15	4.79	4.23	3.43	50
5.89	7.62	5.93	4.10	100
L.S.D P ≤ 0.05				

+ yeast polymer SAP anti- + transpiration	**polymer SAP + anti-transpiration**	**yeast + anti-transpiration**	**+ yeast polymer SAP**	**yeast**	**Kaolin anti-transpiration**	**polymer SAP**
0.319	**0.225**	**0.184**	**0.184**	**0.106**	**0.130**	**0.130**

Table (5) Analysis of variance table for the tabular F values of the quality traits of papaya fruits

Source	d.f	Percentage of protein in fruits (%)	Amount of vitamin C in fruits (mg.100g-1)	Concentration of carotene in fruits (mg.100g-1)
A	2	1043.25**	1665.54**	1557.33**
B	2	116.81**	274.65**	504.08**
C	1	859.22**	255.30**	755.80**
A.B	4	69.21**	4.25**	69.54**
A.C	2	121.70**	14.38**	84.38**
B.C	2	12.56 **	0.44 N.S.	28.55**
A.B.C	4	3.94*	9.11**	6.66**
A: Addition of polymer (2gm-L), B: Anti-transpiration (1gm-L), C: Spray yeast (1gm-L).				

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