Pumice Effect on Yield and Quality of Tomato

Humberto Ramírez-Gómez[1], Manuel Sandoval-Villa[1], Joel Pineda-Pineda[1,2], Prometeo Sánchez-García[1], Gabriel Alcántar-González[1], Antonio Trinidad-Santos[1]

[1]Programa de Edafología, Colegio de Postgraduados Campus Montecillo. C.P. 56230. Montecillo, Texcoco, Estado de México. México

[2]Departamento de Suelos, Universidad Autónoma Chapingo. C.P. 56230. Texcoco, Estado de México

Introduction

- Pumice is a substrate used for hydroponics (Cardarelli *et al.*, 2012).
- Its physical properties are unique in each volcanic region (Gizas y Savvas, 2007).
- In some volcanic areas in Mexico, pumice is used as substrate for the production of tomato, but its physical properties are unknown.

Objective

The objective was to evaluate the physical properties of pumice and its effect on yield and quality of tomato fruit hybrid Sun7705 (*Solanum lycopersicum* L.) under greenhouse conditions.

Materials and Methods

Table 1. Description of substrates.

Substrate	Description
PMSM	Pumice, Mexico state
PSSM	Pumice, sieved, Mexico state
PMV	Pumice, Veracruz
PSV	Pumice, sieved, Veracruz
PMJ	Pumice, Jalisco
PSJ	Pumice sieved, Jalisco
TEZS	Tezontle, sieved, (volcanic gravel)

- **Yield:** portable scale OHAUS Scout Pro.
- **Diameter stem and fruit:** digital vernier.
- **Total soluble solids (TSS):** atago PAL-1, Digital Brix Refractometer.
- **Color:** spectrophotometer X-Rite SP-62. luminosity, chroma, °hue.
- **Ascorbic acid (AA):** Albrecht (1993).

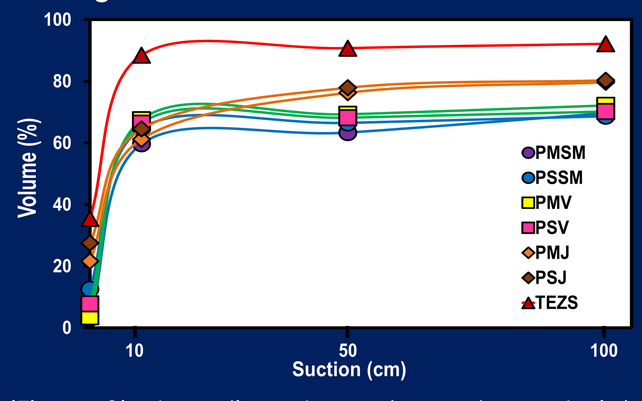
Results and Discussion

- The pumice had the lowest bulk density except pumice of Jalisco and all have higher moisture retention compared with tezontle (volcanic gravel). Pumice State Mexico, Veracruz and tezontle had greater air capacity (Table 2). Moreover, Jalisco pumice provides more readily available water and generally more water is hardly available (Figure 1).

Table 2. Substrates physical properties.

Substrate	BD (g cm^{-3})	%						
		MRC	TP	AS	EAW	RW	HAW	TAW
PMSM	0.54 c	40.31 a	97.02 a	56.71 a	3.68 b	6.29 a	30.34 a	9.97 bc
PSSM	0.57 c	35.28 bc	87.49 ab	52.21 ab	1.78 b	2.16 ab	31.33 a	3.95 d
PMV	0.43 d	32.48 c	96.38 a	63.90 a	1.77 b	2.87 ab	27.84 a	4.64 cd
PSV	0.47 d	33.61 c	92.26 ab	58.64 a	1.81 b	1.99 ab	29.82 a	3.80 d
PMJ	0.84 b	38.80 ab	78.38 bc	39.58 bc	15.07 a	3.40 ab	20.32 b	18.48 a
PSJ	0.82 b	35.49 bc	72.50 c	37.01 c	13.38 a	2.41 ab	19.69 b	15.80 ab
TEZS	1.03 a	11.52 d	64.52 c	52.99 ab	2.28 b	1.40 b	7.85 c	3.68 d

Figure 1. Substrate water liberation curves.



- In general, the higher moisture retention capacity of pumice it has a higher yield per plant (Figure 2), stem diameter, polar and equatorial diameter of the fruit compared tezontle (Table 3). According Kuscu *et al*. (2014) a deficit in irrigation may increase quality tomato but there is a decrease in yield, mainly due to a smaller size of the fruit.

Table 3. Stem diameter, equatorial and polar fruit of tomatoes.

Substrate	Diameter (mm)		
	Stem	Equatorial	Polar
PMSM	11.88 ± 2.02 a	60.09 ± 2.46 a	80.54 ± 2.18 a
PSSM	12.73 ± 2.27 a	60.43 ± 0.85 a	76.76 ± 2.48 ab
PMV	13.09 ± 1.59 a	57.34 ± 3.29 ab	75.67 ± 6.20 ab
PSV	12.46 ± 1.36 a	56.44 ± 2.23 ab	72.53 ± 3.38 b
PMJ	11.06 ± 0.95 ab	56.33 ± 1.64 ab	74.75 ± 4.14 ab
PSJ	10.67 ± 0.99 ab	56.44 ± 3.97 ab	76.25 ± 3.08 ab
TEZS	8.95 ± 0.73 b	54.24 ± 2.41 b	76.98 ± 3.35 ab

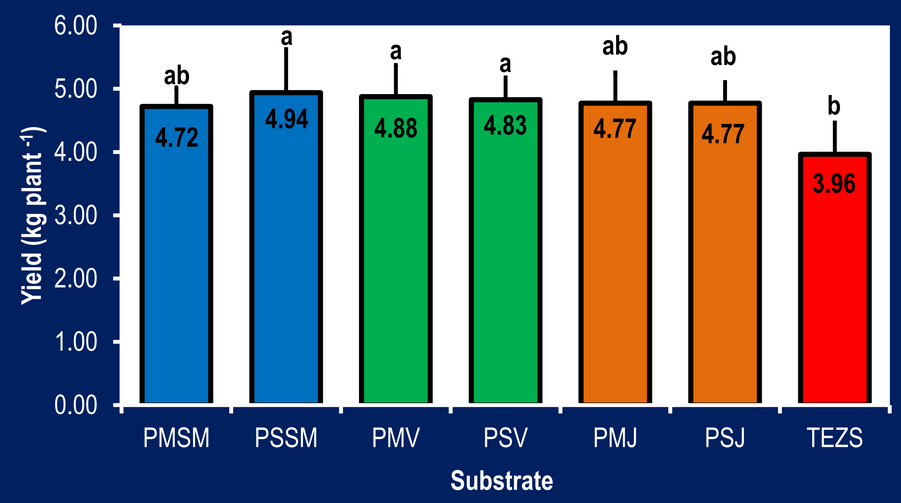


Figure 2. Yiel of tomato plant SUN7705 growing in pumice.

- The water and air holding capacity of the pumice did not affect the quality of tomato fruit (Table 4).

Table 4. Quality of tomato cultivated in pumice

Substrate	TSS (°Brix)	Color			AA mg 100 g^{-1}
		L	C	°h	
PMSM	4.48 ± 0.5 a	46.43 ± 1.24 a	50.32 ± 4.96 a	49.31 ± 4.36 a	47.97 ± 3.08 a
PSSM	4.71 ± 0.4 a	46.77 ± 1.34 a	50.14 ± 2.06 a	49.99 ± 2.01 a	49.82 ± 3.01 a
PMV	4.58 ± 0.5 a	47.18 ± 0.64 a	47.27 ± 3.08 a	47.37 ± 3.35 a	48.94 ± 5.61 a
PSV	4.55 ± 0.5 a	47.02 ± 2.21 a	47.32 ± 3.15 a	50.82 ± 2.88 a	48.89 ± 2.45 a
PMJ	4.26 ± 0.3 a	47.43 ± 0.82 a	47.53 ± 2.15 a	47.61 ± 2.31 a	50.53 ± 3.58 a
PSJ	4.70 ± 0.3 a	46.54 ± 1.35 a	48.44 ± 3.07 a	47.62 ± 2.29 a	49.91 ± 1.67 a
TEZS	4.75 ± 0.6 a	47.78 ± 1.23 a	49.14 ± 1.84 a	50.47 ± 1.51 a	48.62 ± 3.16 a

Conclusions

- In general, pumice physical characteristics make it possible to use it instead of tezontle since plants grown in three out of six pumices reached higher yield and three of them are similar regarding yield, and fruit quality of fruit grown in pumice is similar to quality reached in plants grown in tezontle.

References

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