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USE OF DATE-PALM WASTES AS A SUBSTRATE ON TOMATO YIELD AND NUMBER

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Some problems in soil culture (such as salinity and unsuitable soil characteristics) in many countries, especially in Iran, have expanded soilless culture. The aim of this study was the using of Date-Palm waste as a substrate on tomato yield and number. The research was conducted in a completely block randomized design with 4 replications in three experiments. The treatments were three composting time (t) and three particle sizes included: A= (0-0.5 cm) –t (0), B= (0-0.5 cm) –t (3), C= (0-0.5 cm) –t (6), D= (0.5-1 cm) – t (0), E= (0.5-1 cm) –t (3), F= (0.5-1 cm) –t (6), G= (1-2 cm) -t (0), H= (1-2 cm) –t (3), I= (1-2 cm) – t (6). Papadopolus formula was used for nutrient solution during tomato growth with fertigation method. In experiments 1, 2 and 3 amounts of irrigation were 3 liters, 2.4 liters and 1.8 liters respectively. Also temperature and humidity were constant for all treatments. Comparison of means showed that the treatments had significant effect on yield and number of tomato fruit in three experiments. The results showed that date-palm peat is an appropriate media for soilless culture, also date palm peat with medium size (0.5-1cm) and more composting time (6 months) was more suitable for cultivation and increase yield of fruit.

Soilless culture – composting time – palm waste – size fraction – tomato number – yield

Շատ երկրներում, հատկապես Իրանի հանրապետությունում, հողային կուլտուրաների որոշ խնդիրները (աղիություն, անպիտան հողային պայմաններ), ջրային ռեսուրսների սահմանափակ լինելը, առաջ են բերել բույսերի անհող աճեցման (հիդրոպոնիկա) անհրաժեշտությունը: Հետազոտման նպատակն է՝ ուսումնասիրել, որպես սննդամիջավայր օգտագործվող փյունիկյան արմավենու թափոնների ազդեցությունը տոմատի պտուղների քանակի և բերքատվության վրա: Հետազոտությունը իրականացնելու համար կատարվել է երեկ փորձ, պատահական ընտրանքի եղանակով, չորս կրկնությամբ: Փորձի տարբերակները ընդգրկել են՝ կոմպոստացման երեք ժամանակաշրջան (t) և ֆրակցիոն մասնիկների երեք տարբեր չափ՝ A = (0-0.5 սմ), t (0), B = (0-0.5 սմ), t (3), C = (0-0.5 սմ)-t (6), D = (0.5-1 սմ) - t (0), E = (0.5-1 սմ), t (3), F = (0.5-1 սմ), t (6), G = (1-2 սմ) - t (0), H = (1-2 սմ) - t (3), I = (1-2 սմ) - t (6): Ֆերտիգացիայի եղանակով բույսերի աճեցման ընթացքում սննդարար լուծույթի պատրաստման համար օգտագործվել է Պապադապոլուսի բանաձևը: Առաջին, երկրորդ և երրորդ փորձերի ընթացքում ոռոգման ծավալները համապատասխանաբար կազմել են 3 լիտր (T), 2.4 լիտր (80% T) և 1,8 լիտր (60% T): Ջերմաստիճանը, օդի հարաբերական խոնավությունը և ոռոգման չափը բոլոր տարբերակների համար եղել է նույնը: Ստացված արդյունքները ցույց են տալիս, որ փյունիկյան արմավենու թափոնները համապատասխան միջավայր են հանդիսանում անհող աճեցման (հիդրոպոն) կուլտուրաների աճեցման համար: Տոմատի պտուղների աճեցման, նաև քանակի և բերքատվության ավելացման համար, լավագույն արդյունքներ են ստացվել ֆրակցիոն մասնիկների միջին չափ (0,5-1 սմ) և 6 ամիս կոմպոստացման ժամանակաշրջան ունեցող փյունիկյան արմավենու թափոնների օգտագործման դեպքում:

Հիդրոպոնիկա կոմպոստացման ժամանակաշրջան – փյունիկյան արմավենու թափոնների ծառեր – մասնիկների չափերի – տոմատի պտուղների քանակի – բերքատվություն

Некоторые проблемы почвенных культур (соленость и непригодные почвенные особенности) и ограниченность водных ресурсов во многих странах, особенно в Иране, вызвали необходимость выращивания гидропонных культур. Целью данного исследования является изучение влияния размера фракционных частиц и времени компостирования отходов финиковых пальм на урожайность и количество плодов томата. Опыты проводились методом случайной выборки с тремя вариантами и в четырех повторностях. Варианты опыта включали три времени компостирования (t) и три размера фракционных частиц: A = (0-0.5 см) -t (0), B = (0-0.5 см) - t (3), C = (0-0.5 см) - t (6), D = (0.5 - 1 см) - t (0), E = (0.5-1 см) - t (3), F = (0.5-1 см) - t (6), F = (0.5-1 см) - t (6), G = (1-2 см) - t (0), H = (1-2 см) - t (3), I = (1-2 см) - t (6). Для приготовления питательного раствора в процессе выращивания растений методом фертигации была использована формула Пападополуса. Нормы полива в опытах 1, 2 и 3 составляли соответственно 3 л (T), 2,4 л (80% T) и 1,8 л (60% T). Температура и относительная влажность воздуха для всех вариантов опыта была одинаковой. Сравнение полученных данных показало, что во всех трех вариантах опыта наличие данного субстрата оказывает существенное влияние на урожайность и количество плодов томата. Отходы финиковых пальм со средним размером фракционных частиц (0,5-1 см) 6-ю месяцами времени компостирования являются более подходящим субстратом для выращивания и повышения урожайности и количества плодов томата.

Беспочвенная культуря – время компостирования – отходы финиковых пальм – размеры фракционных частиц – количество плодов томата – урожайность

Tomato is commonly produced as an early spring crop or out-of-season in open field, glasshouse or polyethylene tunnel. Pests and diseases in soil culture have always created problems, especially in protected areas. (Gul et al., 2005) Today, in many countries, soilless culture techniques are used for production, especially in greenhouses (Çlikel, 1999). The choice of substrates for soilless cultivation represents one of the key points to be considered (Leonardi, 2006) due to technical and economical implications (Giuffrida et al., 2008). Samiei et al. (2005) investigated the effect of peat moss, coco peat and date-palm wastes as substrates on the growth of Aglaonema, and their results showed that date-palm peat would be a proper substitute in the future. Also Borji et al (2010) showed that date-palm peat is an appropriate media for soilless culture with suitable physical and chemical properties, availability and low cost. Therefore it can be new substrates that introduce for replacing with other media. The date palm (Phoenix dactylifera) is one of the important palm productions in the gardens of Iran. Based on published statistics, more than 180,000 ha of the country's lands are under the cultivation of date palm, and many provinces of the country, especially southern provinces, grow it. Recently, most of the residuals of the palm grove were burnt. In some areas, the date palm leaves are used for making shade, alcove, break wind, and as a cover for new planted saplings of fruit trees like date palm tree. Date palm peat is the waste and residual of date palm tree (Mohammadi et al., 2011). The aim of this study was the using of Date-Palm waste as a substrate on fruit tomato yield and number.

Materials and methods. This study was performed in the greenhouse research site of Azad Isfahan University (Khorasgan) in a completely randomized block design with 9 treatments and 4 replications in three experiments. Palm wastes were chopped into smaller sizes by combine and chopped wastes are separated in three sizes (<0.5, 0.5-1 and 1-2 cm) by sieve. Then, they were kept in 1.5 m3 plastic bags for controlling the moisture and temperature. Some amounts of animal fertilizer, N and P fertilizers were added to them as a fermentation starter and these bags were placed in hot (25 to 30°C) condition. For respiration, some air holes were made on the bags and the moisture was adjusted to 65%. Every week, these materials were mixed together and put into the bags again (During the 3 and 6 months). The treatments were three composting time (t) and three particle sizes included: A= (0-0.5 cm) –t (0), B= (0-0.5 cm) –t (3), C= (0-0.5 cm) –t (6), D=

(0.5-1 cm) – t (0), E= (0.5-1 cm) –t (3), F= (0.5-1 cm) –t (6), G= (1-2 cm) -t (0), H= (1-2 cm) –t (3), I= (1-2 cm) –t (6). Then, these palm wastes dumped into Ten-liter pots and then 4 holes were created on the bottom of pots as drain. Tomato seeds were planted in coco peat and after 30 days, transplanting of tomatoes was transferred into the pots. Irrigation was done according to papadopolous nutrient solution during eight months. Also temperature and humidity were constant for all treatments. In experiments 1, 2 and 3, amounts of irrigation were 3liters, 2.4 liters and 1.8 liters respectively by hand. The plants were 108 totally. Substrates leaching were performed every fifteen days for prevention of salt accumulation in the substrates. Electrical conductivity (EC), pH and porosity of substrates were measured by Verdonck and Gabriels (1992) methods. Cation exchange capacity (CEC) (Rhoades, 1982) and carbon to nitrogen ratio (C/N) (Walkley and Black, 1934) were determined. Fruit number was counted and yield was measured by digital scale. Analysis of variance of data was done with SAS software. Average Comparison of data was done by Duncan method (5%).

Tab. 1. Selected physiochemical properties of treatments (culture media)

T	PH	EC, ds/m	CEC, cmol/kg	Porosity, %	C/N, %
A	6.84	6.29	38.85	83	37.88
B	6.72	5.68	47.49	88	29.85
C	6.91	5.99	59.11	87	25.43
D	6.74	3.91	28.84	89	40.83
E	6.62	4.42	36.26	88	33.56
F	6.86	4.62	38.3	87	28.2
G	6.69	3.41	18.22	90	43.67
H	6.54	3.8	28.99	89	30.76
I	6.82	4.97	34.95	88	23.68

Results and Discussion. Tab. 2 shows the effect of different treatments on number and yield of tomato fruit in experiment 1. Maximum amount of fruit number was observed in D treatment although it didn't have significant difference with F treatment at level % 5. Treatment F significantly ($P< 0.05$) increased yield of tomato fruit.

Tab. 2. Effect of different treatments on number and yield of tomato in experiment 1.

Treatment	Number	Yield (kg)
A	73.5±6.2ab	9.68±0.82ab
B	76.5±4.5ab	7.78±2.05b
C	69±5.48ab	9.83±0.84ab
D	80.25±6.24a	8.75±2b
E	74.75±4.92ab	9.78±2.16ab
F	74.76±8.49ab	12.12±2.05a
G	66.75±11.7b	7.453±1.06b
H	65.25±7.41b	7.14±2.16b
I	67.25±7.2ab	8.923±0.79b
MSE	7.82	1.62

Tab. 3 shows the effects of different treatments on number and yield of tomato in experiment 2. Treatment B had the highest yield of tomato although it didn't have significant difference with F treatment at level % 5. Highest amount of fruit number were in treatments G and A.

Tab. 3. Effect of different treatments on number and yield of tomato in experiment 2

Treatment	Number	Yield (kg)
A	84.25±11.38a	8.48±0.44ab
B	49.5±11.91b	10±1.13a
C	65.5±11.12ab	7.88±1.73ab
D	68.5±11.9ab	8.59±1.56ab
E	75. 5±7.14ab	7.24±1.51ab
F	69.5±7.14ab	9.9±1.13ab
G	80.25±7.14a	9.88±1.4ab
H	67.25±8.73ab	8.27±1.49ab
I	54.5±6.03b	7.2±1.23b
MSE	12.82	1.66

Effects of different treatments on number and yield of tomato in experiment 3 are shown in tab. 4. The highest number and yield of tomato were observed in treatment F. C/N ratio in water extract could serve as a reliable indicator of compost maturity (Chanyasak et al., 1983) and in a mature compost C/N ratio is less than or equal to 25 (Schuchardt, 2005). Therefore culture media I can be mature compost and culture medias C and F were near the mature compost. It shows in these culture medias biological activity has been decreased and required nutrients are present in adequate amounts for plant growth.

Tab. 4. Effect of different treatments on number and yield of tomato in experiment 3

Treatment	Number	Yield (kg)
A	77±8.98ab	8.57±85b
B	70.5±3.87abcd	7.99±0.9bc
C	64.5±5.98bcd	7.8±0.52bc
D	74.25±13.05abc	8.98±2.47ab
E	58.75±2.63d	6.03±0.49c
F	83±8.76a	11.1±1.34a
G	73.25±10.53abc	9.08±2.42ab
H	64.5±5.98bcd	7.45±0.33bc
I	74.75±5.25abc	8.21±0.9bc
MSE	7.82	1.47

Mature compost gives plants an advantage in increased nutrients and water availability, and reduces disease pressures (Christian et al., 2009). Therefore treatment F significantly increased fruit yield in three experiments. Mohammadi et al. (2011) reported tomato fruit yield and number in date palm and perlite media had no significant difference at 5% level. Tzortzakis and Economakis (2008) represented that higher yield of tomato fruits was obtained from plants grown in organic media as compared with inorganic media. Borji et al. (2012) showed that culture medias including composted palm peat, un-composted palm peat had no significant difference in fruit and number of tomato fruits. Mohammadi et al. (2012) investigated the comparison of Date-Palm wastes and Perlite as culture substrates on growing indices in greenhouse cucumber and reported that Perlite and Date-Palm waste media had similar properties and they had no significant difference on yield and number of cucumber fruit. Hematian et al. (2012) investigated the effect of addition of some organic waste to soil on yield and some growth indices of greenhouse cucumber and reported higher yield were obtained from pure palm peat media. Comparison of means showed that the treatments had significant effect on yield and number of tomato fruit in 3 experiments. In experiment #1, maximum

amount of fruit number was observed in treatment D although it didn't have significant difference with treatment F at level %5 and treatment F significantly ($P< 0.05$) increased yield of tomato fruit. In experiment #2, treatment B had the highest yield of tomato although it didn't have significant difference with treatment F at level %5. Highest amount of fruit number were in treatment G and A in experiment 2. In experiment #3, the highest number and yield of tomato were observed in treatment F. The results showed in three experiments treatment F were better in other treatment with regard to its substrate properties and its yield.

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