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Effect of Mixing Date Palm Leaves Compost (DPLC) With Vermiculite, Perlite, Sand and Clay on Vegetative Growth of Dahlia (*Dahlia pinnata*), Marigold (*Tagetes erecta*), Zinnia (*Zinnia elegans*) and Cosmos (*Cosmos bipinnatus*) Plants

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ABSTRACT

The main objective of this study was to find the best mixture (growth medium) for planting Dahlia, Marigold, Zinnia and Cosmos by mixing DPLC with vermiculite, perlite, sand and clay. Generally, DPLC + vermiculite mixture improved the vegetative growth of plants better than other mixtures. On relative basis, the mean biomass of all the plants grown in DPLC (control) was 80% and 71% than those plants grown in DPLC + vermiculite (2:1 and 1:2), respectively. Mean plant height of Marigold was about 29.6% higher in DPLC+ vermiculite (1:2) as compared to pure DPLC (control). The descending order for better plant growth for other mixtures was DPLC + perlite > DPLC + clay > DPLC + sand. However, Mixtures of DPLC with vermiculite was significantly better than DPLC alone for many growth parameters especially when DPLC was mixed with vermiculite in 1:2 ratio. More research is needed to improve DPLC mixtures in an arid environment for sustainable landscape development for community services.

Key words: Date-Palm-Leaves-Compost (DPLC), vermiculite, sand, clay, plant growth, leaf-area-index, plant height, growth mixtures, mineral composition

INTRODUCTION

Saudi Arabia grows about 18.20 millions date palm trees (Anonymous, 1999). Each tree produces 10-20 leaves per year causing many hazards because the leaves are left around the date palm field after pruning (Bahsa, 1998). Utilizing these leaves for the preparation of compost and reuse it as a growing media improved seed germination and to some extent growth of Dahlia, Marigold, Zinnia and Cosmos plants (Ali, 2008).

Application of different types of composts is well known for their beneficial effects on soils and plants. Hassanein and Abul-Soud (2010) conducted two field experiments to study the effect of different compost types (rice straw, cucumber canopy and maize stalks) and application methods of compost (25 cm deep + turned, 25 cm deep + bed and mulched) on growth and yield of three maize hybrids (Single Cross 10, Single Cross 155 and Three Way Cross 324). The study results indicate that, cucumber canopy compost recorded the highest values of N, P and K % content and lowest maturity period and C/N ratio while the lowest N, P and K % content and highest result of maturity period and C/N ratio gave by maize stalks compost. The mulch compost and cucumber canopy compost recorded the highest results of plant height, grain yield/fed. straw yield/fed. and N, P and K content in leaves at 75 days after sowing.

Bijay-Singh *et al.* (2001) and Hood *et al.* (2000) mentioned that decomposing crop residues may release significant amounts of N and influence the availability of N by affecting mineralization-immobilization processes in the soil. The quantity of N derived from crop residues by a succeeding crop is highly variable and depends largely on residue characteristics and the synchronization between N release and crop N uptake. Pinamonti (2004) investigated two types of composts in mulching and found that compost mulches increased organic matter content, available phosphorous and exchangeable potassium of soil and improved the porosity and water retention capacity of the soil. They also reduced soil temperature fluctuations, reduced evaporation of soil water and influenced the levels of some nutrients measured in leaf samples. Both the compost mulch materials had considerable advantages for the soil management on the grapevine rows, by reducing chemical weed control and allowing for the substitution of chemical fertilizers with no loss in vigor, yield or quality of musts.

Tanu *et al.* (2004) applied four organic amendments: Leaf Compost (LC), Vegetable Compost (VC), Poultry Manure (PM) and Sewage Sludge (SSL) at four doses (40, 80, 100 and 120 t ha⁻¹) for their effect on the herbage yield, essential oil content and Inoculum Potential (IP) of native Arbuscular Mycorrhizal Fungi (AMF) on three varieties of Java citronella, *Cymbopogon winterianus* Jowitt (Manjusha, Mandakini and Bio-13). PM applied at 100 t ha⁻¹ followed by SSL increased the herbage, essential oil content and dry matter yield significantly. Bio-13 performed better and produced the highest herbage, essential oil and dry matter yield. The type and dose of the various organic amendments also significantly influenced the indigenous AMF infectious propagules in soil. Highest number of AMF propagules were recorded in the LC amended plots in all the three varieties. Amongst the varieties, highest native mycorrhizal inoculum was recorded in the Bio-13. Least number of AM infectious propagules were recorded in the Mandakini plants grown in 40 t ha⁻¹ SSL. The benefits of application of compost manures on crop production (Wong *et al.*, 1999) and enhanced recovery of AM population (Gaur and Adholeya, 2000) have been reported to be directly related to the rate of applied dose. The effect of the extent and type of manure composts on native AM inoculum potential applied for enhanced crop production has not been investigated under field conditions where availability of major nutrients and high P fixation is a limiting factor (Bhatia *et al.*, 1998).

Information on the use of Date Palm Leaves Compost (DPLC) is limited under local conditions. The main objective of this study was to prepare DPLC and mix it with other available growth medias such as vermiculite, perlite, sand and clay in a suitable combination to develop better growth medium for ornamental plants (Dahlia, Marigold, Zinnia and Cosmos) for the development of environment friendly landscapes for community service.

MATERIALS AND METHODS

The study was carried in greenhouse at Agriculture Research Station, Derab, King Saud University, Riyadh. Kingdom of Saudi Arabia during 2008.

Preparation of DPLC: Date palm leaves compost was prepared by following the method described by Ali (2008). The Dried Date Palm Leaves (DDPL) were cut into 10 cm in length and buried in 2×1 m size concrete pit with a depth of 1.1 m. Each layer of compost was about 25 cm deep. To prepare the compost pit, first a layer of 96 kg DDPL was placed in the bottom. Then the desired quantity of a mixture of ammonium sulphate [(NH₄)₂SO₄], tripple-superphosphate (TSP), fine (100 µ) calcium carbonate (CaCO₃) and clay in a ratio of 35:7:35:100 kg, respectively per ton of

DDPL was distributed homogeneously. Each layer was sprayed with 77 L of water with a total water salinity of 640 mg L⁻¹ as Total Dissolved Solids (TDS). In all, there were 4 identical layers of DDPL. The total depth of DDPL was around 1 m. The Date Palm Leaves (DPL) were compacted manually at the time of making each compost layer for proper decomposition. Initially, the compost layers were stirred after 6 weeks followed by remixing the compost layers with an interval of 3 weeks. After 6 month, the compost pit was opened. The completely Decomposed Date Palm Leaves Compost (CDPLC) was separated from the un-decomposed part of DPL which was mainly the hard mid-rib of the palm leaves. The decomposed portion of the DPLC was used in the experiment.

Preparation of the mixtures: Four different materials namely Vermiculite, perlite, sand and clay were selected for mixing with DPLC. These were mixed in 2:1 and 1:2 ratio by volume with DPLC to prepare eight different mixtures for comparison with DPLC as the control treatment. The detail of these mixtures is as below:

- DPLC (control)
- DPLC+ vermiculite (2:1)
- DPLC+ vermiculite (1:2)
- DPLC+ perlite (2:1)
- DPLC+ perlite (1:2)
- DPLC+ sand (2:1)
- DPLC+ sand (1:2)
- DPLC+ clay (2:1)
- DPLC+ clay (1:2)

The Water Holding Capacity (WHC) of different mixtures and DPLC was determined by a procedure used to control moisture content in soil samples during aerobic incubation for determination of mineralized N (MacKay and Carefoot, 1981). The mixture samples were placed in 150 mL filter units fitted with a 0.45 µm filter, compacted to achieve uniform density, saturated with water and allowed to equilibrate for 90 min. After equilibration, the samples were placed on a vacuum manifold at 0.01 MPa tension. A sub-sample was oven dried at 105°C for 24 h. The moisture content at 0.01 MPa was determined, while WHC and other cations were determined (Table 1).

Table 1: pH, WHC, N, P, K, Ca and Mg concentration of different mixtures

Treatments	pH	WHC (g g ⁻¹)	N	P	K	Ca	Mg
			----- (%) -----				
DPLC (control)	6.8	1.79	0.93	0.29	0.31	3.45	0.20
DPLC+ vermiculite(2:1)	5.7	1.88	1.81	0.88	0.37	4.41	0.28
DPLC+ vermiculite(1:2)	5.6	2.03	1.85	0.98	0.42	4.57	0.30
DPLC+ perlite (2:1)	6.4	1.84	1.51	0.72	0.34	4.02	0.27
DPLC+ perlite (1:2)	6.5	1.92	1.58	0.77	0.36	4.13	0.24
DPLC+ sand (2:1)	6.7	1.72	1.16	0.57	0.34	3.83	0.23
DPLC+ sand (1:2)	7.1	1.50	1.00	0.55	0.33	3.67	0.21
DPLC+ clay (2:1)	6.9	1.81	1.31	0.58	0.35	4.20	0.25
DPLC+ clay (1:2)	7.0	1.90	1.28	0.60	0.37	4.26	0.28

Total N contents were determined by combustion at 1010°C in a CNS analyzer (Carlo-Erba NA-1500; BICO, Burbank, California). All the mixtures and DPLC were air dried for 4 days and ground to powder with a ball grinder before combustion. The P concentration was measured colorimetrically and K, Ca and Mg ions with an atomic absorption spectrophotometer.

Greenhouse experiment layout: The seeds of Dahlia, Marigold, Zinnia and Cosmos were placed in trays filled with sand, clay and perlite in a ratio of 1:1:1 by volume. The trays were kept in a greenhouse with inside temperature of 18±2°C. The seed germination was complete in a week. Later on, 8 healthy seedlings were transplanted to 20 cm diameter pots filled with different compost mixtures with DPLC alone as control treatment. The pots were kept inside the greenhouse. Later on, the seedlings were thinned to 5 seedlings per pot after one week and the treatments were replicated 3 times. The pots were fertilized at the rate of 150 mg L⁻¹ of compound water soluble fertilizer with a composition of 20:20:20 as N, P and K, respectively with irrigation water. After 6 weeks from planting, number of leaves were counted, leaf area was measured using a leaf area meter (Licor, Model 3100, LICOR Ltd., Lincoln, NE). The LAI was calculated as the ratio of leaf area to land area (Watson, 1947). Height of plants was measured and the tops were cut at the base, chopped and placed in perforated paper bags. The shoot dry weight was determined after oven drying at 80°C to a constant weight. Leaves were separated from shoots, ground, screened and digested by the method of Parkinson and Allen (1975). Tissue N, P, K, Ca and Mg were measured on the sulphuric acid/hydrogen peroxide Kjeldahl digests. The N and P concentrations were measured colorimetrically and K, Ca and Mg with an atomic absorption spectrophotometer.

Statistical analysis: The experiments were laid out as a Completely Randomize Design with 3 replications and with 5 plants per replication. The experiments were repeated twice. All the data were analyzed using ANOVA (SAS, 2000) and means were compared by the Least Significant Different (LSD 0.05) (Steel and Torrie, 1996).

RESULTS AND DISCUSSION

Dahlia: The vegetative growth of Dahlia plants improved significantly in DPLC + vermiculite mixture. Plants grown in DPLC + vermiculite (2:1 and 1:2) were significantly larger than other mixtures and DPLC. Mean height, LAI, number of leaves/plant and shoot dry weight of plants were significantly more when grown in Perlite + DPLC mixture than the addition of sand and clay with DPLC (Table 2). On relative basis, the mean biomass of plants grown in DPLC (control) was 87%

Table 2: Effect of DPLC and different mixtures on the mean vegetative traits of Dahlia

Treatments	Plant height (cm)	Leaf area index (LAI)	No. of leaves plant ⁻¹	Shoot dry weight (g plant ⁻¹)
DPLC alone	19.90	2.62	11.90	2.44
DPLC+ vermiculite (2:1)	25.40	2.95	13.10	2.81
DPLC+ vermiculite (1:2)	25.90	3.09	13.90	2.95
DPLC+ perlite (2:1)	24.10	2.08	12.60	2.32
DPLC+ perlite (1:2)	22.50	2.67	12.80	2.38
DPLC+ sand (2:1)	14.30	2.48	9.23	0.91
DPLC+ sand (1:2)	13.20	2.13	8.78	0.84
DPLC+ clay (2:1)	17.30	2.52	10.00	1.19
DPLC+ clay (1:2)	19.50	2.38	10.30	1.24
LSD (0.05)	1.20	0.13	0.67	0.32

Table 3: Effect of DPLC and different compost mixtures on mean leaf nutrient contents of Dahlia

Treatments	N	P	K	Ca	Mg
	----- (%) -----				
DPLC (control)	2.3	0.23	3.6	2.8	1.0
DPLC+ vermiculite (2:1)	2.6	0.27	3.8	3.2	1.2
DPLC+ vermiculite (1:2)	2.7	0.29	4.5	3.4	1.2
DPLC+ perlite (2:1)	2.4	0.24	3.6	2.8	1.0
DPLC+ perlite (1:2)	2.5	0.26	3.9	3.0	1.2
DPLC+ sand (2:1)	1.9	0.16	3.0	2.1	0.8
DPLC+ sand (1:2)	1.4	0.18	3.2	2.3	0.9
DPLC+ clay (2:1)	2.3	0.21	3.5	2.7	1.2
DPLC+ clay (1:2)	2.3	0.23	3.8	2.9	1.2
LSD (0.05)	ns	ns	ns	ns	ns

ns: Non-significant

and 83% than those plants grown in DPLC + vermiculite (2:1 and 1:2), respectively. This might be due to the improvement in soil fertility (Steffen *et al.*, 1995; Maynard, 1997).

Mean leaf concentration of macronutrients (%) ranged from 1.4-2.7 (N), 0.18-0.27 (P), 3.0-4.5 (K), 2.1-3.4 (Ca) and 0.8-1.2 (Mg) in different compost mixtures. There was no significant difference in the leaf mineral composition among different compost treatments as compared to the DPLC alone (Table 3). This might be due to the increase in growth parameters and high uptake of nutrients from the compost mixtures with other materials (Modaihsh *et al.*, 2008). The leaf N and K contents did not correlate with any growth variables. However, leaf P, Ca and Mg contents were negatively correlated with plant height, P was negatively correlated with total dry weight ($r = -0.62$), leaf area ($r = -0.48$) and number of leaves/plants ($r = -0.50$), Ca was negatively correlated with plant height ($r = -0.37$) and Mg was negatively correlated with shoot dry weight ($r = -0.42$) and plant height ($r = -0.56$).

The negative correlation between P, Ca and Mg contents of leaves and shoot dry weight indicated that N and K or both are the limiting growth factors. This might be an example of the carbohydrate dilution effect where an increase in one limiting nutrient causes increased plant growth that resulted in the decrease in tissue levels of other non-limiting nutrients. In the compost, N supply may have been lower or N was bound in organic complexes rendering it unavailable to plants. This is a common problem with organic substrates with a high C:N ratio (Rose and Wang, 1996). Dahlia was probably N limited in this experiment and thus the growth responses were primarily due to the different N concentrations in the substrates.

Marigold: Growth of Marigold plants was significantly affected by all the planting mixtures (Table 4). Mean plant height was significantly higher when grown in DPLC+ vermiculite (1:2), followed by DPLC+ perlite (1:2), DPLC+ vermiculite (2:1) and DPLC+ perlite (2:1) mixtures, respectively. The difference in plant growth was not significant between DPLC+ vermiculite (2:1), DPLC+ perlite (2:1) and DPLC (control). Mean plant height was about 29.6% higher in DPLC+ vermiculite (1:2) as compared to pure DPLC (control). However, plants grown in DPLC+ vermiculite (2:1 and 1:2) showed the highest LAI followed by DPLC+ perlite (1:2), pure DPLC and DPLC+ perlite (2:1) mixture in descending order (Table 4). Mean number of leaves/plant and shoot dry weight (g/plant) were the highest when grown in DPLC+ vermiculite (1:2) and the lowest in DPLC+ sand (1:2). These results agree with many investigators who concluded that physical properties of nursery potting mixture (Beardsell *et al.*, 1979), use of domestic vermiculite (Biamonte, 1982) and growing media such as peatmoss with clay (Biamonte, 1982) increased the plant height and fresh

Table 4: Effect of DPLC and different mixtures on the vegetative traits of Marigold

Treatments	Plant height (cm)	Leaf area index (LAI)	No. of leaves plant ⁻¹	Shoot dry weight (g plant ⁻¹)
DPLC (control)	27.4	3.28	13.5	4.03
DPLC+ vermiculite (2:1)	30.7	3.86	14.1	4.29
DPLC+ vermiculite (1:2)	35.5	4.19	15.8	4.77
DPLC+ perlite (2:1)	29.2	3.18	13.7	3.45
DPLC+ perlite (1:2)	31.8	3.42	13.8	3.74
DPLC+ sand (2:1)	24.7	2.56	12.5	2.73
DPLC+ sand (1:2)	21.3	2.18	11.7	2.18
DPLC+ clay (2:1)	26.4	2.49	12.9	2.65
DPLC+ clay (1:2)	27.9	2.64	13.4	2.79
LSD (0.05)	4.3	0.32	1.7	0.64

Table 5: Effect of DPLC and different mixtures on mean leaf nutrient contents of Marigold

Treatments	N	P	K	Ca	Mg
	----- (%) -----				
DPLC (control)	2.18	0.22	3.42	2.66	0.95
DPLC+ vermiculite (2:1)	2.47	0.26	3.61	3.04	1.14
DPLC+ vermiculite (1:2)	2.57	0.28	4.28	3.23	1.14
DPLC+ perlite (2:1)	2.28	0.23	3.42	2.66	0.95
DPLC+ perlite (1:2)	2.38	0.25	3.70	2.85	1.14
DPLC+ sand (2:1)	1.81	0.15	2.85	1.99	0.76
DPLC+ sand (1:2)	1.33	0.17	3.04	1.19	0.86
DPLC+ clay (2:1)	2.18	0.20	3.32	2.57	1.14
DPLC+ clay (1:2)	2.18	0.22	3.61	2.76	1.14
LSD (0.05)	ns	ns	ns	ns	ns

ns = Non-significant

biomass. Mean leaf concentration of macronutrients (%) ranged from 1.81-2.57 (N), 0.15-0.28 (P), 3.04-4.28 (K), 1.19-3.23 (Ca) and 0.95-1.14 (Mg) in different compost mixtures. There was no significant difference in the leaf mineral composition among different compost treatments than the control [DPLC alone] (Table 5). However, all the mineral contents of plant leaves showed increasing trend when DPLC was mixed with vermiculite, perlite and clay as compared to sand combination. The results agree with those of Lennox and Lumis (1987) who stated that physical properties of growing mixture namely peatmoss and sand increased the P and K contents in plants shoots and leaves in addition to plant height. Whereas, Handreck and Black (1984) and Havis and Hamilton (1983) observed that properties of different growing media such as compost, peatmoss and mixture of compost with vermiculite appreciably increased the plant mineral composition such as Ca, Mg and K which contradicts the study results. This difference in mineral composition might be due to the difference in fertility status of the composts. Mean leaf P contents showed positive correlation with shoot dry weight ($r = 0.76$) while it was negative with Ca contents ($r = -0.64$). The positive correlation and the high P contents of plants grown in DPLC suggest that Marigold responded to the availability of P in different mixture. Nevertheless, plants produced in DPLC grew considerably larger than those produced in DPLC, sand or clay (2:1) mixture. This might be due to the more P availability in DPLC than its mixture with sand and clay or on the other hand due to better physical properties of DPLC. Similar conclusions were drawn by Swanson (1989) and Sanderson (1983) who found that plant growth in artificial media such as organic manure and peatmoss with sand or medium textured (loam) soil is considerably affected by the critical physical properties of these growing media especially the Ca, Mg, N, P and K contents of plants.

Table 6: Effect of DPLC and different mixtures on vegetative traits of Zinnia

DPLC and mixes	Plant height (cm)	Leaf area index (LAI)	No. of leaves plant ⁻¹	Shoot dry weight (g plant ⁻¹)
DPLC alone	27.6	3.78	11.20	2.57
DPLC+ vermiculite (2:1)	32.7	4.07	11.30	3.45
DPLC+ vermiculite (1:2)	37.5	4.29	13.00	5.15
DPLC+ perlite (2:1)	31.3	3.86	10.80	2.67
DPLC+ perlite (1:2)	33.1	3.90	11.60	2.97
DPLC+ sand (2:1)	28.9	3.69	11.60	3.22
DPLC+ sand (1:2)	27.5	3.13	10.30	2.37
DPLC+ clay (2:1)	29.3	3.46	10.90	3.32
DPLC+ clay (1:2)	26.1	3.08	10.10	2.69
LSD (0.05)	1.8	0.31	0.47	0.82

Table 7: Effect of DPLC and different mixtures on mean leaf nutrient contents of Zinnia

Treatments	N	P	K	Ca	Mg
	----- (%) -----				
DPLC (control)	1.30	0.13	1.20	0.4	0.10
DPLC+ vermiculite (2:1)	1.50	0.14	1.60	0.5	0.10
DPLC+ vermiculite (1:2)	1.70	0.22	2.10	0.7	0.20
DPLC+ perlite (2:1)	1.30	0.12	1.20	0.5	0.10
DPLC+ perlite (1:2)	1.40	0.16	1.40	0.6	0.20
DPLC+ sand (2:1)	1.00	0.12	1.00	0.4	0.10
DPLC+ sand (1:2)	0.90	0.12	1.00	0.4	0.10
DPLC+ clay (2:1)	1.30	0.12	1.00	0.4	0.10
DPLC+ clay (1:2)	1.20	0.12	1.20	0.4	0.10
LSD (0.05)	0.17	0.02	0.32	ns	0.03

ns: Non-significant

Zinnia: Mean plant height, LAI, number of leaves/plant and shoot dry weight increased significantly by mixing DPLC with vermiculite or perlite (Table 6). The leaf N, P and K contents of plants grown in DPLC+ vermiculite were significantly more than other compost mixture treatments except DPLC + vermiculite (1:2) mixture (Table 7). There was no significant effect of any compost mixtures on the leaf Ca content of Zinnia plant. Many investigators reported increases in plant growth parameters with compost mixtures (Roe and Kostewicz, 1992; Diaz-Ravina *et al.*, 1989; Vega-Sanchez *et al.*, 1987; Wong and Chu, 1985).

The leaf contents of N and K of plants grown in DPLC+ vermiculite were higher than other compost mixture treatments (Table 7). The Ca contents of plants were significantly higher in DPLC+ vermiculite (1:2) than other growing mixtures. Whereas, plants grown in DPLC+ perlite (1:2) mixture showed high contents of N, P, K and Ca than plants grown in DPLC (control). There was a negative correlation between shoot dry weight and leaf contents of nitrogen ($r = -0.79$), phosphorus ($r = -0.37$), potassium ($r = -0.43$), While the relationship was positive with Ca contents ($r = 0.82$). The study findings agree with those of Purman and Gouin (1992) who concluded that aging of compost and its application regime significantly affected the growth and population of bedding plants as well as the showed high levels of N, P, K and Ca contents of plants parts.

Cosmos: Different growth mixtures caused significant variations in plant height, LAI, number of leaves/plant and dry weight of shoots/plant (Table 8). The values of all the growth attributes were higher when grown in DPLC+ vermiculite (1:2) and DPLC+ perlite (1:2). The magnitude of the

Table 8: Effect of DPLC and different mixture on the vegetative traits of Cosmos

Treatments	Plant height (cm)	Leaf area index (LAI)	No. of leaves plant ⁻¹	Shoot dry weight (g plant ⁻¹)
DPLC (control)	31.6	3.18	12.4	1.51
DPLC+ vermiculite (2:1)	32.9	3.57	12.5	1.58
DPLC+ vermiculite (1:2)	36.5	3.77	13.1	1.97
DPLC+ perlite (2:1)	31.9	3.45	12.6	1.56
DPLC+ perlite (1:2)	35.9	3.62	12.9	1.58
DPLC+ sand (2:1)	24.8	2.93	11.9	1.24
DPLC+ sand (1:2)	21.7	2.74	11.7	1.15
DPLC+ clay (2:1)	27.5	3.01	13.2	1.37
DPLC+ clay (1:2)	27.5	2.97	12.1	1.32
LSD (0.05)	3.4	0.12	1.8	0.13

Table 9: Effect of DPLC and different mixtures on mean leaf nutrient contents of Cosmos

Treatments	N	P	K	Ca	Mg
	----- (%) -----				
DPLC (control)	1.30	0.13	1.20	0.4	0.10
DPLC+ vermiculite (2:1)	1.50	0.14	1.60	0.5	0.10
DPLC+ vermiculite (1:2)	1.70	0.22	2.10	0.7	0.20
DPLC+ perlite (2:1)	1.30	0.12	1.20	0.5	0.10
DPLC+ perlite (1:2)	1.40	0.16	1.40	0.6	0.20
DPLC+ sand (2:1)	1.00	0.12	1.00	0.4	0.10
DPLC+ sand (1:2)	0.90	0.12	1.00	0.4	0.10
DPLC+ clay (2:1)	1.30	0.12	1.00	0.4	0.10
DPLC+ clay (1:2)	1.20	0.12	1.20	0.4	0.10
LSD 0.05	0.17	0.02	0.32	ns	0.03

ns: Non-significant

reduction in all the growth characters was higher in DPLC+ sand mixture. The values of different growth attributes were almost identical in DPLC+vermiculite (2:1) and DPLC+perlite (2:1) mixtures than DPLC (control), but significantly better than those grown in DPLC+ sand or DPLC + clay. However, plants in DPLC + clay mixture were better than those grown in DPLC + sand mixes. The research findings are in close agreement with those of Al-Oud, (2011) who found that addition of clay and organic fertilizer to sandy soils improved fresh weight of lettuce. Effect of compost on growth can vary with soil type and plant species (Roe, 1998). Parsons and Wheaton (1994) reported that early growth of orange trees increased in one location but not in another in response to the application of municipal solid waste compost. Similar views were expressed by Shiralipour *et al.* (1996), who observed that compost increased shoot dry weight of broccoli grown in pots using field soil.

The difference in leaf nutrient contents was significant among all the compost treatments except for Ca contents which were not significantly different among different treatments (Table 9). The plants did not show any nutrient deficiency or toxicity symptoms in all the compost mixture treatments. However, leaf N, P, K and Mg were significantly higher in those compost mixture containing vermiculite than other mixtures except DPLC + perlite (1:2) mixture. Hornick (1988) reported that annual applications of bio solids compost increased N, P and K concentrations in the soil but not in sweet corn plant tissues which did not agree with the present results. However, compost application increased the N contents in leaves of orange (Parsons and Wheaton, 1994).

Pear leaf Ca content was also higher in trees that received bio solid compost (Korcak, 1986). Leaf P contents showed positive correlation with shoot dry weight ($r = 0.73$), while it was negative between Ca and shoot dry weight ($r = -0.68$).

CONCLUSIONS

Under the conditions of the present study, Quality of growing medium proved to be the dominant factor for growth of all plant species. Despite the heterogeneity of the DPLC mixtures, their use as growth media for ornamental plants is very promising. DPLC mixtures seem potential low cost alternative to imported growing medias. More research is needed to improve DPLC mixtures in an arid environment for sustainable landscape development for community services.

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