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Study of the Effect of Vermicompost as One of the Substrate Constituents on Yield Indexes of Strawberry

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Abstract: In this experiment was investigated the potential of Vermicompost as one of the substrate constituents on yield indexes of three strawberry cultivars. For this, were used from four substrates consisted of (0%, 5%, 15% and 25%) vermicompost and three cultivars (Camarosa, Mrak and Selva). The measured traits consisted of diameter of crown, number of inflorescence, fruit length, mean of fruit weight, fruit number and Yield. The results of this experiment indicated that application of vermicompost in substrate improved indexes of yield. The highest of diameter of crown, fruit length and yield were obtained in interaction of Mrak and S_2 (19.45 mm, 4.47 cm and 264.143 g respectively). The interaction of Selva and S_3 had more fruit number (26.63) than other treatments. Selva cultivar in S_4 had the highest of mean of fruit weight (12.33g) also Mrak in S_4 had more number of inflorescence (7) than other treatments. Camarosa in S_1 had lower fruit length (2.66 cm) and mean of fruit weight (8.27 g) than other treatments also Selva in this substrate had the lowest of yield (140.79 g). The lowest of inflorescence number was observed in interaction of Camarosa and S_3. Selva in S_4 had the lowest of new diameter crown (13.47 mm) and fruit number (13.34 g).

Key words: Strawberry · Substrate · Vermicompost · Yield index

INTRODUCTION

The substrate was described as location of placing of plant roots. The characteristics of Suitable substrate are ability to provide simultaneously sufficient levels of oxygen and water to the roots [1], adequate storage of water and nutrients for the plant [2], balancing of physical, chemical and biological requirements for good plant growth also to be readily available, easy to handle, lightweight and to produce uniform plant growth [3-6]. The most common reason for mixing materials in substrate production is improvement of the physical conditions, like the water to air ratio [7]. Though, peat the most widely is used as substrate but today, because of concerns about destruction of peat bogs [8] and the use of peat in horticulture has recently been questioned from an environmental standpoint, since peat is a non-renewable resource and since it plays a major role in atmospheric CO_2 sequestration [2] therefore several investigation was carried out for evaluating of potential of other material for utilization of them as substrate. The substrate is one of the effective factors in plant growth and yield [9,10] so that [11] stated perhaps the most important factor in production of greenhouse crops is the type of substrate used. Vermicompost consist of available forms nutrition for plant uptake such as nitrates, exchangeable phosphorus, potassium, calcium and magnesium [12-14]. Vermicompost, in contrast to conventional compost is the product of an accelerated biooxydation of organic matter by the use of high densities of earthworm populations without passing a thermophilic stage [15,5,14]. Vermicompost is an environmentally acceptable means for convert waste to nutritious compost [16,17,13].

Desirable growth of plant was appeared with vermicompost application [18, 19]. Vermicomposts contain plant growth-regulating materials, such as plant growth hormones and humic acids, accordingly it was caused the increasing in germination, growth and yields of plants [20,21]. Application of vermicompost as horticultural media usually enhanced seedling growth and

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development and productivity of a wide variety of crops [12,22,23] introduced vermicompost as soil amendment and as plant growth media due to having high porosity, good aeration, drainage, water-holding capacity and very high microbial activity. Since vermicompost is homogenous and has reduced level of contaminants and tends to hold more nutrients over a longer period, without impacting the environment, it is considered as an excellent product [24]. Vermicomposts consistently promote biologicasl activity which can be cause to germinate, flowering, growing and having yield better than in commercial container media, independent of nutrient availability [25].The objective of this experiment was to assess the function of vermicompost in substrate on yield indexes of strawberry cultivars.

MATERIALS AND METHODS

Plant Preparation: The investigation was conducted from 6 Jul. 2010 to 2 Feb. 2011 at the experimental greenhouse and laboratory of the Agricultural Faculty, Ferdowsi University of Mashhad (latitude 36° 16□ N, longitude 59?36' E and 985 m elevation), Iran. Day/ night temperature was 22/17. Cultivars root were put in fungicides (mancozeb and captan) before planting. The hydroponic system was open. Macro nutrient solution containing NH_4, Ca, Mg, NO_3, SO_4, H_2PO_4 and K with 9, 110, 24, 62, 198, 121.25 and 204.75 ppm respectively and micro nutrient solution containing Fe, Mn, Zn, B, Cu and Mo with 1.12, 0.55, 0.26, 0.22, 0.048 and 0.048 ppm [26] used based on 100-250 ml $plant^{-1}$ day^{-1} depending on growth stage. The pH and EC of nutrient solution were adjusted to 5.7 and 0.9-1.4 dS m^{-1}, respectively.

Treatments: Experimental treatment consisted of three strawberry cultivar (Camarosa, Mrak and Selva) and four substrates:

S_1 = Cocopeat+ perlite (50%: 50%)
S_2 = Vermicomposts+ perlite+ cocopeat (5%: 45%: 50%)
S_3 = Vermicomposts+ perlite+ cocopeat (15%: 40%: 45%)
S_4 = Vermicomposts+ perlite+ cocopeat (25%: 35%: 40%)

Growth mediums were prepared based on volume.

Measurement: Each replication was used to assess new crown diameter, inflorescence number, fruit number, mean of fruit weight, fruit length and yield. Physical and chemical characteristics of different substrates were calculated [27]. PH and EC were measured from watery extraction (1:10) at the beginning and the end of cultivation (Table 1).

Experimental Design and Statistical Analysis: The experiment was arranged in factorial experiment based on randomized complete design with four replications. Data were analyzed using SAS 9.1 and means were compared by Duncan's multiple range test (DMRT) at 5% level of confidence.

RESULT AND DISCUSSION

Application of vermicompost in substrates significantly influenced new crown diameter, inflorescence number, fruit number, fruit length, mean of fruit weight and yield in different cultivars. ($P < 0.05$) With due attention to Fig. 1, it is clear which vermicompost using in substrate was effective in yield indexes. With increasing vermicompost content of substrate decreased new crowns diameters but increased number of inflorescence, fruit length and mean of fruit weight also were observed increase and then decrease in number of fruit and yield factors. Fig. 2 shows cultivar agent was effective in measured factors. Mrak cultivar had the highest of inflorescence number (5.33), fruit length (3.77 cm) and yield (232.16 g) also this cultivar and Camarosa had the highest of fruit number (22.99 and 23.47 respectively) and diameter of

Table 1: Physical and chemical characteristics of different substrate

Substrate	pH	ECDs/m	Porosity	Bulk density	Particle density	Organic material	Inorganic material
S1	7.22	1.32	93.40	0.141	2.11	36.24	63.75
S2	7.15	1.95	90.61	0.194	2.04	38.75	61.25
S3	7.12	2.43	87.44	0.253	1.98	42.66	57.34
S4	7.52	2.73	84.11	0.304	1.94	47.88	52.12

Table 2: Interaction of substrate and cultivar on yield indexes of Strawberry

Treatment		Diameter of crown (mm)	Number of inflorescence	Fruit length (cm)	Mean of fruit weight (g)	fruit number	Yield (g)
Substrate	Cultivar						
S1	Camarosa	17.49 bc	4 bc	2.66 f	8.27 e	21.34 e	176.47 f
	Mrak	15.23 de	4.3 b	3.58 b	9.75 bc	20.84 e	203.07 e
	Selva	14.02 ef	3.6 bc	3.83 b	8.74 de	16.11 f	140.79 g
S2	Camarosa	18.04 b	4 bc	3.23 e	9.79 bc	25.90 a	253.52 ab
	Mrak	19.45 a	4 bc	4.47 a	10.41 b	24.20 bc	264.143 a
	Selva	16.88 bc	3 cd	3.21 e	9.35 cd	15.92 f	148.68 g
S3	Camarosa	17.71 bc	2.3 d	3.85 b	10.11 bc	23.35 cd	236.18 c
	Mrak	18.03 b	6:00 AM	3.23 e	10.06 bc	21.82 ed	219.54 d
	Selva	13.56 f	3.33 bcd	3.48 de	9.54 c	26.63 a	254.23 ab
S4	Camarosa	15.41 d	4 bc	3.43 de	9.93 bc	23.29 cd	231.18 cd
	Mrak	16.05 cd	7:00 AM	3.53 cd	9.63 bc	25.11 ab	241.91 bc
	Selva	13.47 f	4.3 b	3.79 bc	12.33 a	13.34 g	164.50 f
Significance		**	**	**	**	**	**

Different letters in columns indicate significant difference between treatments at 5% level, NS, *,** Nonsignificant , significant at P = 0.05 or 0.01, respectively

S1= cocopeat + perlite (50%: 50%)

S2= vermicompost + perlite + cocopeat (5%: 45%: 50%)

S3= vermicomposts + perlite + cocopeat (15%: 40%: 45%)

S4= 25% vermicomposts + 35% perlite + 40% cocopeat (25%: 35%: 40%)

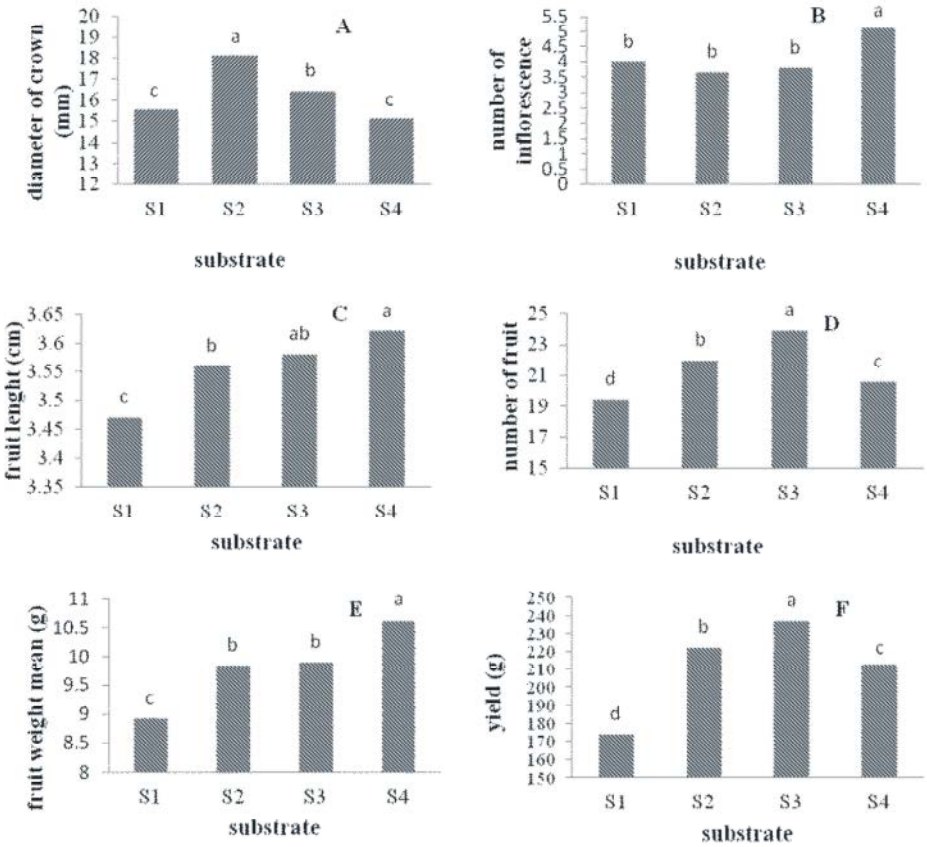

Fig. 1: Effect of substrarte on diameter of crown (A) number of inflorescences (B) fruit length (C) number of fruit (D) Mean of fruit weight (E) and yield (F)

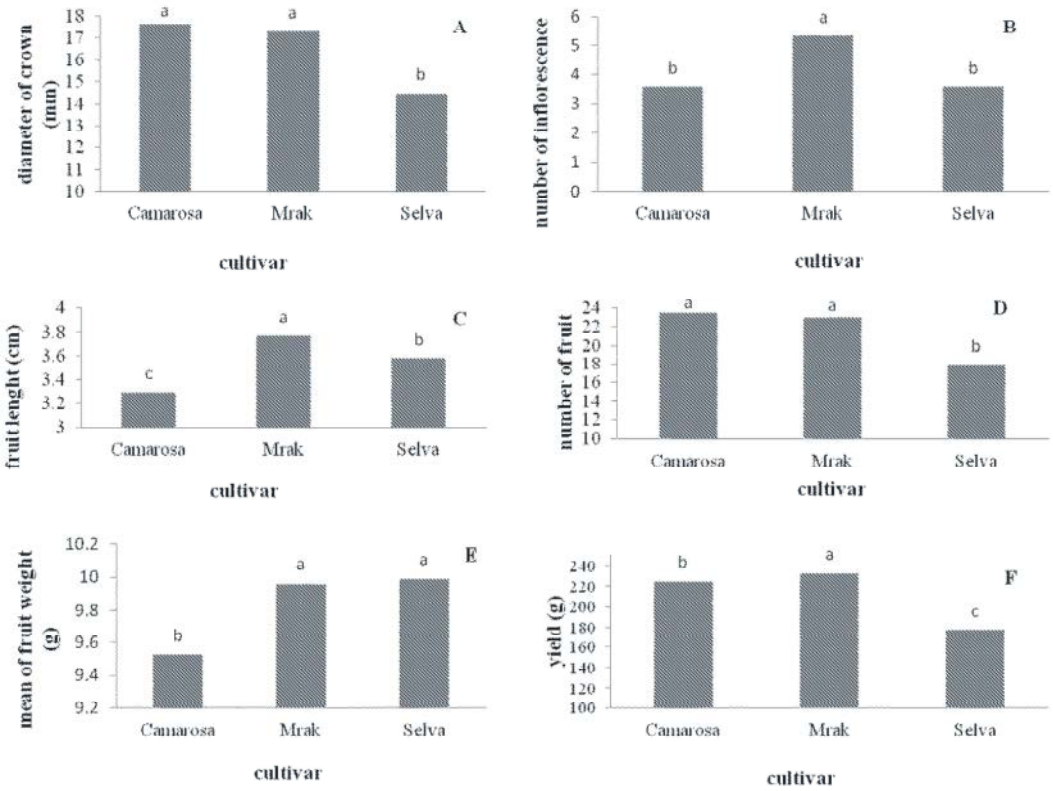

Fig. 2: Effect ofcultivar on diameter of crown (A) number of inflorescences (B) fruit length (C) number of fruit (D) Mean of fruit weight (E) and yield (F)

crown (17.3 and 17.66 mm respectively). The highest of mean of fruit weight was observed in Selva and Mrak cultivars (9.99 and 9.96 g respectively). Table 2 shows the highest of diameter of crown, fruit length and yield in interaction of Mrak and S_2 (19.45 mm, 4.47 cm and 264.143 g). The interaction of Selva and S_3 had more fruit number (26.63) than other treatments. Selva cultivar in S_4 had the highest of mean of fruit weight (12.33g) also Mrak in S_4 had more number of inflorescence (7) than other treatments. Camarosa in S_1 had lower fruit length (2.66 cm) and mean of fruit weight (8.27 g) than other treatments also Selva in this substrate had the lowest of yield (140.79 g). The lowest of inflorescence number was observed in interaction of Camarosa and S_3. Selva in S_4 had the lowest of new diameter crown (13.47 mm) and fruit number (13.34 g) therefore adding of vermicompost to substrate is usful, of course high percentages of it cannot useful due to high EC. Plants was planted in substrates with 25% vermicompost in this experiment, produced more flowers and fruits with high weight but high yield was observed in interaction of Mrak and S_2.

Strawberry plant growth and fruit yield are dependent on the type of growing container used and the configuration or arrangement of the containers [10,25] stated that the greatest plant growth responses and largest yields have usually occurred when vermicomposts used only a relatively small proportion (20- 40%) of the total volume of a substrate mixture, with greater proportions of vermicomposts substituted into the plant growth medium not always improving plant growth further.

The highest of PH, EC and bulk density were related to S_4. S_1 was the highest of porosity, particle density, inorganic material and EC, also it was the lowest bulk density and organic material. S_4 was the highest of bulk density and organic material also the lowest porosity, particle density and inorganic material (Table 1).

We cannot ever ignore the function of soil in crop production but we should consider to limitation of it. In soilless culture, we follow by the substrate that it provides condition for growth and productivity of plant such as soil. Response of Mrak cultivar in the substrate with 15% vermicompost was better than other treatments. Since they have highest yield hence better yield was obtained in the substrate which it provide better physical and chemical condition.

CONCLUSION

According to this experiment application of vermicompost as one of the strawberry substrate constituents improved yield index therefore can be used in substrate although high percentages of vermicompost will not useful due to high EC.

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