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Research Article

Comparative Suitability of Various Growth Media for Producing Cucumber Transplants

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Abstract: Peat is generally used as a medium for growing cucumber, which is highly expensive.Many wastes which are useless by-products of vegetables production process can be useful as organic materials with potential applications. These wastes can be used as alternatives to peat. The study was conducted in a plastic house at Directorate of Vegetable, Department of Horticultural Research &Development, National Agricultural Research Centre, Islamabad. Peat, compost and farmyard manure alone and in combination were compared for producing cucumber seedlings. Maximum germination (96.33%), seedlings shoot length (28.33 cm), seedling height (38.67 cm), seedling vigor index (38.67) and minimum days to emergence (16.33) were found in T_9 (peat, compost and Traditional practicing media in 1:1:1 ratio). Maximum dry matter accumulation (38.50 %) was recorded in T_4 (Peat and compost, in 1:1/2 ratio) and maximum benefit cost ratio (1.87) was recorded in T_2 (compost).

Keywords: Cucumber, seedlings, peat, compost and traditional media

1. INTRODUCTION

Cucumber (*Cucumis sativus* L.) is one of the monoecious annual crops in the Cucurbitaceae family [1]. It is grown on 3.53 thousand hectares with the production of 50.17 thousand tonnes. To fulfill the demand of nation it is imported from the countries of India and Iran [2]. Raising seedling and their transplantation is common practice in cucumber production, although to provide a fast place establishment rate is a common ask for the profitable production of vegetable seedlings [3]. Peat has long been used as a section in soilless potting substrates because of its uniform and encouraging agronomic characteristics [4]. Monoculture leads to lot of problems when seedlings are transplanted to soil which rapid evaporation due to high temperature and salinity at upper layers of soil [5]. Constant increase in cost and the restricted availability of peat, the use of other organic resources as growing media has become enormously essential. Moreover ecological constraints and recycling necessities of organic materials make them suitable for use as a growing media [6]. Eradication of plant pathogens is possible through composting specified by various studies [7]. Use of composted organic waste substitute for high concentration of peat or in mixture with peat for seedling production has become a common practice in the horticultural industry of other countries [8]. Sawdust was proposed as a substitute for high concentrations of peat media for cucumber seedling production [9]. Substitute growing medias have the benefit of being locally formed, renewable and pollutant and disease-free [10], and may be less costly than any other traditional growing media used in soilless crop production. There might be a lot of factors for the negligence of growing cucumber in the country but one of the reasons is seedling production which is usually not done by suitable growth media. This research work was carried out to accomplish the ideal and most suitable growing media to produce healthy, strong and uniform seedling and lessening of production costs and seed waste and to accomplish the best media for seed germination of cucumber.

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2. MATERIALS AND METHODS

A poly glass experiment was carried out to evaluate the growth and economical potential of various growing media for raising of cucumber seedling. The study was conducted at experimental site of Directorate of Vegetable, DHRD, NARC, Islamabad Pakistan, located at 73.08^0E, 33.42^0N and 683 m (elevation). Experiment was laid in a completely randomized design (CRD) with three replicates for each treatment. Treatment plan was as under: T_0: Traditional practicing media (soil, sand, and farmyard manure in 1:1:1 ratio), T_1: peat, T_2: compost, T_3: peat and compost (1:1), T_4: peat and compost (1:1/2), T_5: peat and compost (1/2:1), T_6: peat and traditional practicing media (1:1), T_7: peat and traditional practicing media (1:1/2), T_8: peat and traditional practicing media (1/2:1) and T_9: peat, compost and Traditional practicing media (1:1:1).

2.1 Measurements

Germination %, days to emergence, speed of germination, seedling shoot length (cm), seedling height (cm), seedling vigor index, dry matter accumulation (mg/05 seedlings), cost benefit were recorded during this study of 5 selected seedlings. Seedling vigor index is calculated by multiplying germination (%) and seedling length. The seedling showing the higher seedling vigor index is considered to be more vigorous [11].

$$\text{Germination (\%)} = \frac{\text{Seed Germinated}}{\text{Total Number of Seeds}} \times 100$$

$$\text{Seedling Vigor Index} = \text{Germination (\%)} \times (\text{Shoot length} + \text{Root leght})$$

$$\text{Drymatteraccumulation}(\%) = \frac{\text{DryWeight}}{\text{FreshWeight}} \times 100$$

Benefit cost ratio is calculated by following formula [12].

$$\text{BCR} = \frac{\sum_{i=1}^{t} \frac{Bt}{(1+r)^t}}{\sum_{t=0}^{t} \frac{C_t}{(1+r)^t}}$$

B: represents benefits of the project

C: represents costs of the project

t: represents time measured in years

r: represents discount rate

Organic matter content (%) was estimated by Loss-On-Ignition method [13] while modified Walkley-Black procedure [14] was adopted for the determination of organic carbon. Total nitrogen (%) was determined by Anderson and Ingram [15]and total phosphorus (%) was determined by Chapman and Pratt [16]. Potassium (%) was determined by Steckel and Flannery, [17]. Zinc, Fe, Cu and Mn (mg kg^{-1}) were determined by dry ash method [18]. Ash content was determined by AOAC [19]. Salient characteristics and nutrient content of different growing media are summarized in the Table 1.

Table 1. Nutrient composition of different ratios of medias.

Treatment	Ash content (%)	Organic matter (%)	Organic carbon (%)	Total N (%)	Total P (%)	K (%)	Zn (mg kg^{-1})	Fe (mg kg^{-1})	Cu (mg kg^{-1})	Mn (mg kg^{-1})
T_0: Traditional media	0.18	99.82	57.90	0.76	1.46	0.09	70.8	3.4	39.2	76.8
T_1: Peat	1.33	98.67	57.23	0.54	2.41	0.15	159.0	4.2	43.2	311.6
T_2: compost.	1.33	98.87	57.34	0.47	2.37	0.15	118.6	3.6	34.8	237.6
T_3: Peat and compost (1:1)	0.86	99.14	57.50	0.44	2.17	0.15	110.0	1.6	36.0	217.8
T_4: Peat and compost (1:1/2)	1.08	98.92	57.37	0.54	1.58	0.09	92.4	3.6	31.8	241.2
T_5: Peat and compost (1/2:1)	1.21	98.79	57.30	0.36	1.52	0.08	83.8	1.8	27.6	189.6
T_6: Peat and Traditional media (1:1)	1.45	98.55	57.16	0.19	1.46	0.09	72.2	0.6	30.2	136.4
T_7: Peat and Traditional media (1:1/2)	1.49	98.51	57.14	0.25	1.68	0.09	81.4	3.6	34.8	169.0
T_8: Peat and Traditional media (1/2:1)	1.30	98.70	57.25	0.41	1.42	0.09	112.4	4.0	29.8	208.6
T_9: Peat, Compost and Traditional media (1:1:1)	1.70	98.30	57.01	0.22	1.76	0.08	68.6	8.0	26.8	210.0

2.2. Statistical Analysis

Data were subjected to analysis of variance (ANOVA) to estimate the influence of media. The differences between the means were compared using the least significant difference test (LSD, $P<0.05$), [20]. All statistical tests were conducted using the Statistix 8.1 software package.

3. RESULTS AND DISCUSSION

Our results indicated that maximum germination percentage was observed when cucumber seeds were grown in the peat, compost and traditional practicing media (1:1:1), which was statistically non-significant with the seeds grown using peat and traditional practicing media (1/2:1) and peat and traditional practicing media (1:1/2). Peat and traditional practicing media (1/2:1) and peat, compost and traditional practicing media (1:1:1) resulted in an increase of 10.26 and 10.98% germination percentage. Ratios of 1:1 and 1:1/2 of traditional practicing media and peat and compost (1/2:1) had non-significant effect on the germination percentage. Astatistically significant increasing trend was observed in germination percentage of seeds sown in peat, compost, peat and compost (1:1) and peat and compost (1:1/2).Seedling height was also significantly influenced by the different growth media used in the study. Highest seedling height was observed in the seeds grown in peat, compost and Traditional practicing media (1:1:1) which resulted in an increase of 44.80% in seedling height, followed by statistically non-significant peat and Traditional practicing media (1/2:1). Peat and Traditional practicing media (1:1) and peat and compost (1/2:1) had a significantly different effect on the seedling height. Seedling shoot length was also significantly influenced by the various growth media and their ratios. Highest shoot length was observed in cucumber seedling grown in peat and traditional practicing media (1/2:1) and peat, compost and traditional practicing media (1:1:1) with a statistically non-significant difference. Highest seedling vigor index was observed in the seedlings grown in peat and traditional practicing media (1/2:1) and peat, compost and traditional practicing media (1:1:1) with the statistically non-significant effect peat and compost (1:1) also had a similar effect on the seedling vigor index. Highest dry matter accumulation percentage was observed in the cucumber seedlings grown in peat and compost (1:1/2). Peat and traditional practicing

Table 2. Comparison of treatments as influenced by growth media.

Treatment	Germination %	Days to emergence	Seedling shoot length (cm)	Seedling height (cm)	Seedling vigor index	Dry matter accumulation (%)	Cost benefit
T_0: Traditional media	85.76 i	24.00 a	14.00 g	21.34 g	1829.5 h	27.20 d	0.80
T_1: Peat	87.26 h	23.00 ab	15.66 f	24.00 f	2094.3 g	30.20 c	0.01
T_2: compost.	88.74 g	22.00 bc	17.66 e	26.66 e	2365.9 f	33.30 b	1.87
T_3: Peat and compost (1:1)	90.10 f	21.00 cd	18.66 e	27.00 e	2432.8 f	20.64 f	0.87
T_4: Peat and compost (1:1/2)	92.10 e	20.34 de	20.66 d	29.66 d	2732.6 e	38.50 a	0.42
T_5: Peat and compost (1/2:1)	93.24 de	19.34 ef	21.66 d	31.00 d	2890.2 d	23.16 e	0.06
T_6: Peat and Traditional media (1:1)	93.90 cd	18.34 fg	24.00 c	33.34 c	3130.0 c	26.70 d	-0.04
T_7: Peat and Traditional media (1:1/2)	94.90 bc	17.00 gh	26.34 b	36.34 b	3447.9 b	26.70 d	0.12
T_8: Peat and Traditional media (1/2:1)	95.56 ab	17.34 gh	27.34 ab	38.00 a	3631.4 a	18.86 f	0.38
T_9: Peat, Compost and Traditional media (1:1:1)	96.34 a	16.34 h	28.34 a	38.66 a	3724.7 a	33.80 b	0.84
CV	0.84	4.11	3.19	2.92	2.88	4.90	
LSD (0.05)	1.30	1.39	1.16	1.53	138.87	2.33	

media (1:1) and peat and traditional practicing media (1:1/2) were non-significantly different. Days to germination were significantly reduced by different growing media and their ratios. Minimum numbers of days were observed with the use of peat, compost and traditional practicing media (1:1:1). Results showed that all the vegetative variables have better growth at peat, compost and traditional practicing media (1:1:1) and also germination % and emergence days have shown better results at T_9 as compared to other treatments. More vigorous seedlings are also found in peat, compost and traditional practicing media (1:1:1) as compared to other treatments. Use of equivalent ratio of peat, compost and traditional practicing media was found to be best media for growing cucumber seedlings. Increase in the studied growth parameters might be due to higher phosphorous content. Phosphorous is involved in the formation energy rich compounds which in return derive various bio-chemical reactions within the plant include adenosine triphosphate and adenosine diphosphate [21]. Balanced proportion of Zn, Cu, Fe and Mn may also have promoted the growth of the seedlings. Our results were in line with various scientists as Riaz et al. [22] advocated use of different growing media for zinnia and suggested physical and chemical properties of media, like structure, texture, pH as well as nitrogen, phosphorus and potassium as a dominant factors for the growth and development of plant. Furthermore, Ahmad et al [23] suggested that incorporation of rice hulls and press mud in traditional substrates improved the growth and quality indices and increased flower yield of *Rosa hybrid* L. cvs. 'Kardinal', 'Anjlique' and 'Gold Medal'. Maximum percentage of dry matter has been found in peat and compost (1:1/2). Highest dry matter content could be due to compost with its beneficial effects on better growth of seedling comparable to peat moss. This was agreement with Manal & El-Behairy [24] who found that plant growth was enhanced since several important horticultural parameters, such as dry weight, stem diameter and plant height were improved in plants grown on compost containing media. The results regarding benefit cost ratio clearly depicts that planting media containing compost is more cost effective and gives more financial benefits than the rest of the treatments, the reason could be low cost of the compost with its beneficial effects on better growth of seedling comparable to peat moss. In terms of growth and development of cucumber seedlings equivalent ratios of peat, compost and traditional growth media performed better than only compost but cost benefit ratio proved that compost is better one. This study has clearly shown that cucumber seedlings production can be promoted by the addition of compost and traditional media with peat in equal proportions.

4. CONCLUSIONS

Peat is most commonly used as a medium for growing cucumber, which is usually imported and is highly expensive. Many farm wastes which are generally considered useless by-products of vegetables production process can be useful as organic materials with potential applications. These wastes can be used as alternatives to peat which can reduce the reliance on the peat for seedling production. Therefore, a need was felt to compare the seedling production by peat and other locally available organic materials. Thus an experiment was planned to examine the seedling growth and production in the peat and other locally available growing media proportions. Our results indicated that all the vegetative variables have better growth at peat, compost and traditional practicing media (1:1:1) and also germination percentage and emergence days have shown better results as compared to other treatments. More vigorous seedlings were produced when peat was used as growing medium, compost and traditional practicing media (1:1:1) as compared to other treatments. Use of equivalent ratio of peat, compost and traditional practicing media was found to be best media for growing cucumber seedlings. Therefore, the use of equivalent ratio of compost, peat and traditional practicing media as a seedling growing media is could lead to healthy and vigorous seedlings and will also lead to reliance on the locally available growing media.

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