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The Pharma Innovation

ISSN (E): 2277- 7695
ISSN (P): 2349-8242
NAAS Rating: 5.03
TPI 2019; 8(11): 163-170

www.thepharmajournal.com
Received: 20-09-2019
Accepted: 22-10-2019

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Effect of growing media and fertilization methods on growth and yield of snake gourd grown under matric suction irrigation

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Abstract
A pot experiment laid in an open land with climbing structure was conducted during *kharif* season 2017-18 with snake gourd (*Trichosanthes cucumerina* L.) as test crop. Different growing media with varying substrates such as cocopeat, vermicompost, fly ash, biocompost and pressmud were tested for standardizing the suitable composition for growing snake gourd under matric suction irrigation. Snake gourd variety CO-2 was raised in pots, which were provided water from the tubs placed beneath. The water raised into the growing media of pots by a phenomenon of matric suction. All pots were moistened by tubs which were interconnected by tubes. This arrangement maintained moisture in media throughout the crop period without a drying phase. The growing media was composed by mixing substrates in equal proportion on dry weight basis. The experimental pots were laid in 6 x 3 factorial completely randomized design. The results indicated that growth, yield and quality parameters were highest in the growing media having Cocopeat : Vermicompost : Fly ash fertilized by fertilizer solution, which consequently resulted the highest fruit yield (19.64 kg pot^{-1}). Relatively high yield of snake gourd (16.17 kg pot^{-1}) was recorded in Cocopeat : Vermicompost with fertilizer solution. Followed by, growing media of Cocopeat : Vermicompost : Pressmud with fertilizer solution gave moderate yield (13.38 kg pot^{-1}) which was at par with Cocopeat : Vermicompost : Fly ash with Fertilizer Pellet Pack (13.05 kg pot^{-1}). Besides standardizing the growing media, the promising effect of matric suction irrigation has also been brought out in the present study as an alternative means for surface irrigation. It is concluded that crop production by matric suction irrigation using the growing media may suit well for terrace garden as well as in leveled wastelands with limited water availability.

Keywords: growing media, fertilizer solution, fertilizer pellet pack, snake gourd, matric suction

Introduction
Vegetables play a major role in Indian agriculture and responsible in solving problems of malnutrition among human population. Growing vegetable crops generate greater employment potential in rural areas bringing national security. India is the second largest producer of vegetables after China and contributes about 12 per cent of the world vegetable production (Nayak *et al*., 2016) [19].

The snake gourd (*Trichosanthes cucumerina* L.) is a member of the botanical family *Curcubitacea*. It is a tropical vine and warm season crop requiring growing conditions of 27-30° C and plenty of sunlight. It occupies an important place among vegetables in India. It is an annual plant with rapid growth and of climbing habit. Snake gourd is a nutritious vegetable, containing rich variety of nutrients, vitamins and minerals that are essential for human health, including significant levels of dietary fiber, a low amount of calories and high levels of protein. Snake gourd contains vitamins A, B, C as well as minerals like manganese, magnesium, calcium, iron, potassium and iodine. Important health benefits of snake gourd are the ability to improve strength of the immune system, reduce fever, detoxify the body, treat diabetes, improve the digestive process of the body, increase hydration in the body, boost the strength and quality of hair and aid in weight loss (Velioglu *et al*., 1998) [33].

Open field agriculture is difficult as it involves large space, lot of labour and large volume of water. In most urban and industrial areas, soil is less available for crop growing, or in some areas, there is scarcity of fertile cultivable arable lands due to their unfavorable geographical and topographical conditions. Other serious problem experienced is to hire labour at regular times for conventional open field agriculture. Soilless culture in which plants are raised without soil is becoming more relevant in the present scenario especially for vegetable crops (Joseph and Muthuchamy 2014) [11].

Huge volume of agriculture and industrial waste produced annually in India and through recycling they can become an organic source for agriculture. This waste can be effectively used to prepare growing media for plants. Use of suitable growing media is essential for production of quality horticultural crops. A good growing medium have to provide sufficient anchorage to the plant, serve as reservoir for nutrients and water, allow oxygen diffusion to the roots and permit gaseous exchange among roots, media and atmosphere. Having a better understanding on the soil-water-plant relationship will help in focusing research for a soilless culture.

Irrigation by matric suction is a new technique in which moisture is continuously supplied to growbag media without break from bottom to top. Water is circulated in tubs through pipes at the bottom of pots, where growing media is placed. There is no drainage/ leaching leading to loss of water as well as nutrients. Always moisture is kept at optimum range in growing media from sowing to harvest. Fertilization is possible at right concentration by placing fertilizer pellet pack in the growbag media. Fertilization by fertilizer pellet pack has also been standardized recently as a new method for steady nutrient supply to crops (Tamilselvi and Arulmozhiselvan, 2018) [31]. In order to evaluate the effect of different growing media and methods of fertilization on growth, yield and quality the present study was conducted in snake gourd crop under matric suction irrigation in open field condition.

Materials and Methods

In the present study snake gourd crop was raised in pots in open field with a set up to provide water to the pots by matric suction irrigation. In each pot growing media was filled and the crop was raised.

Components of matric suction irrigation

Matric suction arises due to interaction of water with the matrix of solid particles. With the increase in media water content, matric suction decreases and water is more prone to free movement in the system. In unsaturated media, water moves in the direction of decreasing matric potential from a region of lower matric suction to a region with higher matric suction.

The system consists of components such as water tank, water level maintaining plastic tray with ball valve assembly, series of plastic base tubs interconnected through the 20 mm drip tubes (Figure 1). The base tubs are linked with water level maintaining tray through pipe to ensure the uniform flow in all the base tubs due to gravitational force. This was possible because all the tubs were aligned on the platform fixed at the same level. Each base tub contains one plastic growing media container having five holes (8 mm) at the bottom to admit water from the tub to media.

In each media container a nylon mesh (No. 4) with an area of 18 square inch was placed at the bottom and filled with sand as base media to a height of 4 inch. Base media is partly submerged in the water maintained in base tub which is located at bottom of each container. Above the sand media, again a nylon mesh with an area of 18 square inch was placed to check the downward particle movement of growing media and above the nylon mesh growing media was filled to a height of 9 inch. Through matric and capillary suction the base media gets moistened first by contact with water, later maintains almost saturated moisture content (Figure 2). Successively the growing media gets moistened by the virtue of only matric suction.

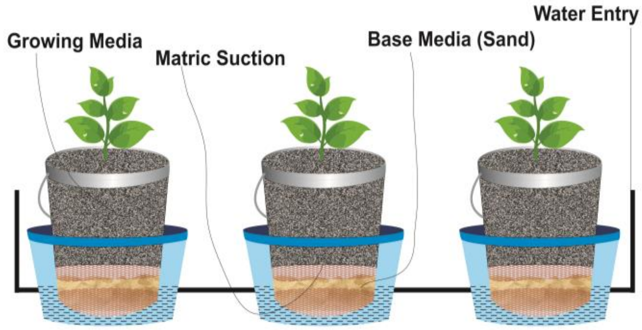

Fig 1: Diagrammatic representation of matric Suction irrigation in pots

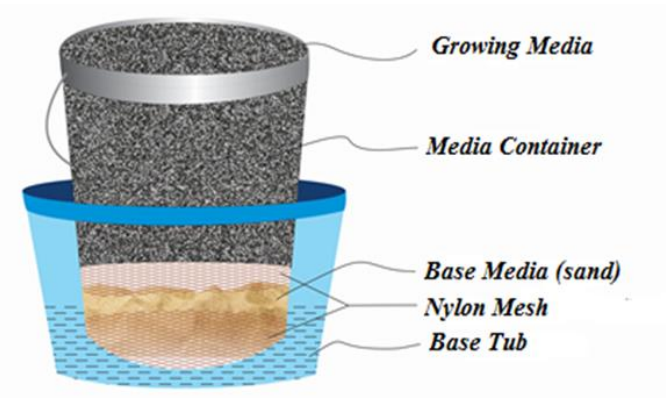

Fig 2: Components of growing media container

Fertilization by fertilizer pellet pack placement

The composition of fertilizer pellet was worked out according to the blanket recommended fertilizer dose of snake gourd of 6:12:12 g of N, P_2O_5 and K_2O. In the fertilizer pellet used for snake gourd, urea, DAP and MOP were mixed to contribute 3000:6000:6000 mg of N, P_2O_5 and K_2O, Then the mixture was pelleted in to 25g pellets. These pellets were then encapsulated in the polymer coated paper pouch and sealed. The encapsulated fertilizer pellet is called as Fertilizer Pellet Pack (FPP). Two fertilizer pellet packs were placed at the bottom layer of growing media in the respective treatments.

Fertilization by fertilizer solution addition

The composition of fertilizer solution was worked out according to the fertigation recommended fertilizer dose for snake gourd crop (75:25:100 kg N, P_2O_5 and K_2O ha^{-1}). Total dosage was divided by the plant population per hectare and per plant requirement was found out. Accordingly, the calculated quantity of water soluble fertilizers viz., 19:19:19 and sulphate of potash were mixed to contribute 37.5:12.5:50 g of N, P_2O_5 and K_2O per plant, which was applied in 12 split doses. Each dose was dissolved in one liter of water and applied around the root zone of the crop in the respective fertilizer solution treatments, starting from 30th days after sowing (DAS) at weekly interval.

Experimental set up and treatments

An open field experiment was carried out in the premises of Tamil Nadu State Agricultural Marketing Board Training Centre, Salem, during *kharif* season in the year 2017-18, in order to standardize growing media suitable for growing snake gourd under matric suction irrigation.

The experimental site lies between the latitude of 11⁰36.500' North and longitude of 78⁰5.634' East with an altitude of 253 meters above the mean sea level. The growing media containers placed in 6 x 3 factorial completely randomized design with 3 replications (Figure 3). The test crop of snake gourd (CO-2) was sown on 24 August 2017 and final harvest was done on 24 December 2017

Fig 3: Experimental set up of growing media containers under matric suction irrigation.

Treatments (Growing media and Method of fertilization)

Factor 1	
Growing Media	M_1 – Commercial Pot Mixture – Soil: Sand: FYM (1:1:1)
	M_2 – Cocopeat: Vermicompost (1:1)
	M_3 – Cocopeat: Biocompost (1:1)
	M_4 – Cocopeat: Vermicompost: Fly ash (1:1:1)
	M_5 – Cocopeat: Biocompost: Fly ash (1:1:1)
	M_6 – Cocopeat: Vermicompost: Pressmud (1:1:1)
Factor 2	
Method of Fertilization:	F_1 – Control
	F_2 – Fertilizer Pellet Pack Placement
	F_3 – Fertilizer Solution

Lay out of matric suction irrigation in open experimental field

In the demarked experimental area, according to treatments and replications, 54 platforms were laid by using fly ash bricks in 9 x 6 rows with spacing of 3 m on either side. The fly ash brick platforms were constructed in such a way that all platforms are in a same alignment having uniform level by adopting tube level method. On the platforms tubs were positioned and interconnected to ensure the water flow due to gravitational force. The growing media containers were placed over the base tubs according to randomization order.

The results of analysis of growing media and method of fertilization on plant growth and yield parameters of crops and quality attributes of fruits were subjected to analysis of variance (Panse and Sukhatme 1985) [22] to find out the performance of snake gourd crop.

Results

Initial characteristics of experimental media

The different growing media used for experiment were collected from different places and their physico-chemical properties viz., pH, EC, organic C, total N, P and K were analyzed (Table 1).

Plant growth parameters

Growth parameters such as primary vine length, number of braches per primary vine, number of nodes per primary vine and root length per pot were observed after final harvest (Table 2). Among the growing media, the highest primary vein length (657.7 cm), number of branches per primary vine (11.44) and number of nodes per primary vine (46.44) were recorded with the plants in the media consisting of Cocopeat : Vermicompost : Fly ash, whereas the lowest primary vine length (426.0 cm), number of branches per primary vine (7.44) and number of nodes per primary vine (24.78) were registered for the growing media having the composition of Cocopeat: Biocompost and which was at par with Cocopeat: Biocompost: Fly ash.

Among the method of fertilization application, fertilizer solution was more effective than FPP. The highest primary vein length (854.0 cm), number of branches per primary vine (14.33), and number of nodes per primary vine (61.33) were recorded in plants raised in Cocopeat: Vermicompost: Fly ash under fertilizer solution method. A similar trend was observed for root length of snake gourd, which ranged from 58.47 to 74.27 cm.

Yield Parameters

The results clearly indicated that the yield attributes of snake gourd (Table 3 and 4) significantly differed among the various growing media and method of fertilization experimented. Among the growing media tested, the media containing Cocopeat: Vermicompost: Fly ash recorded the highest values in yield parameters and yield.

Application of nutrients through fertilizer solution recorded the higher values in yield parameters and yield than placement of nutrients as FPP. The total fruit yield ranged from 4.72 to 19.64 kg pot^{-1}. The growing media having the composition of Cocopeat: Vermicompost: Fly ash receiving fertilization as fertilizer solution ($M_4 F_3$) gave the highest fruit yield of 19.64 kg pot^{-1}. In the case of growing media having Cocopeat: Vermicompost applied with fertilizer solution ($M_2 F_3$) registered moderately high yield (16.17 kg pot^{-1}). The lowest yield was observed with growing media containing Cocopeat: Biocompost (4.72 kg pot^{-1}) and Cocopeat: Biocompost: Fly ash (4.79 kg pot^{-1}) with no fertilization. Obliviously, a similar trend was also observed in total fruit dry matter which ranged between 319.3 and 1328.0 g pot^{-1}.

Fruit quality parameters

Fruit quality parameters (Table 5) viz., crude protein, crude fiber and ascorbic acid contents of snake gourd fruit varied significantly owing to various growing media and methods of fertilization. It was observed that the fruit of plants raised with growing media comprising of Cocopeat: Vermicompost: Fly ash registered significantly the highest contents of crude protein (10.29%), crude fiber (0.82%) and ascorbic acid (11.88 mg 100 g^{-1}), which was followed by the media having Cocopeat : Vermicompost recording moderate values in quality parameters. The fruits of plants applied with fertilizer solution recorded the high crude protein (10.28%), crude fiber (0.80%) and ascorbic acid (11.63 mg 100 g^{-1}) when compared to FPP.

Discussion

The pot experiment set up in the open field with vine climbing structure, conducted to study the effect of different growing media and method of fertilization on snake gourd under matric suction irrigation showed promising results with the media containing Cocopeat: Vermicompost: Fly ash composed in equal proportion on dry weight basis when nutrients were supplied through fertilizer solution. In the growing media wherever Cocopeat and vermicompost were used, there was enhancement in growth. In addition to cocopeat and vermicompost when fly ash was combined there was exceptionally high growth and yield. This supportive performance of fly ash might be due to the presence of substantial essential plant nutrients such as N, P, K, Ca, Mg, S and micronutrients, besides having high water holding capacity (58.2%) due to its fine texture and high surface area. Fly ash has already been recognized as a potential source for increasing the availability of mineral nutrients for plant growth (Mittra *et al.* 2005; Lee *et al.* 2007; Pandey and Singh 2010) [17, 14, 21]. Sikka and Kansal (2000) [29], Lee e*t al.* (2005) [15] and Jala and Goel (2006) [9] reported that in combination with various organic manures, fly ash can enhance soil microbial activities, nutrient availability and plant productivity.

Such increase in growth was also attributed to continuous supply of nutrients incrementally by fertilizer solution, throughout the crop period to meet the full nutritional requirement of snake gourd crop. In a similar study, Thriveni *et al.* (2015) [32] recorded the highest vine length and number of branches per vine of bitter gourd when grown with 100 per cent NPK integrated with vermicompost and bio fertilizers. Similarly, Jeyaraman *et al*., (2008) [10] have also recorded in snake gourd.

The results on the fruit yield of snake gourd distinctly indicated the importance of combing right fertilization with right composition of growing media for getting an enhanced production. All the growing media fertilized with fertilizer solution treatments significantly increased the yield of fruits over control. The yield recorded was highest in the media having the combination of Cocopeat: Vermicompost: Fly ash with fertilizer solution, as this media would have provided good anchorage and supply of most of the inherently bound macronutrients and micronutrients. Further, the incremental application of fertilizer solution would have in addition provided readily available forms of N, P, and K nutrients.

In general, integration of fly ash with inorganic fertilizer and FYM produced considerably higher grain and straw yield in rice than all other treatment combination as reported by Yeledhalli *et al*. (2008) [34] and Reddy *et al*. (2010) [26]. Bhople *et al*. (2011) [4] also observed that application of fly ash at increasing level in combination with N, P and K increased the grain and straw yield of rice.

Matte and Kene (1995) [16], Selvakumari *et al*. (2000) [28] and Yeledhalli *et al*. (2008) [34] reported increase in yield due to addition of fly ash in several crops. Selvakumari *et al*. (2000) [28] also reported the highest grain yield in rice when fly ash was applied in combination with compost, fertilizer and *Azospirillum*. The supply of nutrients, conducive physical environment leading to better aeration, increase in soil moisture holding capacity, root activity would have resulted due to complementary effect of fly ash when combining with FYM, which would have increased straw and grain yield of rice.

The superior influence of application of fertilizer solution on growth and yield attributes finally has enhanced fruit yield of snake gourd in the present study. Increase in yield due to application of water soluble form might have instantly supplied available fertilizer N, P and K in the root zone as in fertigation which would have facilitated direct absorption and translocation by plants more quickly, thereby resulted in higher photosynthetic activity. In a similar study, application of water soluble fertilizers through fertigation resulting in significant increase in plant growth parameters, yield parameters and quality parameters of fruits was observed by Gupta *et al.* (2010) [8] in tomato and Prabhakar *et al.* (2013) [24] in watermelon.

Irrespective of all the varying composition of growing media experimented, the fertilizer pellet pack placement of fertilization recorded considerable increase in yield of snake gourd over no fertilization. Yield parameters such as number of harvests, fruit length, fruit girth, number of fruits and single fruit weight were found influenced by fertilizer pellet pack placement. This might be due to slow release of nutrients spread over the cropping period promoting continuous growth of crop leading to an increased yield. Previously in different studies, increase in yield due to deep placement of fertilizer N, P and K in the form of Nutriseed Pack / Fertilizer Pellet Pack in the root zone was reported by Surabhi Hota and Arulmozhiselvan (2016) [30] in tomato, Raja Rajeshwaran and Arulmozhiselvan (2018) [25] in sugarcane and Tamilselvi and Arulmozhiselvan (2018) [31] in tomato.

Orozco *et al*. (1996) [20] reported that growing media containing vermicompost provided nutrients for the growth of crop adequately as vermicompost contains most plant nutrients in available forms such as nitrates, phosphates, exchangeable calcium and soluble potassium. Arancon *et al*. (1996) found out that there was occurrence of marked decrease in total N in soils where no application of vermicompost was made when compared to soil with vermicompost application. In vermicompost treated soils, the presence of large amount of total C and N in vermicompost could have provided enough N for mineralization, thereby increased N stabilization. Sangeeta Shree *et al.* (2018) [27] observed that combined application of vermicompost and inorganic fertilizers increased fruit weight and yield of bitter gourd. Similar findings were reported by Anuja and Poovizhi (2009) [1] in cucumber and Kameswari *et al*. (2011) [12] in sponge gourd.

Apart from providing mineral nutrients, vermicompost also contributes to the biological fertility by adding beneficial microbes to soil. Mucus, excreted through the digestive canal of earthworm, stimulates antagonism and competition between diverse microbial population resulting in the production of some antibiotics and hormones boosting plant growth (Edwards and Bohlen 1996) [5]. In addition, mucus accelerates and enhances decomposition of organic matter composing stabilized humic substances, which embody water-soluble phytohormonal elements (Edwards and Arancon 2004) [6] and plant available nutrients at high levels (Atiyeh *et al*., 2000) [3].

There was a significant difference in quality parameters of fruits among the media. The results on quality parameters clearly indicated the highest content of crude protein, crude fiber and ascorbic acid in the fruits of snake gourd grown in media consisting Cocopeat: Vermicompost: Fly ash fertilized with fertilizer solution. This might be due to the continuous supply of readily available nutrients by periodical application of fertilizer solution, synergistically interacting with vermicompost and fly ash. Several studies indicated that application of organic manures along with inorganic fertilizers enhanced quality aspects of fruit. This quality improvement might be due to quick metabolic transformation of soluble compounds and more conversion of metabolites into amino acids and sugar (Gawande *et al.*, 1998; Kumar *et al.*, 2016 and Phookan *et al.*, 2016) [7, 13, 23]. Mohan Kumar *et al.* (2017) observed that the highest value of ascorbic acid and total soluble solids were observed with application of 100% N through vermicompost with panchagavya (3%) in snake gourd. The lower content of quality aspects has resulted in the fruits of plants raised in the growing media having the composition of Cocopeat : Biocompost : Fly ash which could be attributed to inadequate supply of nutrients due to antagonistic effect between biocompost and fly ash, since biocompost is having higher concentration of soluble salts.

The promising effect of matric suction irrigation has been identified in the present study as an alternative means for surface irrigation. Matric suction irrigation reduces the labour cost and suits for easy maintenance, as one-time installation of the set up provides water to crop year-round. Water is circulated in pipes at the bottom of pots all the time where growing media container is placed. There is no drainage/ leaching leading to prevention of water loss as well as nutrients. Always moisture is kept at optimum range in growing media. There is no drying cycle from sowing to harvest. Based on these advantages, it is concluded that crop production by matric suction irrigation using the growing media identified in the present study may suit well for terrace garden as well as in leveled wastelands with limited water availability.

Table 1: Characteristics of substrates and growing media

S. No	Substrates/Growing Media	pH	EC (dS m^{-1})	OC (%)	Total Nutrients (%)			C/N Ratio
					N	P_2O_5	K_2O	
1.	Farmyard manure	7.63	0.58	13.78	0.54	0.28	0.69	26
2.	Vermicompost	6.84	0.64	15.36	1.52	0.77	1.20	10
3.	Cocopeat	6.72	0.68	28.56	0.26	0.06	1.38	110
4.	Fly ash	5.91	0.13	1.72	0.05	0.28	0.54	34
5.	Pressmud	6.78	2.86	19.14	1.36	2.79	1.46	14
6.	Biocompost	7.41	3.41	24.18	1.68	2.17	1.86	14
7.	(M_1) Soil: Sand: FYM	7.58	0.78	3.20	0.39	0.18	0.55	8
8.	(M_2) CP: VC	6.78	0.68	20.74	0.68	0.48	1.30	30
9.	(M_3) CP: BC	7.35	2.84	22.32	1.28	0.90	1.61	17
10.	(M_4) CP: VC: FA	6.74	0.68	12.18	0.58	0.39	1.14	21
11.	(M_5) CP: BC: FA	6.68	2.46	12.61	0.62	0.53	1.34	20
12.	(M_6) CP: VC: PM	6.72	1.88	19.27	0.98	1.24	1.38	20

CP	Cocopeat	PM	Pressmud	FYM	Farmyard Manure
VC	Vermicompost	BC	Biocompost	M_1 to M_6	Growing Media
FA	Fly ash				

Table 2: Effect of growing media and fertilization on growth parameters of snake gourd (*Kharif* 2017-18)

Media	Fertilization		Growth Parameters			
			Primary vein length (cm.)	No. of branches/ primary vein^{-1}	No. of nodes primary vein^{-1}	Root length pot^{-1} (Cm.)
Soil: Sand: FYM (M_1)	F_1	Control	318.0	6.00	18.67	65.33
	F_2	FPP	433.0	7.33	24.00	67.67
	F_3	FS	629.0	10.67	37.00	69.87
Mean			460.0	8.00	26.56	67.62
CP : VC (M_2)	F_1	Control	390.0	7.00	26.00	66.87
	F_2	FPP	571.0	9.67	41.00	69.80
	F_3	FS	768.0	12.67	55.00	71.87
Mean			576.3	9.78	40.67	69.51
CP : BC (M_3)	F_1	Control	325.0	6.00	18.00	58.50
	F_2	FPP	419.0	7.00	24.67	60.17
	F_3	FS	534.0	9.33	31.67	63.77
Mean			426.0	7.44	24.78	60.81
CP : VC : FA (M_4)	F_1	Control	447.0	8.33	29.67	70.67
	F_2	FPP	672.0	11.67	48.33	72.40
	F_3	FS	854.0	14.33	61.33	74.27
Mean			657.7	11.44	46.44	72.44
CP : BC : FA (M_5)	F_1	Control	322.1	6.00	17.67	58.47
	F_2	FPP	421.0	7.00	24.67	60.37
	F_3	FS	546.0	9.33	32.33	64.63
Mean			429.7	7.44	24.89	61.16
CP : VC : PM (M_6)	F_1	Control	353.0	6.33	23.33	65.73
	F_2	FPP	526.0	9.33	37.67	68.40
	F_3	FS	685.0	11.67	48.67	70.27
Mean			521.3	9.11	36.56	68.13
Fertilization Mean	F_1	Control	359.2	6.61	22.22	64.26
	F_2	FPP	507.0	8.67	33.39	66.47
	F_3	FS	669.3	11.33	44.33	69.11

CD (P=0.05)	SEd	CD	SEd	CD	SEd	CD	SEd	CD
Media (M)	6.60	13.39	0.22	0.45	0.53	1.08	0.67	1.37
Fertilization (F)	4.67	9.47	0.16	0.32	0.38	0.76	0.48	0.97
M X F	11.43	23.18	0.38	0.78	0.92	1.87	1.17	NS

CP	Cocopeat	PM	Pressmud	FPP	Fertilizer Pellet Pack
VC	Vermicompost	BC	Biocompost	FS	Fertilizer Solution
FA	Fly ash	FYM	Farmyard Manure		

Table 3: Effect of growing media and fertilization on yield parameters of snake gourd (*Kharif* 2017-18)

Media	Fertilization		Yield Parameters			
			Days to first harvest	No. of harvests	Fruit length (Cm.)	Fruit girth (Cm.)
Soil: Sand: FYM (M_1)	F_1	Control	52.33	6.67	21.60	18.23
	F_2	FPP	51.67	8.00	24.17	19.40
	F_3	FS	51.67	9.67	27.23	21.43
Mean			51.89	8.11	24.33	19.69
CP : VC (M_2)	F_1	Control	52.33	8.33	25.70	19.53
	F_2	FPP	51.67	9.67	28.43	21.60
	F_3	FS	51.00	10.33	32.27	22.53
Mean			51.67	9.44	28.80	21.22
CP : BC (M_3)	F_1	Control	60.33	5.67	20.47	18.40
	F_2	FPP	59.00	7.00	22.43	18.43
	F_3	FS	57.33	8.67	24.70	19.43
Mean			58.89	7.11	22.53	18.76
CP : VC : FA (M_4)	F_1	Control	51.67	9.33	27.40	20.37
	F_2	FPP	51.00	10.67	30.63	22.73
	F_3	FS	51.00	11.67	35.77	24.20
Mean			51.22	10.56	31.27	22.43
CP : BC : FA (M_5)	F_1	Control	61.33	6.33	20.50	17.33
	F_2	FPP	61.00	7.33	22.20	18.37
	F_3	FS	60.33	8.33	24.33	19.40
Mean			60.89	7.33	22.34	18.37
CP : VC : PM (M_6)	F_1	Control	53.67	7.33	22.80	18.53
	F_2	FPP	52.33	8.67	25.63	19.67
	F_3	FS	51.67	10.33	29.47	21.87
Mean			52.56	8.78	25.97	20.02
Fertilization Mean	F_1	Control	55.28	7.28	23.08	18.73
	F_2	FPP	54.44	8.56	25.58	20.03
	F_3	FS	53.83	9.83	28.96	21.48

CD (P=0.05)	SEd	CD	SEd	CD	SEd	CD	SEd	CD
Media (M)	0.65	1.32	0.26	0.52	0.31	0.63	0.22	0.46
Fertilization (F)	0.46	0.93	0.18	0.37	0.22	0.44	0.16	0.32
M X F	1.13	NS	0.44	NS	0.53	1.08	0.39	0.79

CP	Cocopeat	PM	Pressmud	FPP	Fertilizer Pellet Pack
VC	Vermicompost	BC	Biocompost	FS	Fertilizer Solution
FA	Fly ash	FYM	Farmyard Manure		

Table 4: Effect of growing media and fertilization on yield parameters of snake gourd (*Kharif* 2017-18)

Media	Fertilization		Yield Parameters			
			No. of fruits pot^{-1}	Single fruit weight (g)	Yield (kg pot^{-1})	Fruit dry matter (g pot^{-1})
Soil:Sand:FYM (M_1)	F_1	Control	24.00	203.8	4.89	321.6
	F_2	FPP	31.67	234.0	7.41	508.6
	F_3	FS	42.67	267.2	11.40	780.6
Mean			32.78	235.0	7.90	536.9
CP : VC (M_2)	F_1	Control	33.33	218.4	7.28	485.2
	F_2	FPP	42.67	252.2	10.76	734.7
	F_3	FS	55.00	294.0	16.17	1096
Mean			43.67	254.9	11.40	772.1
CP : BC (M_3)	F_1	Control	25.00	188.8	4.72	319.3
	F_2	FPP	31.00	219.7	6.81	457.7
	F_3	FS	37.67	255.4	9.62	652.4
Mean			31.22	221.3	7.05	476.4
CP : VC : FA (M_4)	F_1	Control	39.67	240.7	9.55	646.7
	F_2	FPP	47.00	277.7	13.05	864.2
	F_3	FS	60.33	325.5	19.64	1328

Mean			49.00	281.3	14.08	946.2
CP : BC : FA (M_5)	F_1	Control	25.00	191.6	4.79	328.3
	F_2	FPP	29.67	220.1	6.53	441.4
	F_3	FS	37.67	251.4	9.47	648.2
Mean			30.78	221.0	6.93	472.6
CP : VC : PM (M_6)	F_1	Control	32.00	209.7	6.71	448.4
	F_2	FPP	38.00	240.3	9.13	620.2
	F_3	FS	47.67	280.7	13.38	910.5
Mean			39.22	243.5	9.74	659.7
Fertilization Mean	F_1	Control	29.83	208.8	6.32	424.9
	F_2	FPP	36.67	240.6	8.95	604.5
	F_3	FS	46.83	279.0	13.28	902.6

CD (P=0.05)	SEd	CD	SEd	CD	SEd	CD	SEd	CD
Media (M)	0.44	0.88	2.94	5.96	0.13	0.26	11.21	22.74
Fertilization (F)	0.31	0.62	2.08	4.22	0.09	0.19	7.93	16.08
M X F	0.75	1.53	5.09	NS	0.22	0.46	19.42	39.38

CP	Cocopeat	PM	Pressmud	FPP	Fertilizer Pellet Pack
VC	Vermicompost	BC	Biocompost	FS	Fertilizer Solution
FA	Fly ash	FYM	Farmyard Manure		

Table 5: Effect of growing media and fertilization on quality parameters of snake gourd (*Kharif 2017*-18)

Media	**Fertilization**		**Quality parameters**		
			Crude protein (%)	**Crude fiber (%)**	**Ascorbic acid (mg 100g $^{-1}$)**
Soil: Sand: FYM (M_1)	F_1	Control	8.00	0.76	9.68
	F_2	FPP	9.06	0.76	10.47
	F_3	FS	10.38	0.80	11.20
Mean			9.15	0.77	10.45
CP : VC (M_2)	F_1	Control	8.94	0.79	10.66
	F_2	FPP	9.94	0.79	11.27
	F_3	FS	10.75	0.81	12.11
Mean			9.88	0.80	11.35
CP : BC (M_3)	F_1	Control	7.69	0.74	9.59
	F_2	FPP	8.63	0.75	10.40
	F_3	FS	9.63	0.79	11.17
Mean			8.65	0.76	10.38
CP : VC : FA (M_4)	F_1	Control	9.31	0.80	11.13
	F_2	FPP	10.25	0.81	11.89
	F_3	FS	11.31	0.84	12.61
Mean			10.29	0.82	11.88
CP : BC : FA (M_5)	F_1	Control	7.56	0.73	9.61
	F_2	FPP	8.25	0.76	10.36
	F_3	FS	9.31	0.79	11.04
Mean			8.37	0.76	10.34
CP : VC : PM (M_6)	F_1	Control	8.50	0.76	10.33
	F_2	FPP	9.31	0.77	10.92
	F_3	FS	10.31	0.80	11.65
Mean			9.38	0.78	11.00
Fertilization Mean	F_1	Control	8.33	0.76	10.17
	F_2	FPP	9.24	0.77	10.89
	F_3	FS	10.28	0.80	11.63

CD (P=0.05)	SEd	CD	SEd	CD	SEd	CD
Media (M)	0.12	0.25	0.011	0.022	0.12	0.25
Fertilization (F)	0.09	0.18	0.008	0.015	0.09	0.17
M X F	0.21	NS	0.018	NS	0.21	NS

CP	Cocopeat	PM	Pressmud	FPP	Fertilizer Pellet Pack
VC	Vermicompost	BC	Biocompost	FS	Fertilizer Solution
FA	Fly ash	FYM	Farmyard Manure		

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