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ORIGINAL ARTICLE

Effect of Growing Media on Ginger *(Zingiber Officinale* Rosc*.)* Production under Different Growing Situations.

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ABSTRACT
The promising and significant effect on growth attributes and yield contributing characters were observed by growing ginger with growth media of 40% cocopeat + 30% red soil + 20% vermicompost +10% sand (T_{10}) over other growth media. Better amount of cocopeat (40%) created aerated condition in pots and fast mineralization of applied vermicompost (20%) and less amount of sand (10%) in addition to amount of vermicompost through slurry application might have helped in more response to organics which in turn increased dry weight of ginger pot^{-1} (g) thereby favoured growth and yield contributing characters . The next treatment in order of sequence found to be growing of ginger under shade net by using growth media of 40% Cocopeat + 30% Red soil + 20% FYM + 10% Sand (T_9) . Ginger is known to respond more to organics than inorganic fertilization.
Keywords*: Ginger, growing media, growing situations, polyhouse, shade net, open field.*

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INTRODUCTION

Ginger *(Zingiber officinale* Rosc*.)* is known in India from ancient times. Ginger was one of the oriental spices to reach southeastern Europe in the ancient spice trade. It belongs to the family *Zingiberaceae* under the natural order scitaminae. Ginger is a herbaceous perennial and is an underground rhizome about 2 to 2.5 cm in diameter and is branched. Roots are fibrous and go up to 20 to 30 cm soil depth. Leaves are thin and lanceolate . Ginger grows best in warm and humid climate and mainly grown in tropic up to an elevation of 1500 m above sea level. It is a shade loving plant requires ample moisture for growth.

In Maharashtra, the area under ginger was 3,360 hectares [1]. Cultivation of ginger in a specialized way is carried out in Satara district of Maharashtra which contributes the maximum to the total ginger production as compared to other places in the state. The largest area under ginger was 2500 hectares with a production of 50000 tonnes was recorded in Satara district of Maharashtra. The per hectare productivity of ginger in Maharashtra accounts about 2000 kg ha^{-1} [1].

The high yield of ginger is a function of the adequate and timely supply of plant nutrients. Among the various agronomic technologies influencing the production of ginger, the nutrient is found to exert great influence on growth and yield of ginger. Imbalance and low or no fertilizer application is one of the most important factors in obtaining the poor yield.

Nowadays people are becoming health conscious and started avoiding consumption of food which contains chemical residues and using organically produced food. Looking at the importance of organic manures, biofertilizers and inorganic fertilizers and their integrated effect on crop production both qualitatively and quantitatively. Ginger is such a crop which response to organic manures. Organic manures improve the quality of ginger and develop ginger rhizome which will in turn increased rhizome yield. In spite of that, ginger is shade loving crop too. The study presented here describes a new research topic that has not been previously reported. This experiment is accepted with a scope that ginger can be

grown in the city area. In the system, the rhizomes can be grown in different growth media under growing situations *viz.,* polyhouse, shade net and open environment.

MATERIALS AND METHODS

An experiment was laid out during summer, 2015-2016 in Polyhouse No. 7, Shadenet No. 7 and the open field at Hi-Tech Floriculture and Vegetable Project, College of Agriculture, Pune.

The exact location of Pune is at North latitude of 18.22' and 73.51'. East longitude in the plain zone having an altitude of 557.7 m above the mean sea level (MSL). Middle of June to middle of October (south-west monsoon) are the monsoon months during which the maximum annual rainfall is received. An average 714 mm rainfall usually received in this area, out of which 75% is received during the months from June to September mainly due to South-West monsoon and the remaining from North-East monsoon during October and November.

Table1: Treatment details with their symbols

Treatment	Proportion(%)	Media used
T_1	100	Red soil
T_2	100	Cocopeat
T_3	80:20	Red soil + Sand
T_4	40:40:20	Cocopeat +Red soil + Sand
T_5	80:10:10	Cocopeat + F.Y.M. + Sand
T_6	80:10:10	Red soil + F.Y.M. + Sand
T_7	80:10:10	Cocopeat + Vermicompost + Sand
T_8	80:10:10	Red soil + Vermicompost + Sand
T_9	40:30:20:10	Cocopeat + Red soil + F.Y.M + Sand
T_{10}	40:30:20:10	Cocopeat + Red soil + Vermicompost + Sand
T_{11}	40:30:10:10:10	Cocopeat+Red soil +F.Y.M + Vermicompost + Sand

Growing situations: Shadenet, polyhouse and open field situations

An experiment was conducted in Factorial Completely Randomized Block Design with 11 treatments replicated thrice. Mahim variety of ginger was transplanted in pots on 8th May, 2015 and harvested on 7th Feb, 2016.Growth contributing characters in ginger (viz. plant height, number of tillers (shoots) plant^{-1}, number of functional leaves plant^{-1} and leaf area plant^{-1}) were recorded at an interval of 28 days from 70 DAT. Yield contributing characters viz. fresh and dry weight of rhizomes pot^{-1} were recorded at harvest.

1 Plant height

The plant height was recorded from ground level up to the base of the upper most fully opened leaf on the tallest (main) shoot of the plant. The height of the plant was expressed in centimetres.

2 Number of shoots/tillers

A number of the green shoots produced by the plant which planted in each pot was counted by excluding the main shoot and their average value was worked out.

3 Green or fresh weight of rhizome plant^{-1}

At the time of harvesting, the plant was uprooted from each pot and cleans separately. The yield of the plant was reported as green rhizome yield (g) plant^{-1}.

4 Dry matter weight of rhizome per plant

The dry weight of rhizome was usually recorded by using the rhizome used for determining the fresh or green weight. These rhizomes were sun-dried and then oven dried at 65±°C till a constant weight was obtained. The rhizomes were then weighed for their dry matter after harvest.

RESULTS AND DISCUSSION

Mean of all observations growth attributes recorded at 70, 98, 126, 154, 182, 210 DAT and at harvest are recorded in table 1 while yield attributes are in table 2. The growth attributes *viz.,* plant height, number of tillers, number of leaves, leaf area and the yield contributing characters *viz., the* fresh and dry weight of rhizome pot^{-1} (g) was favourably influenced by all the growth media.

The promising and significant effect on growth attributes were observed by growing ginger with growth media of 40% cocopeat + 30% red soil + 20% vermicompost +10% sand (T_{10}) over other growth media throughout the growing period of the ginger crop. Plant height (98.5cm), number of tillers (12.9), number of function leaves (102.7), leaf area (25.1dm^2), the Fresh weight of rhizome pot^{-1} (485.17g), fresh weight of rhizome pot^{-1} (289.44g) under shade net condition. Better amount of cocopeat (40%) created aerated condition in pots and fast mineralization of applied vermicompost (20%) and less amount of sand (10%) in addition to amount of vermicompost through slurry application might have helped in more response to

organics thereby favoured growth and yield contributing characters which inturn increased dry weight of ginger pot^{-1}(g). The next treatment in order of sequence found to be growing of ginger under shadenet by using growth media of 40% Cocopeat + 30% Red soil + 20% FYM + 10% Sand (T_9). Yield attributes like fresh weight (485.17g) and dry weight (289.44g) were observed by growing ginger also high with growth media of 40% cocopeat + 30% red soil + 20% vermicompost +10% sand (T_{10}) over other growth media throughout the growing period of the ginger crop. These findings corroborate the findings of Lalramthara *et al*. [3]. The maximum Plant height, No. of tillers, No. of functional leaves i.e. the period of grand growth was observed in between 126 to 154 DAT. These findings corroborate with the findings of Jadwiga [2]. leaf area plant^{-1} of ginger was highest at 210 DAT as when the ginger crop was grown under all shadenet situation, polyhouse and open situations. This was mainly due to the architecture of canony, interception of solar radiation used in producing a number of functional leaves and losses in respiration. A shade-loving characteristics of ginger crop favoured the increased plant height. Similar results were reported by Nangare [4].

Effect of interaction

The interaction effect between growing situations and growth media on growth attributes *viz.,* plant height, number of tillers, number of functional leaves, leaf area and the yield contributing characters *viz*., the fresh and dry weight of rhizome pot^{-1} (g) were found significant.

The promising and significant effect on growth attributes and yield contributing characters were observed when ginger was grown under shade net condition by using growth media of 40% cocopeat + 30% red soil + 20% Vermicompost+ 10% sand (T_{10}).

Table 1: Mean growth contributing characters of ginger thorough tout the growth period as influenced by different treatments.

Growth characters	Plant height(cm)			Number of tillers			Number of functional leaves			Leaf area(dm^2)		
Treatment	Shade net	Poly-house	Open field	Shade net	Poly-house	Open field	Shade net	Poly-house	Open field	Shade net	Poly-house	Open field
T_1	76.9	58.0	36.3	9.4	7.7	4.7	76.4	71.1	36.6	21.2	18.6	13.7
T_2	62.7	25.9	28.1	8.4	6.7	4.5	41.4	25.9	16.6	19.4	14.3	8.6
T_3	71.8	55.9	34.1	9.2	7.5	4.6	71.0	61.2	31.6	21.0	16.8	13.2
T_4	69.1	50.9	31.3	8.6	7.3	4.5	48.2	53.6	29.4	20.0	15.2	11.0
T_5	81.8	58.7	40.0	9.7	7.8	4.8	82.2	73.1	39.6	21.6	18.9	14.1
T_6	85.3	59.5	42.2	9.9	7.9	4.9	85.5	75.9	45.0	22.2	19.1	14.4
T_7	86.7	62.8	45.4	10.1	8.4	5.1	87.8	79.0	55.3	22.6	19.4	15.1
T_8	88.4	65.5	45.8	10.8	8.7	5.2	90.2	80.8	60.2	23.5	20.0	15.4
T_9	96.3	70.1	48.1	11.7	8.9	6.2	101.3	89.8	64.4	24.4	21.4	16.2
T_{10}	98.5	72.2	50.3	12.9	9.6	6.4	102.7	92.7	66.9	25.1	22.6	17.8
T_{11}	90.6	66.6	46.6	11.1	8.9	5.6	92.7	81.8	62.4	23.9	21.0	15.5

Table2: Mean fresh and dry weight of rhizome pot $^{-1}$ (g) in ginger as influenced by different treatments at harvest

Sr. No.	Treatment	Fresh weight (pot^{-1}g)			Dry weight (pot^{-1}g)		
		Shade net	Poly-house	Open field	Shade net	Poly-house	Open field
T_1	100% Red soil	258.87	118.57	162.40	77.55	50.80	41.90
T_2	100% Cocopeat	133.73	51.83	35.00	57.67	25.60	8.10
T_3	80% Red soil + 20% Cocopeat	240.60	115.50	112.73	69.00	31.90	24.50
T_4	40% Cocopeat + 40% Red soil +20% Sand	140.97	98.67	56.90	60.13	19.67	16.35
T_5	80% Cocopeat + 10% F.Y.M. + 10% Sand	261.77	198.10	163.87	113.27	61.30	58.90
T_6	80% Red soil + 10% F.Y.M. + 10% Sand	307.87	203.37	174.60	115.30	63.90	47.24
T_7	80% Cocopeat + 10% Vermicompost +10% Sand	395.07	210.63	177.80	116.97	65.60	58.04
T_8	80% Red Soil + 10% Vermicompost + 10% Sand	414.63	247.73	191.93	134.53	80.33	78.05
T_9	40% Cocopeat+30% Red soil+20% F.Y.M.+ 10% Sand	482.07	268.83	236.00	283.30	83.73	57.24
T_{10}	40% Cocopeat + 30% Red soil + 20% Vermicompost+ 10% Sand	485.17	275.50	295.20	289.44	118.53	86.41
T_{11}	40% Cocopeat + 30% Red soil + 10% F.Y.M. + 10% Vermicompost+ 10% Sand	434.37	261.87	231.10	143.50	80.93	66.51

This might be due to optimum weather condition prevailed in shade net situation which in turn more interception of radiation as compared to polyhouse and open situations being a shade loving crop which inturns increased rhizome yield thereby all the growth and yield contributing characters of ginger.
A better amount of cocopeat (40%), F.Y.M. (20%) and less amount of sand (10%) in addition to the amount of vermicompost through slurry application might have helped in more response to organics which in turn increased rhizome yield thereby potassium uptake (g) of ginger.

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