International Journal of Chemical Studies

P-ISSN: 2349–8528
E-ISSN: 2321–4902
IJCS 2018; 6(4): 1469-1474

Received: 18-05-2018
Accepted: 25-06-2018

JM Vashi
Department of Vegetable Science, ASPEE College of Horticulture and Forestry Navsari Agricultural University, Navsari, Gujarat, India

SN Saravaiya
Department of Vegetable Science, ASPEE College of Horticulture and Forestry Navsari Agricultural University, Navsari, Gujarat, India

BN Patel
Department of Fruit Science, ASPEE College of Horticulture and Forestry Navsari Agricultural University, Navsari, Gujarat, India

KD Desai
Department of Vegetable Science, ASPEE College of Horticulture and Forestry Navsari Agricultural University, Navsari, Gujarat, India

AI Patel
Department of Vegetable Science, ASPEE College of Horticulture and Forestry Navsari Agricultural University, Navsari, Gujarat

Himani B Patel
Department of Vegetable Science, ASPEE College of Horticulture and Forestry Navsari Agricultural University, Navsari, Gujarat, India

Correspondence
JM VASHI
Department of Vegetable Science, ASPEE College of Horticulture and Forestry Navsari Agricultural University, Navsari, Gujarat, India

Response of different growing conditions on growth and tuber yield of greater yam (*Dioscorea alata* L.)

JM Vashi, SN Saravaiya, BN Patel, KD Desai, AI Patel and Himani B Patel

Abstract
A field experiment was carried out, with a view to study the Response of Greater Yam (*Dioscorea alata* L.) to different growing conditions at Vegetable Research Scheme, Regional Horticultural Research Station of the Navsari Agricultural University, Navsari, Gujarat, India during 2015-2016 and 2016-2017. The experiment was conducted in Large Plot; analysis as CRD with factorial concept (FCRD) with three repetitions which included three growing conditions (G_1: Naturally Ventilated Poly house, G_2: Net house and G_3: Open field), three planting distance (D_1: 60 cm x 60 cm, D_2: 60 cm x 45 cm and D_3: 90 cm x 90 cm) and two varieties (V_1: Round type and V_2: Long type). The results revealed that higher values for growth characters namely, number of tillers at harvest, vine length at harvest and fresh weight tuber and yield characters *viz*., tuber girth, tuber length and tuber yield 1000 m^{-2} were found significant in Naturally Ventilated Poly house on pooled analysis basis.

Keywords: Greater yam, growing conditions, naturally ventilated poly house

Introduction
Greater yam is primarily used for human consumption in the tropical and sub tropical regions. The yam tubers are rich source of carbohydrates, protein and amino acid. Normally tubers are consumed as boiled, baked or fried vegetables. It is also useful for making chips, flakes and flour. Greater yam is basically a dioecious twining herbaceous vine. Stems are 10 m or more in length and freely branching above. It possesses four wings on the thick stem, which twines to the right. The petiole has also wings. Leaves are ovate, cordate, bigger and opposite in phylotaxy. Tubers are variable in shape but mostly cylindrical. The skin of the tuber is black and brown, whereas flesh is white, yellowish, or purplish. Each plant may produce 1 to 3 tubers. Its cultivars rarely flower. Flowers are small, occasional, male and female arising from leaf axils on separate plants (*i.e.* dioecious species), male flowers having panicle which is 30 cm long, female flowers having smaller spikes. Fruit is botanically a 3 parted capsule and seeds are winged (Chadha, 2002) [5].

Protected cultivation practices can be defined as a cropping technique wherein the micro climate surrounding the plant body is controlled partially or fully as per the requirement of crops grown during their period of growth. With the advancement in horticulture various types of protected cultivation practices suitable for a specific type of agro-climatic zone have emerged. Among these protective cultivation practices, poly green house, net house, shade house, plastic tunnel *etc*. are very useful for India. This technology can be adopted by the rural youth for more income per unit of land. The improvement in economy of farmers with the decreasing land holding is also possible through the protected cultivation by increasing production per unit area. The glut of vegetable during a short period of harvesting is also the problem in the country which can be minimized with the protected cultivation as harvesting period of crops under protected structures is longer. Recently many progressive farmers of Gujarat have started the cultivation of greater yam under protected conditions like (Poly house, Net house etc. Keeping in view of farmers survey, this research was set up to find out better growing condition for greater yam growth and yield.

Materials and Methods
The experiment was undertaken at the Vegetable Research Scheme, Regional Horticultural Research Station of the Navsari Agricultural University, Navsari, Gujarat, India during

2015-16 and 2016-17. The experiment was conducted in Large Plot; analysis as CRD with factorial concept (FCRD) with three repetition which included three growing conditions (G_1: Naturally Ventillated Poly house, G_2: Net house and G_3: Open field), three planting distance (D_1: 60 cm x 60 cm, D_2: 60 cm x 45 cm and D_3: 90 cm x 90 cm) and two varities (V_1: Round type and V_2: Long type).The experiment was included 18 combinations namely, $G_1D_1V_1$; $G_1D_1V_2$; $G_1D_2V_1$; $G_1D_2V_2$; $G_1D_3V_1$; $G_1D_3V_2$; $G_2D_1V_1$; $G_2D_1V_2$; $G_2D_2V_1$; $G_2D_2V_2$; $G_2D_3V_1$; $G_2D_3V_2$; $G_3D_1V_1$; $G_3D_1V_2$; $G_3D_2V_1$; $G_3D_2V_2$; $G_3D_3V_1$ and $G_3D_3V_2$..The experiment was conducted on same location without changing the randomization for the succesive year to access treatment effects.Tuber pieces of 200 g were used for planting material for both variety. The experimental growing conditions for all three locations were thoroughly prepared as our treatment includes different spacing treatments. The beds inside the poly house and net house were made symmetrical and levelling was done with the help of wooden plank. Cultural practices for three growing conditions (Naturally Ventilated Poly house, Net house and Open field) were maintained same for two seasons.

For recording different field observations, five plants of greater yam from each net plot area were selected randomly in the beginning and tagged with the labels. Total number of tillers was recorded by counting the total number of tillers at harvest. Vine length was measured from base of the plant to tip of the main shoot with the help of meter tape at final harvest and fresh weight of tuber recorded immediately after harvest. Tuber girth and length were measured with measuring tape. The collected data were subjected to statistical analysis as per Panse and Sukhatme (1967) [8].

Results and Discussion

Total number of tillers at harvest was significantly influenced by different growing conditions. Significantly maximum total number of tillers at harvest was observed in growing condition G_1 (Naturally Ventilated Poly house) during 2015 – 16 (8.77), 2016 – 17 (7.51) and in pooled analysis (8.14). Significantly lower number of tillers at harvest was observed in growing condition G_3 (Open field) during both the years of experiment as well as in pooled analysis (5.29, 3.98 and 4.63; respectively). Different growing conditions were significantly influenced vine length (m) during both the years of experimentation and in pooled analysis. Significantly higher vine length during 2015-16 (9.44 m), 2016-17 (8.66 m) and in pooled analysis (9.05 m) was noted with naturally ventilated poly house (G_1). Significantly lower vine length was observed with open field condition (G_3) during individual years of experimentation and in pooled analysis. (5.20 m, 4.30 m and 4.75 m; respectively).This might be due to the use of ultraviolet stabilized plastic film, which allowed filtered light inside the Naturally Ventilated Poly house as compared to other growing conditions. The reduction in number of tillers and vine length of greater yam under open field condition was might be due to non control of light radiation, such results of higher growth rate under greenhouse conditions have been reported by Nimje *et al.* (1990) [7], Bhatnagar *et al.* (1990) [2]., Naik (2005) [6] and Bai and Sudha (2015) [1] in capsicum and Papadopoules and Ormrod (1991) [9] in tomato.

Effects of different growing conditions were significantly affected on fresh weight of tuber (g) at harvest. Significantly higher fresh weight of tuber (g) was observed in G_1 (Naturally Ventilated Poly house) during 2015-16 (1723.45 g), 2016-17 (1632.97 g) and in pooled analysis (1678.21 g). While, significantly lower fresh weight of tuber was recorded in G_3 (Open field condition) during both the years of experiments as well as in pooled analysis (904.05 g, 882.70 g and 893.37 g; respectively). This might be due to the greater yam had higher yield under Naturally Ventilated Poly house due to light compensation for higher photosynthesis and control solar injury by controlling ultraviolet radiation. This positively influenced the morpho-phenological and physiological events of greater yam plants. It was concluded that the better growth, development and yield of greater yam was achieved under Naturally Ventilated Poly house due to optimum utilization of solar energy. Similar results were reported by Naik (2005) [6] and Biradar *et al*. (2014) [3] in capsicum, Rajesekar *et al*. (2013) [11], Rana *et al*., (2015) [12] in tomato.

Significantly higher tuber girth (cm) was found in G_1 (Naturally Ventilated Poly house) during 2015 - 16, 2016 – 17 and in pooled analysis (27.63 cm, 28.93 cm and 28.28 cm; respectively). While, significantly lower tuber girth (cm) was noted with treatment G_3 (Open field condition) during both years of experimentation as well as in pooled analysis (20.32 cm, 20.80 cm and 20.56 cm; respectively). Tuber length was also observed significantly higher with G_1 (Naturally Ventilated Poly house) during 2015-16, 2016-17 and in pooled analysis (21.98 cm, 22.06 cm and 22.02 cm; respectively).While, significantly lower tuber length was noted with G_3 (Open field) during both years of experimentation as well as in pooled analysis (16.89 cm, 16.85 cm and 16.87 cm; respectively). Naturally Ventilated Poly house (G_1) recorded significantly higher tuber yield 1000 m^{-2} during both years of experimentation and in pooled analysis (2699.42 kg, 2408.34 kg and 2553.88 kg; respectively). While, significantly lower yield 1000 m^{-2} was observed with G_3 (Open field) during individual years of experimentation and in pooled analysis, respectively (1769.06 kg, 1541.53 kg and 1655.29 kg; respectively).

All these yield attributing parameters of greater yam were significantly higher with Naturally Ventilated Poly house as compared to Net house and Open field. This might be due to the translocation of more photosynthesis from source to sink and also favourable microclimate that prevailed in the Naturally Ventilated Poly house throughout the crop growth period. Greater yam had higher yield under Naturally Ventilated Poly house due to light compensation for higher photosynthesis and control solar injury due to filtered solar radiation. This positively influenced the morpho-phenological and physiological events of greater yam vines. It was concluded that the better growth, development and yield of greater yam was achieved under Naturally Ventilated Poly house due to optimum utilization of solar energy. The results corroborate with the findings of Naik (2005) [6] in capsicum, Parvej *et al*. (2010) [10] in tomato and Brahma *et al*. (2012) [4] in capsicum.

Table 1: Response of different treatments on total number of tillers at harvest

Treatments	Total number of tillers at harvest		
Growing conditions (G)	2015-16	2016-17	Pooled
G_1 (Poly house)	8.77	7.51	8.14
G_2 (Net house)	7.34	6.06	6.70
G_3 (Open field)	5.29	3.98	4.63
S.Em. ± (G)	0.20	0.15	0.12
C.D.at 5 % (G)	0.57	0.42	0.34
Planting distance (D)			
D_1 (60 cm x 60 cm)	6.37	5.07	5.72
D_2 (60 cm x 45 cm)	7.96	6.68	7.32
D_3 (90 cm x 90 cm)	7.08	5.80	6.44
S.Em. ± (D)	0.20	0.15	0.12
C.D. at 5 % (D)	0.57	0.42	0.34
Variety (V)			
V_1 (Round type)	6.95	5.66	6.30
V_2 (Long type)	7.32	6.04	6.68
S.Em. ± (V)	0.16	0.12	0.10
C.D. at 5 % (V)	NS	0.34	0.28
C.D. at 5 % (GD)	NS	NS	NS
C.D.at 5 % (GV)	NS	NS	NS
C.D.at 5 % (DV)	NS	NS	NS
C.D. at 5 % (GDV)	NS	NS	NS
S.Em. ± (YG)			0.17
C.D. at 5 %			NS
S.Em. ± (YD)			0.17
C.D. at 5 %			NS
S.Em. ± (YGD)			0.30
C.D. at 5 %			NS
S.Em. ± (YV)			0.14
C.D. at 5 %			NS
S.Em. ± (YGV)			0.25
C.D. at 5 %			NS
S.Em. ± (YDV)			0.25
C.D. at 5 %			NS
S.Em. ± (YGDV)			0.43
C.D. at 5 %			NS
C.V. %	11.76	10.63	11.38

Table 2: Response of different treatments on vine length (m) at harvest

Treatments	Vine length (m) at harvest		
Growing conditions (G)	**2015-16**	**2016-17**	**Pooled**
G_1 (Poly house)	9.44	8.66	9.05
G_2 (Net house)	7.69	6.87	7.28
G_3 (Open field)	5.20	4.30	4.75
S.Em. ± (G)	0.18	0.15	0.12
C.D.at 5 % (G)	0.52	0.42	0.33
Planting distance (D)			
D_1 (60 cm x 60 cm)	6.50	5.65	6.08
D_2 (60 cm x 45 cm)	8.44	7.64	8.04
D_3 (90 cm x 90 cm)	7.38	6.55	6.96
S.Em. ± (D)	0.18	0.15	0.12
C.D. at 5 % (D)	0.52	0.42	0.33
Variety (V)			
V_1 (Round type)	7.21	6.37	6.79
V_2 (Long type)	7.67	6.85	7.26
S.Em. ± (V)	0.15	0.12	0.13
C.D. at 5 % (V)	0.43	0.34	0.39
C.D. at 5 % (GD)	NS	NS	0.56
C.D.at 5 % (GV)	NS	NS	NS
C.D.at 5 % (DV)	NS	NS	NS
C.D. at 5 % (GDV)	NS	NS	NS
S.Em. ± (YG)			0.17
C.D. at 5 %			NS
S.Em. ± (YD)			0.17
C.D. at 5 %			NS

S.Em. ± (YGD)			0.28
C.D. at 5 %			NS
S.Em. ± (YV)			0.14
C.D. at 5 %			NS
S.Em. ± (YGV)			0.23
C.D. at 5 %			NS
S.Em. ± (YDV)			0.23
C.D. at 5 %			NS
S.Em. ± (YGDV)			0.41
C.D. at 5 %			NS
C.V. %	10.40	9.44	10.01

Table 3: Response of different treatments on average fresh weight of tuber (g)

Treatments	**Fresh weight of tuber (g)**		
Growing conditions (G)	**2015-16**	**2016-17**	**Pooled**
G_1 (Poly house)	1723.45	1632.97	1678.21
G_2 (Net house)	1386.05	1324.03	1355.04
G_3 (Open field)	904.05	882.70	893.37
S.Em. ± (G)	32.37	30.57	22.14
C.D.at 5 % (G)	92.90	87.74	62.49
Planting distance (D)			
D_1 (60 cm x 60 cm)	1157.10	1114.40	1135.75
D_2 (60 cm x 45 cm)	1530.65	1456.43	1493.54
D_3 (90 cm x 90 cm)	1325.80	1268.87	1297.33
S.Em. ±(D)	32.37	30.57	22.00
C.D. at 5 % (D)	92.90	87.74	62.08
Variety (V)			
V_1 (Round type)	1293.67	1239.44	1266.56
V_2 (Long type)	1382.03	1320.35	1351.19
S.Em. ± (V)	26.43	24.96	18.05
C.D. at 5 % (V)	75.85	71.64	50.96
C.D. at 5 % (GD)	NS	NS	105.89
C.D.at 5 % (GV)	NS	NS	NS
C.D.at 5 % (DV)	NS	NS	NS
C.D. at 5 % (GDV)	NS	NS	NS
S.Em. ± (YG)			31.48
C.D. at 5 %			NS
S.Em. ± (YD)			31.48
C.D. at 5 %			NS
S.Em. ± (YGD)			54.53
C.D. at 5 %			NS
S.Em. ± (YV)			25.71
C.D. at 5 %			NS
S.Em. ± (YGV)			44.52
C.D. at 5 %			NS
S.Em. ± (YDV)			44.52
C.D. at 5 %			NS
S.Em. ± (YGDV)			77.11
C.D. at 5 %			NS
C.V. %	10.27	10.13	10.21

Table 4: Response of different treatments on tuber girth (cm)

Treatments	**Tuber girth (cm)**		
Growing conditions (G)	**2015-16**	**2016-17**	**Pooled**
G_1 (Poly house)	27.63	28.93	28.28
G_2 (Net house)	23.98	24.99	24.49
G_3 (Open field)	20.32	20.80	20.56
S.Em. ± (G)	0.34	0.50	0.30
C.D.at 5 % (G)	0.99	1.43	0.85
Planting distance (D)			
D_1 (60 cm x 60 cm)	23.36	24.48	23.92
D_2 (60 cm x 45 cm)	21.38	21.57	21.47
D_3 (90 cm x 90 cm)	27.20	28.67	27.94
S.Em. ± (D)	0.34	0.50	0.30
C.D. at 5 % (D)	0.99	1.43	0.86
Variety (V)			

V_1 (Round type)	26.70	27.77	27.23
V_2 (Long type)	21.25	22.05	21.65
S.Em. ± (V)	0.28	0.41	0.25
C.D. at 5 % (V)	0.81	1.17	0.69
C.D. at 5 % (GD)	NS	NS	1.46
C.D.at 5 % (GV)	NS	NS	NS
C.D.at 5 % (DV)	1.40	2.03	1.20
C.D. at 5 % (GDV)	NS	NS	2.11
S.Em. ± (YG)			0.43
C.D. at 5 %			NS
S.Em. ± (YD)			0.74
C.D. at 5 %			NS
S.Em. ± (YGD)			0.74
C.D. at 5 %			NS
S.Em. ± (YV)			0.35
C.D. at 5 %			NS
S.Em. ± (YGV)			0.61
C.D. at 5 %			NS
S.Em. ± (YDV)			0.61
C.D. at 5 %			NS
S.Em. ± (YGDV)			1.05
C.D. at 5 %			NS
C.V. %	6.09	8.51	7.45

Table 5: Response different treatments on tuber length (cm)

Treatments	**Tuber length (cm)**		
Growing conditions (G)	**2015-16**	**2016-17**	**Pooled**
G_1 (Poly house)	21.98	22.06	22.02
G_2 (Net house)	17.24	17.00	17.12
G_3 (Open field)	16.89	16.85	16.87
S.Em. ± (G)	0.54	0.69	0.43
C.D.at 5 % (G)	1.55	1.98	1.22
Planting distance (D)			
D_1 (60 cm x 60 cm)	18.22	18.29	18.26
D_2 (60 cm x 45 cm)	18.42	17.81	18.11
D_3 (90 cm x 90 cm)	19.48	19.82	19.65
S.Em. ± (D)	0.54	0.69	0.43
C.D. at 5 % (D)	NS	NS	1.22
Variety (V)			
V_1 (Round type)	11.84	11.88	11.86
V_2 (Long type)	25.57	25.39	25.48
S.Em. ± (V)	0.44	0.56	0.36
C.D. at 5 % (V)	1.26	1.62	1.00
C.D. at 5 % (GD)	NS	NS	NS
C.D.at 5 % (GV)	2.19	2.80	1.73
C.D.at 5 % (DV)	NS	NS	1.74
C.D. at 5 % (GDV)	NS	NS	2.97
S.Em. ± (YG)			0.62
C.D. at 5 %			NS
S.Em. ± (YD)			0.62
C.D. at 5 %			NS
S.Em. ± (YGD)			1.07
C.D. at 5 %			NS
S.Em. ± (YV)			0.50
C.D. at 5 %			NS
S.Em. ± (YGV)			0.88
C.D. at 5 %			NS
S.Em. ± (YDV)			0.88
C.D. at 5 %			NS
S.Em. ± (YGDV)			1.52
C.D. at 5 %			NS
C.V. %	12.24	15.72	14.08

Table 6: Response of different treatments on tuber yield 1000 m^{-2} (kg)

Treatments	Tuber yield 1000 m^{-2} (kg)		
Growing conditions (G)	2015-16	2016-17	Pooled
G_1 (Poly house)	2699.42	2408.34	2553.88
G_2 (Net house)	2351.89	2075.65	2213.77
G_3 (Open field)	1769.06	1541.53	1655.29
S.Em. ± (G)	45.63	38.92	29.71
C.D.at 5 % (G)	130.97	111.71	83.83
Planting distance (D)			
D_1 (60 cm x 60 cm)	2254.02	1987.29	2120.66
D_2 (60 cm x 45 cm)	2966.51	2655.07	2810.79
D_3 (90 cm x 90 cm)	1599.83	1383.16	1491.50
S.Em. ± (D)	45.63	38.92	29.84
C.D. at 5 % (D)	130.97	111.71	84.20
Variety (V)			
V_1 (Round type)	1753.64	1587.74	1670.69
V_2 (Long type)	2793.27	2429.27	2611.27
S.Em. ± (V)	37.26	31.78	70.03
C.D. at 5 % (V)	106.93	91.21	NS
C.D. at 5 % (GD)	226.84	193.49	142.77
C.D.at 5 % (GV)	185.21	157.99	118.54
C.D.at 5 % (DV)	185.21	157.99	119.26
C.D. at 5 % (GDV)	320.80	273.64	201.84
S.Em. ± (YG)			42.41
C.D. at 5 %			NS
S.Em. ± (YD)			42.41
C.D. at 5 %			NS
S.Em. ± (YGD)			73.46
C.D. at 5 %			NS
S.Em. ± (YV)			34.63
C.D. at 5 %			97.75
S.Em. ± (YGV)			59.98
C.D. at 5 %			NS
S.Em. ± (YDV)			59.98
C.D. at 5 %			NS
S.Em. ± (YGDV)			103.89
C.D. at 5 %			NS
C.V. %	8.52	8.22	8.40

Conclusion

Apart from the research results of two years of experiment, it was concluded that higher growth and yield attributes of greater yam was recorded with Naturally Ventilated Poly house as compared to Net house and Open field.

References

1. Bai G, Sudha B. Growth yield of chilli as influenced by spacing under greenhouse condition. Int. J Agric. Sci. 2015; 11(20):297-300.
2. Bhatnagar RR, Vedprakash RC, Srivastav RC. Production of vegetables in polythene greenhouse during winters in mid hills of Uttar Pradesh. Prog. Hort. 1990; 22:97-100.
3. Biradar MS, Patil AA, Mantur SM, Mannikeri IM. Influence of growing environment and planting geometry on yield and yield attributes of capsicum (*Capsicum annuum* L. *var*. *Grossum Sendt.*) genotypes. Karnataka J Agric. Sci. 2014; 27(2):202-207.
4. Brahma S, Phookan DB Kachari M, Hazarika TK. Response of capsicum to different plant density under poly house and open conditions. Indian J Hort. 2012; 69(2):292-294.
5. Chadha KL. Handbook of Horticulture, Indian Council of Agricultural Research, New Delhi, 2002, 522-525.
6. Naik RK. Influence of N-substitution levels through organic and inorganic sources on growth, yield and post-harvest quality of capsicum under protected condition. Thesis Ph.D. Univ. Agric. Sci., Dharwad, Karnataka, India, 2005.
7. Nimje PM. Wajnan OD, Shyam M. Greenhouse technology for vegetable crop production. Proc. of XI Int. Cong. on the use of Plastics in Agric, 1990, 83-90.
8. Panse VG, Sukhatme PV. Statistical Methods for Agricultural Workers, Indian Council of Agricultural Research, New Delhi, India, 1967, 272-279
9. Papadopoulous AP, Ormrod DP. Plant spacing effects on growth and development of the greenhouse tomato. Canadian J. Pl. Sci. 1991; 71:297-304.
10. Parvej MR, Khan MAH, Awal MA. Phenological development and production of tomato under polyhouse climate. J Agric. Sci. 2010; 5(1):19-31.
11. Rajasekar M, Arumugam T, Kumar R. Influence of weather and growing environment on vegetable growth and yield. J Hort. and Forestry. 2013; 5(10):160-167.
12. Rana N, Kumar M, Walia A, Sharma S. Tomato Fruit Quality under Protected Environment and Open Field Conditions. Int. J Bio- resources and Strees Management. 2015; 5(3):422-426.