www.ThePharmaJournal.com

The Pharma Innovation

ISSN (E): 2277- 7695
ISSN (P): 2349-8242
NAAS Rating 2017: 5.03
TPI 2017; 6(10): 400-407

www.thepharmajournal.com
Received: 03-08-2017
Accepted: 04-09-2017

Meenakshi Badu
Department of Horticulture, Dr. Y.S.R. Horticultural University, Andhra Pradesh, India

P Ashok
Department of Horticulture, Dr. Y.S.R. Horticultural University, Andhra Pradesh, India

K Sasikala
Department of Agronomy, Dr. Y.S.R. Horticultural University, Andhra Pradesh, India

TSKK Kiran Patro
Department of Horticulture, Dr. Y.S.R. Horticultural University, Andhra Pradesh, India

Correspondence
Meenakshi Badu
Department of Horticulture, Dr. Y.S.R. Horticultural University, Andhra Pradesh, India

Mean performance of orange flesh sweet potato (*Ipomoea batatas* (L.) Lam.) Genotypes under coastal Andhra Pradesh condition

Meenakshi Badu, P Ashok, K Sasikala and TSKK Kiran Patro

Abstract
Field experiment was conducted during 2015-16 at Horticultural College and Research Institute, Dr. Y. S. R. Horticultural University, Venkataramannagudem, West Godavari district. The objective of the experiment was to determine and evaluate the growth and yield performance of orange flesh sweet potato genotypes under coastal Andhra Pradesh condition. Treatments comprised of 25 different genotypes. The experiment was laid out in randomized complete block design with three replications. The performance evaluation of different genotypes was assessed by analyzing data on vegetative growth and yield. Results demonstrated that there is significant difference on performance of different orange flesh sweet potato genotypes. Based on the mean performance, the genotype VRSP-3 found to be elite for length of leaf lobe whereas for the width of leaf lobe SWA-2, ACC-5 for petiole length, VRSP-13 for leaf area, VRSP-12 for total leaf dry weight, for chlorophyll content VRSP-2, VRSP-4 for length of vine, for internodal length Kiran, VRSP-13 for number of branches per plant, for fresh weight of whole plant, dry weight of whole plant and fresh weight of root VRSP-12, for dry weight of root VRSP-9, for number of root tubers per plant VRSP-13, for root tuber length VRSP-1, for root tuber girth VRSP-3, for root tuber yield per plant VRSP-12, VRSP-13, VRSP-3, VRSP-1, VRSP-5 and VRSP-9 and for root tuber yield per hectare VRSP-3, VRSP-8, VRSP-13, VRSP-1 and VRSP-12 were found to be elite among all the 25 genotypes.

Keywords: OFSP (*Ipomoea batatas* (L.) Lam.), mean performance, vegetative growth, root tuber yield

Introduction
Sweetpotato (*Ipomoea batatas* (L.) Lam.) Is a member of the morning glory family (Convulvulaceae), producing edible storage roots and leaves. The crop is cultivated in all regions where there is sufficient moisture to support its growth. Sweet potato can yield large amounts of energy-rich nutritious foods during relatively short cropping seasons. Susceptibility to sweet potato weevil and rats are among the production constraints of sweet potato in coastal Andhra Pradesh condition. Erroneous beliefs tied to its consumption such as male sterility, impotence and pile, poor marketing mechanism, low value addition as well as lack of improved desirable varieties have also militated against its production and consumption in the country. The dominant sweet potato varieties grown by farmers have white or cream flesh, which contain little or no beta-carotene. Beta-carotene content was however, higher in OFSP cultivars than the white flesh types.

Consequent upon the aforementioned constraints, the International Potato Center (CIP) and the Central tuber crops research institute (CTCRI) Trivendrum, Kerala began to focus on developing several improved sweet potato lines with greater root yield and disease resistance potential. The potential of the improved lines cannot be realized unless they are evaluated to identify genotypes with desirable attributes in the study area. Therefore, the objective of this study was to evaluate selected improved genotypes for adaptation, higher root tuber yield potential with a view to selecting superior ones for introduction into the production system in the study area.

Material and Methods
The experiment was laid out in randomized complete block design with three replications. Plant density was arranged by varying row the spacing between plant, 60 * 20 cm respectively and the plot size was be 2.5 m wide and 2m long. 25 improved different orange flesh sweet potato genotypes were obtained from All India Co-ordinated Research Project on tuber crops, Venkataramannagudem. The recommended dosage of N, P and K at 60: 25: 50 kg/ha was

applied in the form of urea, single super phosphate and muriate of potash respectively as per the package and practices standardized by CTCRI and all the necessary agronomic/cultural practices was done where necessary and as the crop requirement in uniform manner. Genotypes used for the experiment were ST-14, Sree Kanaka, SWA-2, Kamala Sundari, CIP-440127, ACC-22, ACC-11, Kiran, Gouri, CO-1, VRSP-1, VRSP-2, ACC-5, VRSP-3, VRSP-4, VRSP-5, VRSP-6, VRSP-7, VRSP-8, VRSP-9, VRSP-10, VRSP-11, VRSP-12, VRSP-13 and VRSP-14. Five plants were taken at random each in genotype and tagged for recording observations. Observations were taken by uprooting the whole plant at 30 days intervals up to harvest. The observations recorded were length of leaf lobe, width of leaf lobe, petiole length, leaf area, total leaf dry weight, chlorophyll content (a, b and total), length of vine, internodal length, number of branches per plant, fresh weight of whole plant, dry weight of whole plant, fresh weight of root, dry weight of root, number of root tubers per plant, root tuber length, root tuber girth, root tuber yield per plant and root tuber yield per hectare.

Results and Discussion

Leaf Characters

1. Length of leaf lobe (cm)

The data pertaining to length of leaf lobe are presented in Table 1. On days 30, 60, 90 and 120, among all the genotypes VRSP-3 recorded the maximum length of leaf lobe (12.4 cm, 12.6 cm, 12.7 cm and 12.7 cm), while ACC-22 recorded the minimum length of leaf lobe (8.3 cm, 9.1 cm, 9.2 cm and 9.1 cm).

2. Width of leaf lobe (cm)

The data pertaining to width of leaf lobe are presented in Table 2. On days 30, 60, 90 and 120, among all the genotypes SWA-2 recorded the maximum width of leaf lobe (10.2 cm, 10.6 cm, 10.7 cm and 10.7 cm), while ACC-11 recorded the minimum width of leaf lobe (1.2 cm, 1.3 cm, 1.3 cm and 1.3 cm).

3. Petiole length (cm)

The data pertaining to petiole length are presented in Table 3. On day 30, among all the genotypes SWA-2 recorded the maximum petiole length (11.9 cm), while CIP-440127 recorded the minimum petiole length (7.3 cm). On day 60, among all the genotypes CO-1 recorded the maximum petiole length (26.1 cm), while Kamala Sundari and Gouri recorded the minimum petiole length (10.0 cm). On days 90 and 120, among all the genotypes ACC-5 recorded the maximum petiole length (37.9 cm and 34.4 cm), while Sree Kanaka recorded the minimum petiole length (14.3 cm and 13.4 cm).
Petiole length varies according to genotypes at different intervals.

4. Leaf area (cm^2)

The data pertaining to leaf area are presented in Table 4. On day 30, among all the genotypes VRSP-7 recorded the maximum leaf area (2868.5 cm^2), while ACC-11 recorded the minimum leaf area (347.2 cm^2). On day 60, among all the genotypes VRSP-12 recorded the maximum leaf area (125322.1 cm^2), while Kiran recorded the minimum leaf area (4778.3cm^2). On day 90, among all the genotypes VRSP-13 recorded the maxiamum leaf area

Table 1: Length of leaf lobe (cm) in different orange flesh sweet potato genotypes under study

S. No.	Name of genotypes	Length of leaf lobe (cm)			
		30 days	60 days	90 days	120 days
1.	ST-14	10.7	11.0	11.1	11.1
2.	Sree Kanaka	8.5	9.5	9.6	9.6
3.	SWA-2	11.1	11.5	11.4	11.4
4.	Kamala Sundari	9.3	10.0	10.3	10.1
5.	CIP-440127	9.2	9.7	10.1	10.1
6.	ACC-22	8.3	9.1	9.2	9.1
7.	ACC-11	9.1	9.8	10.1	10.0
8.	Kiran	9.1	9.7	10.1	10.0
9.	Gouri	9.	10.1	10.3	10.2
10.	CO-1	10.5	11.1	11.5	11.5
11.	VRSP-1	9.7	10.3	10.4	10.4
12.	VRSP-2	10.3	10.7	10.8	10.8
13.	ACC-5	10.8	11.2	11.4	11.4
14.	VRSP-3	12.4	12.6	12.7	12.7
15.	VRSP-4	9.2	9.7	10.1	10.1
16.	VRSP-5	10.0	10.7	10.8	10.8
17.	VRSP-6	11.7	12.2	12.4	12.4
18.	VRSP-7	11.7	12.4	12.6	12.5
19.	VRSP-8	8.7	9.5	9.6	9.6
20.	VRSP-9	9.6	10.3	10.5	10.5
21.	VRSP-10	11.2	11.7	11.8	11.8
22.	VRSP-11	10.0	10.7	10.9	10.8
23.	VRSP-12	11.3	11.7	11.8	11.8
24.	VRSP-13	10.3	10.8	11.2	11.1
25.	VRSP-14	9.0	9.8	10.2	10.1
Gm		10.06	10.63	10.86	10.82
SEm±		0.51	0.50	0.33	0.35
CD at 5%		1.46	1.44	0.94	1.00

Table 2: Width of leaf lobe (cm) in different orange flesh sweet potato genotypes under study

S. No.	Name of genotypes	Width of leaf lobe (cm)			
		30 days	60 days	90 days	120 days
1.	ST-14	8.2	8.3	8.5	8.5
2.	Sree Kanaka	3.5	4.1	4.2	4.2
3.	SWA-2	10.2	10.6	10.7	10.7
4.	Kamala Sundari	6.0	8.6	8.6	8.6
5.	CIP-440127	3.6	4.6	4.7	4.6
6.	ACC-22	4.3	4.4	4.5	4.4
7.	ACC-11	1.2	1.3	1.3	1.3
8.	Kiran	4.5	5.1	5.2	5.2
9.	Gouri	1.4	1.6	1.6	1.6
10.	CO-1	2.7	3.2	3.2	3.2
11.	VRSP-1	5.4	6.0	6.2	6.1
12.	VRSP-2	9.3	9.6	10.6	10.6
13.	ACC-5	7.4	7.6	7.9	7.9
14.	VRSP-3	4.5	4.7	5.1	5.1
15.	VRSP-4	3.2	4.0	4.5	4.5
16.	VRSP-5	3.0	3.1	3.2	3.2
17.	VRSP-6	4.2	4.5	4.7	4.6
18.	VRSP-7	4.4	5.6	6.6	6.5
19.	VRSP-8	4.2	5.1	6.1	6.0
20.	VRSP-9	3.8	4.5	5.0	4.9
21.	VRSP-10	3.6	3.9	4.0	3.9
22.	VRSP-11	3.6	4.2	4.3	4.3
23.	VRSP-12	7.4	7.8	8.8	8.7
24.	VRSP-13	2.6	2.8	2.9	2.8
25.	VRSP-14	1.9	2.0	2.1	2.0
Gm		4.57	5.12	5.41	5.39
SEm±		0.29	0.41	0.27	0.27
CD at 5%		0.84	1.19	0.78	0.78

(387345.4 cm^2), while Kiran recorded the minimum leaf area (13537.1 cm^2). On day 120, among all the genotypes VRSP-12 recorded the maximum leaf area (146493.1 cm^2), while Kiran recorded the minimum leaf area (4956.3 cm^2).

Based on the results obtained, increase in length of leaf lobe, width of leaf lobe and leaf area were observed up to 90 DAP and thereafter it declined gradually. It could be due to an increase in the photosynthetic activity and supply of photosynthetic assimilates to meristematic and cambial tissue, results in extension of leaf lobe. The maintenance of high turgor potential in the cell leads to cell expansion thereby increased the leaf size and ultimately the length of leaf lobe, width of leaf lobe and leaf area. Shoba *et al.* (1990) [5] reported that leaf area decreased with plant age in cultivars selected due to leaf senescence in Garlic.

Total leaf dry weight (g)

The data pertaining to total leaf dry weight are presented in Table 5.

Significant differences were observed in total leaf dry weight among different genotypes of OFSP at 30, 60, 90 and 120 DAP. Based on the results obtained, increase in total leaf dry weight was observed up to 90 DAP and thereafter it declined gradually. It varies among different genotypes.

Chlorophyll a (mg/g)

Significant differences were observed in chlorophyll-a content among different genotypes of OFSP at 30, 60, 90 and 120 DAP (Table 6).

Based on the results obtained, increase in chlorophyll-a content was observed up to 90 DAP and thereafter it declined gradually because of leaf senescence.

Chlorophyll b (mg/g)

Significant differences were observed in chlorophyll-b content among different genotypes of OFSP at 30, 60, 90 and 120 DAP (Table 7).

Based on the results obtained, increase in chlorophyll-b content was observed up to 90 DAP and thereafter it declined gradually due to leaf senescence.

Total chlorophyll (mg/g)

Significant differences were observed in total chlorophyll content among different genotypes of OFSP at 30, 60, 90 and 120 DAP (Table 8).

On days 30, 60 and 90 among all the genotypes VRSP-2 recorded the maximum total chlorophyll content (2.15 mg/g, 2.31 mg/g and 3.11 mg/g), while ST-14 recorded the minimum total chlorophyll content (1.16 mg/g, 1.35 mg/g and 1.89 mg/g).

On day 120, among all the genotypes VRSP-12 recorded the maximum total chlorophyll content (1.45 mg/g), while ST-14 recorded the minimum total chlorophyll content (0.21 mg/g).

These results suggest that total chlorophyll content of the leaf was reduced according to the senescence processes. Similar trend has been reported by Xhunga and Zafirati (1994) in late tomatoes.

Vine Characters

1. Length of Vine (cm)

The data pertaining to length of vine are presented in Table 9.

Significant differences were observed in length of vine among different genotypes of OFSP at 30, 60, 90 and 120 DAP. On day 30, among all the genotypes VRSP-4 recorded the maximum length of vine (144.8 cm), while SWA-2 recorded the minimum length of vine (44.4 cm).

Table 3: Petiole length (cm) in different orange flesh sweet potato genotypes under study

S. No.	Name of genotypes	Petiole length (cm)			
		30 days	60 days	90 days	120 days
1.	ST-14	8.5	16.8	24.0	22.7
2.	Sree Kanaka	8.4	12.7	14.3	13.4
3.	SWA-2	11.9	18.4	22.5	21.2
4.	Kamala Sundari	9.8	10.0	20.4	17.8
5.	CIP-440127	7.3	13.3	16.5	15.8
6.	ACC-22	10.5	18.4	25.6	24.5
7.	ACC-11	10.3	21.4	22.6	21.8
8.	Kiran	8.7	18.6	25.2	23.1
9.	Gouri	8.5	10.0	31.0	23.6
10.	CO-1	10.2	26.1	26.5	26.1
11	VRSP-1	7.5	19.7	26.8	24.0
12	VRSP-2	10.5	21.3	25.9	24.3
13	ACC-5	10.1	21.7	37.9	34.4
14	VRSP-3	11.6	20.8	31.6	28.5
15	VRSP-4	8.2	12.3	24.2	17.5
16	VRSP-5	8.7	20.1	20.3	20.0
17	VRSP-6	10.5	17.7	29.6	26.3
18	VRSP-7	10.6	19.8	25.6	23.1
19	VRSP-8	10.4	26.0	28.9	28.0
20	VRSP-9	8.2	21.3	33.8	23.2
21	VRSP-10	10.7	23.6	28.7	23.1
22	VRSP-11	7.6	16.4	28.5	24.3
23	VRSP-12	9.1	20.2	24.1	24.1
24	VRSP-13	9.5	20.2	33.6	23.5
25	VRSP-14	8.3	20.7	24.2	22.6
Gm		9.46	18.73	26.12	23.10
SEm+		0.89	2.02	1.28	0.90
CD at 5%		2.55	5.77	3.66	2.56

Table 4: Leaf area (cm^2) in different orange flesh sweet potato genotypes under study

S. No.	Name of genotypes	Leaf area (cm^2)			
		30 days	60 days	90 days	120 days
1.	ST-14	1972.6	6018.3	18054.7	6070.9
2.	Sree Kanaka	681.9	33810.4	95914.4	34987.7
3.	SWA-2	1783.7	7447.7	22485.0	7470.3
4.	Kamala Sundari	1331.6	5437.7	16958.9	5540.3
5.	CIP-440127	774.2	23937.7	76731.2	25343.9
6.	ACC-22	1113.7	57286.9	180062.4	58788.9
7.	ACC-11	347.2	17221.5	53785.4	17684.5
8.	Kiran	1343.2	4778.3	13537.1	4956.3
9.	Gouri	446.1	16542.1	51104.4	16822.6
10.	CO-1	874.2	36468.8	108617.5	37999.1
11.	VRSP-1	1340.7	61079.1	182785.5	61929.6
12.	VRSP-2	2116.8	61694.8	204037.3	69601.3
13.	ACC-5	1122.0	41168.1	131120.5	43070.8
14.	VRSP-3	958.3	52374.6	167101.0	55292.4
15.	VRSP-4	1064.4	41045.9	204488.1	48485.7
16.	VRSP-5	854.7	52723.7	104645.6	54915.2
17.	VRSP-6	1483.5	45446.6	231143.7	47205.7
18.	VRSP-7	2868.5	5917.2	28811.2	6406.5
19.	VRSP-8	1430.6	63542.0	309975.2	77553.9
20.	VRSP-9	1562.9	39179.9	115535.6	44518.1
21.	VRSP-10	1585.6	23798.8	163670.5	24392.5
22.	VRSP-11	960.6	29634.1	84631.4	30867.6
23.	VRSP-12	1641.6	125322.1	320814.3	146493.1
24.	VRSP-13	937.4	86863.0	387345.4	95330.2
25.	VRSP-14	1353.7	42801.7	126253.7	45409.5
Gm		1277.98	39261.64	135984.4	42685.43
SEm+		116.9	2875.08	13820.75	3953.56
CD at 5%		333.6	8200.50	39420.50	11276.62

Table 5: Total leaf dry weight (g) in different orange flesh sweet potato genotypes under study

S. No.	Name of genotypes	Total leaf dry weight (g)			
		30 days	60 days	90 days	120 days
1.	ST-14	4.9	19.2	100.6	90.3
2.	Sree Kanaka	3.2	34.7	102.1	100.4
3.	SWA-2	6.8	43.2	140.1	135.3
4.	Kamala Sundari	5.1	52.8	98.4	91.3
5.	CIP-440127	4.5	41.4	119.9	119.9
6.	ACC-22	5.2	45.1	115.7	101.9
7.	ACC-11	6.0	52.3	142.9	135.2
8.	Kiran	9.6	46.3	148.3	139.9
9.	Gouri	4.9	29.2	78.2	75.3
10.	CO-1	6.4	37.7	85.6	81.2
11.	VRSP-1	9.2	60.5	180.2	163.1
12.	VRSP-2	12.2	59.2	150.2	138.2
13.	ACC-5	4.8	37.2	85.2	51.9
14.	VRSP-3	7.5	55.3	186.9	179.2
15.	VRSP-4	7.4	45.3	147.9	132.3
16.	VRSP-5	11.2	48.2	153.4	147.0
17.	VRSP-6	5.9	47.9	137.2	121.8
18.	VRSP-7	11.2	55.5	133.5	121.5
19.	VRSP-8	5.2	50.3	146.2	141.7
20.	VRSP-9	10.1	56.3	147.9	142.1
21.	VRSP-10	15.2	57.4	159.7	137.2
22.	VRSP-11	6.9	51.0	121.2	118.1
23.	VRSP-12	7.2	51.8	192.7	185.0
24.	VRSP-13	13.2	61.2	187.2	181.2
25.	VRSP-14	22.7	58.4	151.0	132.7
Gm		8.30	47.95	136.54	126.59
SEm±		0.54	3.28	13.94	13.91
CD at 5%		1.56	9.35	39.78	39.68

Table 6: Chlorophyll a (mg/g) in different orange flesh sweet potato genotypes under study

S. No.	Name of genotypes	Chlorophyll a (mg/g)			
		30 days	60 days	90 days	120 days
1.	ST-14	0.79	0.91	1.07	0.10
2.	Sree Kanaka	0.85	1.19	1.30	0.22
3.	SWA-2	0.93	1.00	1.17	0.31
4.	Kamala Sundari	1.00	1.20	1.32	0.39
5.	CIP-440127	1.10	1.12	1.25	0.40
6.	ACC-22	1.28	1.30	1.33	0.44
7.	ACC-11	1.12	1.14	1.35	0.50
8.	Kiran	1.29	1.47	1.64	0.53
9.	Gouri	1.14	1.16	1.39	0.62
10.	CO-1	1.40	1.51	1.73	0.70
11.	VRSP-1	1.18	1.20	1.54	0.66
12.	VRSP-2	1.48	1.57	1.83	0.73
13.	ACC-5	1.20	1.31	1.52	0.64
14.	VRSP-3	0.90	0.99	1.15	0.28
15.	VRSP-4	1.17	1.27	1.39	0.69
16.	VRSP-5	0.98	1.12	1.27	0.47
17.	VRSP-6	0.88	1.06	1.30	0.26
18.	VRSP-7	1.23	1.34	1.43	0.73
19.	VRSP-8	1.33	1.38	1.46	0.59
20.	VRSP-9	1.11	1.20	1.51	0.67
21.	VRSP-10	0.95	1.09	1.32	0.46
22.	VRSP-11	0.99	1.11	1.35	0.59
23.	VRSP-12	1.2	1.29	1.56	0.78
24.	VRSP-13	1.10	1.23	1.46	0.67
25.	VRSP-14	1.19	1.23	1.57	0.71
Gm		1.11	1.21	1.40	0.52
SEm±		0.06	0.06	0.06	0.06
CD at 5%		0.17	0.17	0.17	0.17

Table 7: Chlorophyll b (mg/g) in different orange flesh sweet potato genotypes under study

S. No.	Name of genotypes	Chlorophyll b (mg/g)			
		30 days	60 days	90 days	120 days
1.	ST-14	0.36	0.43	0.81	0.10
2.	Sree Kanaka	0.43	0.47	0.86	0.13
3.	SWA-2	0.45	0.52	0.91	0.20
4.	Kamala Sundari	0.47	0.53	1.16	0.22
5.	CIP-440127	0.51	0.57	0.93	0.31
6.	ACC-22	0.53	0.59	1.21	0.34
7.	ACC-11	0.55	0.72	0.97	0.41
8.	Kiran	0.61	0.60	1.22	0.47
9.	Gouri	0.59	0.77	1.09	0.42
10.	CO-1	0.64	0.64	1.26	0.50
11.	VRSP-1	0.60	0.81	1.11	0.42
12.	VRSP-2	0.67	0.74	1.28	0.52
13.	ACC-5	0.56	0.61	1.01	0.56
14.	VRSP-3	0.43	0.56	1.12	0.21
15.	VRSP-4	0.39	0.47	0.98	0.56
16.	VRSP-5	0.45	0.49	0.91	0.36
17.	VRSP-6	0.60	0.72	1.13	0.18
18.	VRSP-7	0.64	0.70	1.07	0.65
19.	VRSP-8	0.58	0.67	0.97	0.49
20.	VRSP-9	0.49	0.54	0.98	0.55
21.	VRSP-10	0.50	0.64	1.24	0.36
22.	VRSP-11	0.49	0.63	1.17	0.50
23.	VRSP-12	0.53	0.67	1.15	0.67
24.	VRSP-13	0.54	0.68	1.25	0.58
25.	VRSP-14	0.51	0.57	1.19	0.57
Gm		0.52	0.61	1.08	0.41
SEm±		0.06	0.06	0.06	0.02
CD at 5%		0.17	0.17	0.17	0.06

Table 8: Total Chlorophyll (mg/g) in different orange flesh sweet potato genotypes under study

S. No.	Name of genotypes	Total chlorophyll (mg/g)			
		30 days	60 days	90 days	120 days
1.	ST-14	1.16	1.35	1.89	0.21
2.	Sree Kanaka	1.28	1.66	2.16	0.35
3.	SWA-2	1.38	1.52	2.08	0.51
4.	Kamala Sundari	1.47	1.73	2.48	0.61
5.	CIP-440127	1.61	1.69	2.18	0.71
6.	ACC-22	1.81	1.89	2.54	0.78
7.	ACC-11	1.67	1.86	2.32	0.91
8.	Kiran	1.91	2.08	2.87	1.01
9.	Gouri	1.73	1.93	2.48	1.04
10.	CO-1	2.04	2.15	2.99	1.20
11.	VRSP-1	1.78	2.01	2.65	1.08
12.	VRSP-2	2.15	2.31	3.11	1.25
13.	ACC-5	1.76	1.92	2.53	1.20
14.	VRSP-3	1.33	1.55	2.27	0.49
15.	VRSP-4	1.56	1.74	2.37	1.25
16.	VRSP-5	1.43	1.61	2.18	0.83
17.	VRSP-6	1.49	1.79	2.44	0.45
18.	VRSP-7	1.87	2.04	2.50	1.38
19.	VRSP-8	1.91	2.05	2.43	1.08
20.	VRSP-9	1.60	1.74	2.49	1.22
21.	VRSP-10	1.45	1.73	2.56	0.82
22.	VRSP-11	1.48	1.74	2.52	1.09
23.	VRSP-12	1.75	1.96	2.71	1.45
24.	VRSP-13	1.65	1.92	2.72	1.26
25.	VRSP-14	1.70	1.80	2.76	1.28
Gm		1.64	1.83	2.49	0.93
SEm±		0.12	0.12	0.12	0.06
CD at 5%		0.34	0.34	0.34	0.18

Table 9: Length of vine (cm) in different orange flesh sweet potato genotypes under study

S. No.	Name of genotypes	Length of vine (cm)			
		30 days	60 days	90 days	120 days
1.	ST-14	144.0	206.5	260.2	252.2
2.	Sree Kanaka	73.0	137.0	225.2	219.4
3.	SWA-2	44.4	119.7	182.7	169.3
4.	Kamala Sundari	53.6	185.8	247.2	240.1
5.	CIP-440127	48.4	115.0	169.0	161.4
6.	ACC-22	74.6	164.6	323.4	304.5
7.	ACC-11	79.6	132.0	290.2	275.2
8.	Kiran	67.9	155.6	185.4	172.2
9.	Gouri	52.8	94.9	226.0	204.4
10.	CO-1	60.4	124.8	231.3	212.0
11.	VRSP-1	106.3	144.8	248.8	231.6
12.	VRSP-2	53.8	125.6	251.2	242.1
13.	ACC-5	55.2	148.1	315.1	295.3
14.	VRSP-3	54.5	122.2	242.2	224.1
15.	VRSP-4	144.8	230.1	396.0	372.4
16.	VRSP-5	92.6	192.4	267.1	234.6
17.	VRSP-6	67.6	152.1	198.6	172.4
18.	VRSP-7	90.0	172.0	226.2	213.9
19.	VRSP-8	68.8	168.4	183.6	172.7
20.	VRSP-9	83.8	167.7	328.0	205.3
21.	VRSP-10	70.0	124.0	276.2	252.2
22.	VRSP-11	62.0	184.5	262.9	234.3
23.	VRSP-12	72.9	115.2	137.1	125.0
24.	VRSP-13	62.0	165.0	317.8	196.7
25.	VRSP-14	105.8	272.8	345.6	323.5
Gm		75.58	156.86	253.52	228.27
SEm±		8.40	17.96	17.25	12.54
CD at 5%		23.96	51.23	49.21	35.77

On day 60, among all the genotypes VRSP-14 recorded the maximum length of vine (272.8 cm), while Gouri recorded the minimum length of vine (94.9 cm).

On days 90 and 120, among all the genotypes VRSP-4 recorded the maximum length of vine (396.0 cm and 372.4 cm), while VRSP-12 recorded the minimum length of vine (137.1 cm and 125.0 cm).

Length of the vine varies among the genotypes at different intervals. The similar trend has also been observed by Ramaswamy and Muthukrishnan (1982) [4] and Vekatachalam *et al*. (1990) [7].

2. Internodal Length (cm)

The data pertaining to internodal length are presented in Table 10. Significant differences were observed in intermodal length among different genotypes of OFSP at 30, 60, 90 and 120 DAP. On day 30, among all the genotypes VRSP-4 recorded the maximum internodal length (3.7 cm), while ST-14 recorded the minimum intermodal length (2.0 cm).

On day 60, among all the genotypes ACC-22 recorded the maximum internodal length (5.7 cm), while ACC-5 recorded the minimum intermodal length (2.6 cm).

On days 90 and 120, among all the genotypes Kiran recorded the maximum intermodal length (8.3 cm and 7.9 cm), while ACC-5 recorded the minimum intermodal length (2.7 cm and 2.7 cm).

3. Number of branches per plant

The data pertaining to number of branches are presented in Table 11. Significant differences were observed in number of branches among different genotypes of OFSP at 30, 60, 90 and 120 DAP.

Based on the results obtained, increase in number of branches were observed up to 90 DAP and thereafter they declined gradually except in VRSP-1 and VRSP-12 where number of branches per plant increased at 120 DAP. In VRSP-1 and VRSP-12 genotypes, new branches were produced even at the time of harvest. Kamalam (1990) [3] observed significant variation for number of branches per plant.

Biomass Production

1. Fresh weight of whole plant (g)

The data pertaining to fresh weight of whole plant are presented in Table 12. Significant differences were observed in fresh weight of whole plant among different genotypes of OFSP at 30, 60, 90 and 120 DAP.

Based on the results obtained, increase in fresh weight of whole plant was observed up to 90 DAP and thereafter it declined gradually. Fresh weight increased gradually upto 90 DAT, indicating that translocation of photosynthates from leaf area (source) to tuber (sink) which results in increase in root weight. These results are in conformity with the findings of Ashok *et al.*, (2013) [1] in onion.

2. Dry weight of whole plant (g)

The data pertaining to dry weight of whole plant are presented in Table 13. Significant differences were observed in dry weight of whole plant among different genotypes of OFSP at 30, 60, 90 and 120 DAP.

Based on the results obtained, increase in dry weight of whole plant was observed up to 90 DAP and thereafter it declined gradually except in Kiran where maximum was recorded at 120 DAP. The increase in dry weight of whole plant might be due to an increase in length of leaf lobe, width of leaf lobe, petiole length, leaf area, leaf weight, length of vine and

Table 10: Internodal length (cm) in different orange flesh sweet potato genotypes under study

S. No.	Name of genotypes	Internodal length (cm)			
		30 days	60 days	90 days	120 days
1.	ST-14	2.0	4.1	6.2	5.5
2.	Sree Kanaka	2.3	2.7	3.7	3.3
3.	SWA-2	2.3	3.1	4.0	3.7
4.	Kamala Sundari	2.5	3.2	5.5	5.1
5.	CIP-440127	2.6	4.1	6.6	6.2
6.	ACC-22	3.0	5.7	8.1	7.8
7	ACC-11	2.9	3.6	5.3	5.1
8.	Kiran	2.5	5.5	8.3	7.9
9.	Gouri	2.3	2.7	3.4	3.1
10.	CO-1	2.4	2.8	3.4	3.2
11.	VRSP-1	2.7	3.1	3.6	3.3
12.	VRSP-2	2.6	2.7	2.9	2.8
13.	ACC-5	2.6	2.6	2.7	2.7
14.	VRSP-3	2.6	2.9	3.6	3.2
15.	VRSP-4	3.7	3.9	4.4	4.1
16.	VRSP-5	3.6	3.9	4.6	4.3
17.	VRSP-6	3.3	3.5	4.5	4.2
18.	VRSP-7	3.1	3.3	3.4	3.3
19.	VRSP-8	3.0	3.2	3.5	3.3
20.	VRSP-9	2.8	3.1	3.4	3.2
21.	VRSP-10	2.5	2.7	3.2	2.9
22.	VRSP-11	3.1	3.9	5.4	5.1
23.	VRSP-12	2.7	2.7	2.8	2.8
24.	VRSP-13	2.4	2.7	3.2	2.9
25.	VRSP-14	2.7	2.8	2.9	2.9
Gm		2.77	3.42	4.38	4.13
SEm±		0.29	0.17	0.39	0.18
CD at 5%		0.83	0.49	1.13	0.51

Table 11: Number of branches per plant in different orange flesh sweet potato genotypes under study

S. No.	Name of genotypes	Number of branches			
		30 days	60 days	90 days	120 days
1.	ST-14	1.8	8.0	9.5	8.6
2.	Sree Kanaka	2.2	7.8	9.2	7.9
3.	SWA-2	1.8	4.8	9.8	6.5
4.	Kamala Sundari	2.0	4.8	9.1	7.6
5.	CIP-440127	2.5	9.4	11.4	10.6
6.	ACC-22	3.0	7.2	17.5	12.7
7	ACC-11	3.0	9.6	11.8	10.9
8.	Kiran	2.0	8.7	9.4	9.1
9.	Gouri	3.0	9.3	11.1	10.2
10.	CO-1	2.8	10.4	12.2	11.1
11.	VRSP-1	2.0	9.0	9.5	11.2
12.	VRSP-2	2.2	5.7	10.7	7.5
13.	ACC-5	1.5	6.8	9.5	7.9
14.	VRSP-3	1.7	8.8	14.6	12.4
15.	VRSP-4	2.5	6.5	11.4	8.9
16.	VRSP-5	2.7	9.5	13.3	11.7
17.	VRSP-6	2.2	5.8	11.4	9.7
18.	VRSP-7	2.8	12.0	13.2	12.9
19.	VRSP-8	3.3	11.6	14.0	12.9
20.	VRSP-9	3.1	9.1	12.6	10.9
21.	VRSP-10	3.2	7.2	9.0	7.9
22.	VRSP-11	2.8	9.5	12.8	11.2
23.	VRSP-12	3.0	7.3	10.4	10.7
24.	VRSP-13	3.7	15.0	17.7	16.2
25.	VRSP-14	4.8	13.0	13.6	13.2
Gm		2.66	8.70	11.81	10.41
SEm±		0.29	0.86	1.19	0.62
CD at 5%		0.82	2.45	3.40	1.78

Table 12: Fresh weight of whole plant (g) in different orange flesh sweet potato genotypes under study

S. No.	Name of genotypes	Fresh weight of whole plant (g)			
		30 days	60 days	90 days	120 days
1.	ST-14	50.0	226.4	1188.7	711.1
2.	Sree Kanaka	30.0	264.9	803.6	596.3
3.	SWA-2	61.0	387.5	1240.4	855.6
4.	Kamala Sundari	36.0	601.4	1146.4	639.0
5.	CIP-440127	38.0	381.6	1224.5	814.0
6.	ACC-22	63.6	464.1	1207.3	745.1
7.	ACC-11	68.6	532.1	1379.2	855.3
8.	Kiran	56.0	439.3	1250.6	845.6
9.	Gouri	78.0	492.6	1241.9	876.0
10.	CO-1	87.6	438.8	938.0	586.7
11.	VRSP-1	66.0	463.0	1640.2	1156.6
12.	VRSP-2	97.0	541.3	1410.8	952.5
13.	ACC-5	66.0	381.1	867.8	528.5
14.	VRSP-3	92.0	821.3	1870.2	1188.5
15.	VRSP-4	62.0	558.5	1615.1	916.6
16.	VRSP-5	91.0	656.3	2084.9	1113.8
17.	VRSP-6	113.2	477.5	1364.3	920.2
18	VRSP-7	109.0	482.0	1178.4	780.8
19.	VRSP-8	99.0	386.7	1922.7	1072.9
20.	VRSP-9	65.3	562.7	2039.2	1100.8
21.	VRSP-10	58.2	308.7	692.5	475.5
22.	VRSP-11	55.0	442.8	1075.6	736.8
23.	VRSP-12	119.6	732.2	2346.7	1380.4
24.	VRSP-13	125.0	821.3	2236.0	1195.8
25.	VRSP-14	241.0	564.4	1396.1	877.8
Gm		81.13	490.11	1414.49	876.93
SEm±		3.12	23.58	44.11	57.15
CD at 5%		8.92	67.26	125.83	163.03

Table 13: Dry weight of whole plant (g) in different orange flesh sweet potato genotypes under study

S. No.	Name of genotypes	Dry weight of whole plant (g)			
		30 days	60 days	90 days	120 days
1.	ST-14	10.9	40.0	210.5	197.0
2.	Sree Kanaka	6.8	70.9	215.2	209.8
3.	SWA-2	14.8	90.5	300.0	284.6
4.	Kamala Sundari	10.9	110.6	220.2	203.4
5.	CIP-440127	8.9	85.6	274.9	261.6
6.	ACC-22	13.1	93.2	242.5	230.4
7	ACC-11	11.4	100.1	291.7	272.7
8.	Kiran	10.5	79.2	117.7	166.2
9.	Gouri	11.1	61.3	164.2	153.1
10.	CO-1	14.1	82.1	175.6	167.5
11.	VRSP-1	14.3	110.4	407.3	327.3
12.	VRSP-2	25.3	121.5	311.1	299.5
13.	ACC-5	14.1	112.2	291.5	275.8
14.	VRSP-3	20.3	126.5	367.1	353.2
15.	VRSP-4	11.7	105.3	310.7	266.2
16.	VRSP-5	22.3	118.1	332.2	320.3
17	VRSP-6	19.1	99.2	309.5	292.3
18.	VRSP-7	23.1	114.3	279.9	263.9
19.	VRSP-8	30.9	121.0	323.7	305.7
20.	VRSP-9	24.3	102.1	327.1	312.5
21	VRSP-10	16.3	96.6	307.3	285.9
22.	VRSP-11	14.9	107.0	269.9	252.3
23.	VRSP-12	15.9	117.3	421.5	410.0
24.	VRSP-13	27.2	125.0	400.5	389.8
25.	VRSP-14	47.7	125.4	309.8	284.8
Gm		17.64	100.67	289.71	271.47
SEm±		0.93	4.91	12.01	16.84
CD at 5%		2.66	14.00	34.27	48.05

Table 14: Fresh weight of root (g) in different orange flesh sweet potato genotypes under study

S. No.	Name of genotypes	Fresh weight of root (g)			
		30 days	60 days	90 days	120 days
1.	ST-14	9.6	26.8	38.8	584.4
2.	Sree Kanaka	6.3	25.2	33.7	348.3
3.	SWA-2	9.6	38.4	48.5	744.7
4.	Kamala Sundari	9.3	26.3	32.2	320.2
5.	CIP-440127	9.0	40.3	53.1	812.9
6.	ACC-22	7.0	48.3	86.3	693.6
7	ACC-11	10.0	35.0	41.5	402.0
8.	Kiran	9.0	19.7	27.0	287.0
9.	Gouri	8.6	46.1	60.4	608.4
10.	CO-1	12.6	23.0	30.8	298.1
11.	VRSP-1	8.3	57.2	140.6	989.1
12.	VRSP-2	8.3	60.0	114.0	852.9
13.	ACC-5	8.3	29.1	39.6	484.5
14.	VRSP-3	13.3	84.7	157.6	1000.2
15.	VRSP-4	7.3	37.1	44.2	545.5
16.	VRSP-5	9.0	65.4	120.3	978.6
17	VRSP-6	7.6	34.3	45.6	516.9
18.	VRSP-7	10.3	64.6	120.7	797.6
19.	VRSP-8	9.3	78.3	130.4	956.2
20.	VRSP-9	8.3	82.3	160.8	982.6
21.	VRSP-10	10.0	44.5	72.7	579.5
22.	VRSP-11	8.0	40.7	49.7	444.4
23.	VRSP-12	9.6	90.7	169.0	1018.1
24.	VRSP-13	8.3	86.3	162.4	1097.3
25.	VRSP-14	6.6	46.9	87.4	605.7
Gm		8.97	49.30	82.69	677.94
SEm±		0.73	1.70	2.66	24.11
CD at 5%		2.08	4.84	7.59	68.76

number of branches per plant from 30 to 90 DAP. The decrease in dry weight of whole plant was observed at 120 DAP could be due to decrease in leaf area due to ageing of the leaves.

3. Fresh weight of root (g)

The data pertaining to fresh weight of root are presented in Table 14. Significant differences were observed in fresh weight of root among different genotypes of OFSP at 30, 60,

90 and 120 DAP. Based on the results obtained, increase in fresh weight of root was observed up to 120 DAP. But rapid increase in fresh weight of root was observed from 30 DAP to 60 DAP in all the genotypes. These results suggested that tuber initiation in OFSP takes place at 60 DAP. Again there was rapid increase in fresh weight of root was observed from 90 DAP to 120 DAP in all the genotypes suggested that tuber bulking in OFSP takes place between 90 and 120 DAP.

4. Dry weight of root (g)

The data pertaining to dry weight of root are presented in 15. Significant differences were observed in dry weight of root among different genotypes at 30, 60, 90 and 120 DAP.

Based on the results obtained it may be concluded that dry matter production is considered to be one of the most reliable measures for judging the optimum plant growth. An increase in dry weight of root was observed up to 120 DAP. Increased dry matter production is mainly because of accumulation of starch, total soluble solids and other metabolites in the root.

Root Characters

1. Number of root tubers per plant

The data pertaining to number of root tubers per plant are presented in Table 16. Significant differences were observed in number of root tubers among different genotypes of OFSP at harvesting time.

Among all the genotypes VRSP-13 recorded the maximum number of root tubers per plant (9.0), while Sree Kanaka, ACC-11, ACC-5 and VRSP-11 recorded the minimum number of root tubers per plant (2.0).

2. Root tuber length (cm)

The data pertaining to root tuber length are presented in Table 16. Significant differences were observed in root tuber length among different genotypes of OFSP at harvesting time.

Among all the genotypes VRSP-1 recorded the maximum root tuber length (21.9 cm), while VRSP-6 recorded the minimum root tuber length (12.0 cm).

Table 15: Dry weight of root (g) in different orange flesh sweet potato genotypes under study

S. No.	Name of genotypes	Dry weight of root (g)			
		30 days	60 days	90 days	120 days
1.	ST-14	2.5	7.0	10.1	211.8
2.	Sree Kanaka	1.3	5.3	7.1	108.3
3.	SWA-2	1.9	7.8	9.8	225.4
4.	Kamala Sundari	2.4	6.8	8.3	115.2
5.	CIP-440127	1.7	7.9	10.3	239.3
6.	ACC-22	1.8	12.9	22.9	253.6
7.	ACC-11	2.2	7.8	9.3	130.5
8.	Kiran	2.4	5.4	7.4	108.2
9.	Gouri	2.2	12.0	15.8	220.2
10.	CO-1	3.3	6.0	8.1	108.2
11.	VRSP-1	2.0	13.9	35.3	330.8
12.	VRSP-2	2.2	16.2	30.9	316.4
13.	ACC-5	1.6	5.7	7.7	143.7
14.	VRSP-3	3.3	21.3	39.7	352.1
15.	VRSP-4	1.8	9.3	11.1	191.6
16.	VRSP-5	2.2	16.4	30.2	343.6
17.	VRSP-6	1.8	8.4	11.2	179.3
18.	VRSP-7	2.6	16.9	31.5	288.1
19.	VRSP-8	2.5	21.1	31.5	354.0
20.	VRSP-9	2.2	22.1	43.2	362.5
21.	VRSP-10	2.5	11.2	18.3	204.0
22.	VRSP-11	2.0	10.6	12.9	160.4
23.	VRSP-12	2.4	22.9	42.7	359.1
24.	VRSP-13	1.9	20.5	38.6	371.0
25.	VRSP-14	1.6	11.5	21.4	209.2
Gm		2.21	12.32	20.61	235.46
SEm+		0.17	0.45	0.52	11.60
CD at 5%		0.49	1.30	1.49	33.08

Table 16: Root characters of different orange flesh sweet potato genotypes under study

S. No.	Name of genotypes	No. of root tubers per plant	Root tuber length (cm)	Root tuber girth (cm)	Root tuber yield per plant (g)	Root tuber yield (t/ha)
1.	ST-14	4.0	15.5	20.8	491.0	20.3
2.	Sree Kanaka	2.0	16.5	16.8	214.0	16.6
3.	SWA-2	4.0	15.9	21.2	526.0	20.3
4.	Kamala Sundari	3.0	14.8	12.2	210.0	11.0
5.	CIP-440127	5.0	15.5	17.8	611.1	27.0
6.	ACC-22	6.0	13.5	14.3	681.8	36.0
7.	ACC-11	2.0	14.1	16.1	257.5	12.6
8.	Kiran	3.0	13.6	13.2	217.9	15.0
9.	Gouri	4.0	18.4	16.0	489.0	19.5
10.	CO-1	3.0	15.5	16.2	268.9	18.1
11.	VRSP-1	7.0	21.9	18.3	931.7	40.9

12.	VRSP-2	7.0	18.6	16.5	831.7	40.0
13.	ACC-5	2.0	16.5	16.1	276.4	20.6
14.	VRSP-3	7.0	18.8	30.3	974.2	41.3
15.	VRSP-4	2.6	14.0	21.6	391.5	17.8
16.	VRSP-5	7.3	15.3	22.5	909.5	40.5
17.	VRSP-6	4.0	12.0	11.0	377.9	17.5
18.	VRSP-7	6.0	15.3	20.6	755.8	36.9
19.	VRSP-8	7.0	17.0	23.1	873.2	41.3
20.	VRSP-9	8.0	17.2	21.0	902.1	40.5
21.	VRSP-10	3.0	16.0	21.5	406.9	18.2
22.	VRSP-11	2.0	19.8	20.6	314.7	15.2
23.	VRSP-12	8.6	20.0	21.5	986.7	40.9
24.	VRSP-13	9.0	18.6	20.0	978.5	41.2
25.	VRSP-14	3.0	16.0	21.0	425.5	20.0
Gm		4.78	16.44	18.84	572.18	26.79
SEm±		0.54	0.61	0.72	36.10	1.08
CD at 5%		1.55	1.74	2.0	102.99	3.09

3. Root tuber girth (cm)

The data pertaining to root tuber girth are presented in Table 16. Significant differences were observed in root tuber girth among different genotypes of OFSP at harvesting time.

Among all the genotypes VRSP-3 recorded the maximum root tuber girth (30.3 cm), while VRSP-6 recorded the minimum root tuber girth (11.0 cm).

4. Root tuber yield per plant (g)

The data pertaining to root tuber yield per plant are presented in Table 16. Significant differences were observed in root tuber yield per plant among different genotypes of OFSP at harvesting time.

Among all the genotypes VRSP-12 recorded the maximum root tuber yield per plant (986.7 g), followed by VRSP-13 (978.5 g), VRSP-3 (974.2 g), VRSP-1 (931.7 g), VRSP-5 (909.5 g) and VRSP-9 (902.1 g), while Kamala Sundari recorded the minimum root tuber yield per plant (210.0 g). Similar results were also reported by Byju and Ray (2002) [2] for root yield per plant.

Kamalam (1990) [3] conducted a trial with fifteen cultivars of sweet potato and observed very high variability for number of tubers and tuber yield.

5. Root tuber yield (t/ha)

The data pertaining to root tuber yield are presented in Table 16. Significant differences were observed in root tuber yield per hectare among different genotypes of OFSP at harvesting time.

Among all the genotypes VRSP-3 and VRSP-8 recorded the maximum root tuber yield (41.3 t/ha), followed by VRSP-13 (41.2 t/ha), VRSP-1 and VRSP-12 (40.9 t/ha), while Kamala Sundari recorded the minimum root tuber yield (11.0t/ha).

Based on the results obtained it may be concluded that there was an increase in number of root tubers, root tuber length, root tuber girth and root tuber yield per plant due to more utilization of photosynthates in economic parts as compared to vegetative parts and ultimately results in increase in root tuber yield per hectare. The above results are in conformity with the results obtained by Tiwari *et al*. in sweet potato.

Acknowledgement

I extend my deep sense of reverence and gratitude to Associate Dean, College of Horticulture, Venkataramannagudem, Dr. Y.S.R.H.U. The germplasm supplied by AICRP on Tuber crops Project, HRS, V.R. Gudem is greatly acknowledged. I am highly thankful to ICAR for providing financial assistance in the form of stipend to complete this endeavour.

References

1. Ashok P, Sasikala K, Netra Pal. Growth analysis studies in onion (*Allium cepa* L), International Journal of Farm Sciences. 2013; 3(1):30-46.
2. Byiu G, Ray RC. Effect of graded levels of potassium on yield and yield components of sweet potato (*Ipomoea botatas* (L.) Lam.) Journal of root crops. 2002; 30(2):91-93.
3. Kamalam P. Variation for quantitative traits in the first clonal generation of the open pollinated progenies of sweetpotato. Journal of Root Crops, ISRC National Symposium. 1990, 49-52.
4. Ramaswamy R, Muthukrishnan R. Studies on varietal performance of exotic sweet potato clones under Coimbatore conditions, Madras Agricultural Journal. 1982; 69(9):593-596.
5. Shoba, H, Arunugam R, Halen S. Physiology of growth and development of garlic (*Allium sativum* L). South Indian Horticulture. 1990; 38(6):323-328.
6. Tiwari JP, Amar C, Nair PKR. Growth analysis of ten sweet potato varieties (*Ipomoea botatas* Poir). Tropical Tuber Crops. Nat. Symp, 1885, 147-151.
7. Venkatachalam R, Sarala Devi D, Mohammed Yassin M, Seemanthini Ramados. An evaluation of some sweet potato types under Tamil Nadu condition. Journal of Root Crops. 1990; 13:42-44.
8. Xhunga S, Zafirati V. Relationship between assimilate supply and the economic productivity of late tomatoes. Bujqesia shquiptare. 1994; 4:24-25.