

Original Research Article

Comparative Performance of Brinjal (*Solanum melongena* L.) Grafts under Polyhouse and Open Field Conditions

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ABSTRACT

The experiment entitled “Comparative performance of brinjal (*Solanum melongena* L.) grafts under polyhouse and open field conditions” was carried out in 2018-19 with ten treatments viz. T₁: 20S:20RS, T₂: 25S:20RS, T₃: 30S:20RS, T₄: 20S:25 RS, T₅: 25S:25 RS, T₆: 30S:25RS, T₇: 20S:30RS, T₈: 25S:30RS, T₉: 30S:30RS, T₁₀: Seedlings of Kali-rawai and each treatment was replicated thrice in Randomized Block Design. The brinjal variety Swarn Pratibha was used as rootstock and cv. Kali-rawai was used as scion. The highest grafting success (77.33%) as well as survival (75.33 %) was observed in T₅. Highest survival percentage after transplanting in polyhouse (100%) was recorded in almost all the treatments viz. T₂, T₃, T₄, T₅, T₆, T₇ and T₈ except T₁ (97.78%) and T₁₀ (91.12%). Under open field conditions survival percentage of brinjal grafts was maximum (100%) in various treatments viz. T₂, T₄, T₆ and T₇ and were at par with T₁, T₃, T₅, T₆ and T₉ (97.78%) whereas significantly lowest survival percentage (80%) was observed in T₁₀ (control). Yield (t/ha) was in the range of 5.12 to 6.05 t^{ha} (polyhouse) and 29.62 to 44.11 t^{ha} (open field). The longest main root in polyhouse and open field was noted in T₆ (33.77 cm and 41.93 cm respectively). Maximum number of secondary roots in polyhouse and open field were produced in T₇ (263.57 and 512.57 respectively) and was significantly superior over all other treatments.

Keywords

Solanum melongena, Brinjal grafts, Comparative performance, Grafting success, Grafting survival

Introduction

Brinjal is an important solanaceous crop grown during *rabi* season under Konkan agroclimatic conditions. It has occupied prominent position in rice based cropping system of the region. Traditionally, the local varieties were preferred for cultivation; however, the improved/hybrid varieties are becoming popular among the farmers due to their enhanced growth and high yield. But there are limitations in cultivation of these

varieties due to their susceptibility to incidence of bacterial wilt in konkan soils. To overcome this constraint, grafting technique is an effective way for managing the disease where resistant varieties/local types can be used as rootstock on which the desirable scion variety can be grafted. Grafted vegetables produced higher yield and exhibit improved tolerance to environmental stresses, control soil-borne pathogens, soil salinity and low soil temperatures (Lee, 1994; Edelstein 2004; King *et al.*, 2008). Grafting is also an

effective technique in ameliorating crop losses which are caused by adverse environmental conditions (Dietmar *et al.*, 2010).

Materials and Methods

The experiment entitled “Comparative performance of brinjal (*Solanum melongena* L.) grafts under polyhouse and open field conditions” was carried out at experimental field of Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth, Dapoli Dist. Ratnagiri (M.S.) India 415 712 during year 2018-19 with ten treatments and three replication under Randomized Block Design. The bacterial wilt tolerant variety ‘Swarn Pratibha’ was used as a rootstock and cv. Kali rawai was used as a scion. The experiment consisted of ten treatments *viz.* T₁: 20 days old scion grafted on 20 days old rootstock (20S:20RS), T₂: 25 days old scion grafted on 20 days old rootstock (25S:20RS), T₃: 30 days old scion grafted on 20 days old rootstock (30S:20RS), T₄: 20 days old scion grafted on 25 days old rootstock (20S:25RS), T₅: 25 days old scion grafted on 25 days old rootstock (25S:25RS), T₆: 30 days old scion grafted on 25 days old rootstock (30S:25RS), T₇: 20 days old scion grafted on 30 days old rootstock (20S:30RS), T₈: 25 days old scion grafted on 30 days old rootstock (25S:30RS), T₉: 30 days old scion grafted on 30 days old rootstock (30S:30RS), T₁₀: Seedlings of Kali-rawai. Seeds of rootstock and scion were sown in protrays filled with cocopeat and vermicompost in 3:1 ratio as per the treatments. Cleft grafting was carried out when scion and rootstock seedlings attained their respective age according to the treatments and were kept in healing chambers at 27 to 32 °C temperature and a relative humidity (RH) 85-95 % upto eight days for healing of the graft union. After healing, hardening of successful grafts was done for fifteen days in naturally ventilated polyhouse. Well acclimatized

grafts were transplanted in naturally ventilated polyhouse and open field as per the treatments. All recommended interculture and plant protection practices were carried out to raise the healthy crop. Various observations *viz.* grafting success % (20th DAG), per cent survival of grafts (30th DAG), girth at collar and graft union (mm) were recorded before transplanting whereas survival after transplanting, plant height (cm), number of leaves, total leaf area (cm²) and number of branches, stem diameter (mm) above graft union, stem diameter (mm) at graft union, stem diameter (mm) below graft union, days for initiation and 50 per cent flowering, days for first harvest, last harvest, harvesting span, fruit length (cm), fruit diameter (cm), fruit weight (g), yield per plant (kg), yield per hectare (t), length of main root (cm) and number of secondary roots were recorded under open field as well as polyhouse conditions. The data obtained were analysed as per the method suggested by Panse and Sukhatme (1995).

Results and Discussions

The data presented in Table 1 and illustrated in Figure 1 exhibited significant difference in grafting success (%) as well as graft survival and were in the range of 72.67% to 77.33% and 70.67% to 75.33% respectively after 20 days of grafting. The highest grafting success (77.33%) as well as survival (75.33%) was observed in T₅ (25S:25RS).

The data given in Table 1 regarding the girth at collar exhibited significant difference in various treatments and highest collar girth was noted in T₈ (3.57 mm), it was at par with T₉ and T₇ whereas girth at graft union was maximum in T₉ (4.14 mm) and was significantly superior with other treatments.

Survival of grafts (Table 1 and Figure 2) was recorded after transplanting under polyhouse

as well as open field conditions. In polyhouse, survival of grafts was in range of 91.12 % to 100%. Significantly highest survival percentage (100 %) was recorded in almost all the treatments *viz.* T₂, T₃, T₄, T₅, T₆, T₇ and T₈ except T₁ (97.78 %) and T₁₀ (91.12 %). However, T₁ was at par with all other treatments except control (T₁₀) which exhibited lowest survival percentage (91.12 %). Under open field conditions survival percentage of brinjal grafts was in range of 80% to 100%. Maximum survival percentage (100 %) was recorded in various treatments *viz.* T₂, T₄, T₆ and T₇ and were at par with T₁, T₃, T₅, T₆ and T₉ (97.78 %) whereas significantly lowest survival percentage (80%) was observed in T₁₀ (control).

At 120 days after transplanting, plant height of brinjal grafts (Table 2) in polyhouse was in the range of 60.02 cm to 83.80 cm with mean of 76.77 cm. Maximum plant height was recorded in T₉ (83.80 cm) and was at par with T₅ (82.59 cm) whereas in open field, plant height was in the range of 56.58 cm to 78.13 cm with mean of 73.73 cm. The highest plant height was registered in T₉ (78.13 cm) which was at par with T₆ (77.59 cm) and significantly superior over all other treatments.

In polyhouse conditions, number of leaves (Table 2) was in the range of 59.73 to 69.73. Maximum number of leaves was recorded in T₇ (69.73) and was at par with T₈ (69.67), T₆ (69.47), T₉ (69.47), T₃ (69.07) and T₅ (68.53) whereas number of leaves in open field was in the range of 107.20 to 121.93 with mean of 119.31. Highest number of leaves was noted in T₈ (121.93) and was at par with T₅ (121.87), T₆ (121.67), T₉ (121.53), T₃ (120.73), T₄ (119.80) and T₂ (119.47).

The total leaf area (Table 2) also varied significantly under both the growing conditions. In polyhouse, it was in the range

of 6022.76 to 7070.05 cm² with mean of 6856.57 cm² whereas in open field it ranged between 10434.93 to 12134.51 cm² with mean of 11562.51 cm². Thus, it was evident that more healthier growth was achieved under open field conditions as compared to polyhouse conditions.

Number of branches (Table 2) under both the growing conditions varied non-significantly and it was in the range of 4.07 to 4.67 in polyhouse and 14.07 to 15.13 in open field. Number of branches per plant is an important character in crop like brinjal which decides the plant spread and fruiting area which ultimately contributes to the yield.

Stem diameter above graft union (Table 3) ranged from 16.57 to 17.55 mm in polyhouse whereas it was 18.63 to 19.23 mm in open field. Highest stem diameter above graft union was registered in T₈ under both the growing conditions (17.55 mm and 19.23 mm respectively). The stem diameter at graft union was in range of 18.33 to 19.28 mm in polyhouse whereas it was 22.24 to 23.09 mm in open field. Maximum stem diameter at graft union was noted in T₇ (19.28 mm) in polyhouse and in T₈ (23.09 mm) in open field. Stem diameter below graft union ranged from 20.58 to 21.38 mm in polyhouse whereas it was 25.85 to 27.21 mm in open field. Highest stem diameter below graft union was registered in T₈ under both the growing conditions (21.38 mm and 27.21 mm respectively).

The non-significant difference among the various treatments with respect to initiation of flowering (Table 4) was recorded in both growing conditions. The early initiation of flowering was observed in polyhouse and was in range of 42.67 to 44.00 days with mean 43.20 days whereas in open field conditions, slightly delayed flowering was observed as compared to polyhouse and the

days required were in the range of 44.67 to 46.33 days with mean 45.43 days. Days for 50% flowering also followed similar trend and the range was 54.33 to 55.67 with mean of 54.83 days in polyhouse whereas it ranged between 55.00 to 57.00 with mean of 56.10 days in open field.

The days required for first harvest (Table 5) under varied non-significantly both in polyhouse and open field conditions. Under polyhouse, days for first harvest ranged between 74.00 to 76.33 with mean of 74.77 days whereas it was in the range of 75.67 to 78.33 with mean of 76.83 days in open field.

Table.1 Effect of age of scion and rootstock on grafting success, survival, girth at collar region (mm), girth at graft union (mm), survival of grafts under polyhouse and open field conditions of brinjal grafts

Treatments	Grafting Success (%)	Survival %	Girth at collar region (mm)	Girth at graft union (mm)	Survival %	
	20 th DAG	30 th DAG	(1 month after grafting)		Polyhouse	Open field
T₁ (20 S : 20 RS)	76.67 (61.12)	74.00 (59.35)	1.82	2.76	97.78 (85.01)	97.78 (85.01)
T₂ (25 S : 20 RS)	75.33 (60.22)	73.33 (58.91)	1.81	3.13	100 (90)	100 (90)
T₃ (30 S : 20 RS)	72.67 (58.48)	70.67 (57.22)	1.82	3.54	100 (90)	97.78 (85.01)
T₄ (20 S : 25 RS)	76.00 (60.67)	74.00 (59.34)	2.69	3.26	100 (90)	100 (90)
T₅ (25 S : 25 RS)	77.33 (61.60)	75.33 (60.22)	2.71	3.65	100 (90)	97.78 (85.01)
T₆ (30 S : 25 RS)	74.67 (59.78)	72.67 (58.48)	2.70	3.93	100 (90)	100 (90)
T₇ (20 S : 30 RS)	72.67 (58.48)	70.67 (57.21)	3.51	3.62	100 (90)	100 (90)
T₈ (25 S : 30 RS)	75.33 (60.23)	72.67 (58.48)	3.57	3.99	100 (90)	97.78 (85.01)
T₉ (30 S : 30 RS)	72.67 (58.48)	72.00 (58.06)	3.54	4.14	100 (90)	97.78 (85.01)
T₁₀ (Seedlings)	-	-	-	-	91.12 (72.86)	80 (63.43)
Range	72.67-77.33	70.67-75.33	1.81-3.57	2.76-4.14	91.12-100.00	80.00-100.00
Mean	74.81	72.81	2.68	3.56	98.89	96.89
Result	SIG	SIG	SIG	SIG	SIG	SIG
S.E.+/-	0.98	1.00	0.03	0.02	1.02	1.64
C.D. 5%	2.93	2.99	0.09	0.08	3.03	4.87

(Figures in the parenthesis indicate arcsine transformed value)

Table.2 Effect of age of rootstock and scion on plant height (cm), number of leaves , total leaf area (cm²) and number of branches of brinjal under polyhouse and open field conditions

Treatments	Plant height (cm)		Number of leaves		Total leaf area (cm ²)		Number of Branches	
	Polyhouse	Open field	Polyhouse	Open field	Polyhouse	Open field	Polyhouse	Open field
T₁ (20 S : 20 RS)	77.24	73.44	67.00	119.20	6712.44	11345.85	4.07	14.07
T₂ (25 S : 20 RS)	78.94	74.22	67.80	119.47	6897.90	11460.92	4.47	14.07
T₃ (30 S : 20 RS)	81.42	76.39	69.07	120.73	6965.96	11546.85	4.00	14.20
T₄ (20 S : 25 RS)	78.70	73.70	67.67	119.80	6796.40	11726.34	4.27	14.33
T₅ (25 S : 25 RS)	79.65	74.65	68.53	121.87	7031.22	11738.20	4.47	14.20
T₆ (30 S : 25 RS)	82.59	77.59	69.47	121.67	7070.05	11575.15	4.67	15.00
T₇ (20 S : 30 RS)	81.05	76.07	69.73	119.73	7038.27	11782.44	4.60	14.40
T₈ (25 S : 30 RS)	81.53	76.54	69.67	121.93	7058.78	11880.32	4.60	14.00
T₉ (30 S : 30 RS)	83.80	78.13	69.47	121.53	6971.87	12134.09	4.07	15.13
T₁₀ (Seedlings)	60.02	56.58	59.73	107.20	6022.76	10434.93	4.40	14.00
Range	60.02-83.80	56.58-78.13	59.73-69.73	107.20-121.93	6022.76-7070.05	10434.93-12134.09	4.07-4.67	14.07-15.13
Mean	76.77	73.73	67.81	119.31	6856.57	11562.51	4.36	14.34
Result	SIG	SIG	SIG	SIG	SIG	SIG	NS	NS
S.E.m+-	0.42	0.20	0.62	0.88	131.43	101.92	0.36	0.16
C.D. at 5%	1.25	0.60	1.84	2.60	390.50	302.83		

Table.3 Effect of age of rootstock and scion on stem diameter (mm) above graft union, stem diameter (mm) at graft union and stem diameter (mm) below graft union of brinjal under polyhouse and open field conditions

Treatments	Stem diameter (mm) above graft union		Stem diameter (mm) at graft union		Stem diameter (mm) below graft union	
	Polyhouse	Open field	Polyhouse	Open field	Polyhouse	Open field
T₁ (20 S : 20 RS)	16.57	18.63	18.61	22.24	20.65	26.35
T₂ (25 S : 20 RS)	16.99	18.72	18.71	22.41	20.83	26.56
T₃ (30 S : 20 RS)	17.18	18.96	18.90	22.68	21.08	26.76
T₄ (20 S : 25 RS)	17.01	18.78	18.33	22.44	20.80	26.56
T₅ (25 S : 25 RS)	17.25	19.05	19.08	22.71	21.19	26.88
T₆ (30 S : 25 RS)	17.19	18.92	18.92	22.50	21.07	26.71
T₇ (20 S : 30 RS)	17.39	19.19	19.28	23.07	21.21	26.96
T₈ (25 S : 30 RS)	17.55	19.23	19.23	23.09	21.38	27.21
T₉ (30 S : 30 RS)	17.52	19.15	19.17	23.06	21.28	27.00
T₁₀ – Seedlings (at collar region)	-	-	-	-	20.58	25.85
Range	16.57-17.55	18.63-19.23	18.33-19.28	22.24-23.09	20.58-21.38	25.85-27.21
Mean	17.18	18.96	18.91	22.69	21.01	26.68
Result	SIG	SIG	SIG	SIG	SIG	SIG
S.E.m+-	0.05	0.08	0.07	0.10	0.05	0.06
C.D. at 5%	0.14	0.24	0.20	0.30	0.15	0.17

Table.4 Effect of age of rootstock and scion on days required for initiation and 50 per cent flowering of brinjal under polyhouse and open field conditions

Treatments	Days for initiation of flowering		Days for 50% flowering	
	Polyhouse	Open field	Polyhouse	Open field
T ₁ (20 S : 20 RS)	43.33	46.00	55.00	56.67
T ₂ (25 S : 20 RS)	43.00	46.00	54.67	56.67
T ₃ (30 S : 20 RS)	43.00	44.67	54.67	55.33
T ₄ (20 S : 25 RS)	43.33	45.33	55.33	57.00
T ₅ (25 S : 25 RS)	43.00	45.00	54.67	56.33
T ₆ (30 S : 25 RS)	43.00	44.67	54.67	55.00
T ₇ (20 S : 30 RS)	43.33	45.33	55.00	55.67
T ₈ (25 S : 30 RS)	44.00	45.33	55.67	55.67
T ₉ (30 S : 30 RS)	43.33	45.67	54.33	56.00
T ₁₀ (Seedlings)	42.67	46.33	54.33	56.67
Range	42.67-44.00	44.67-46.33	54.33-55.67	55.00-57.00
Mean	43.20	45.43	54.83	56.100
Result	NS	NS	NS	NS
S.E.m+-	0.53	0.79	0.56	0.79
C.D. at 5%				

Table.5 Effect of age of rootstock and scion on days required for first harvest, last harvest and span of harvest of brinjal under polyhouse and open field conditions

Treatments	Days for first harvest		Days for last harvest		Harvesting span (days)	
	Polyhouse	Open field	Polyhouse	Open field	Polyhouse	Open field
T ₁ (20 S : 20 RS)	75.00	77.33	127.33	143.67	52.33	66.33
T ₂ (25 S : 20 RS)	74.67	77.67	124.67	143.33	50.00	65.67
T ₃ (30 S : 20 RS)	74.67	75.67	124.00	142.00	49.33	66.33
T ₄ (20 S : 25 RS)	75.00	76.67	124.00	143.33	49.00	66.67
T ₅ (25 S : 25 RS)	74.33	76.67	125.33	143.33	51.00	66.67
T ₆ (30 S : 25 RS)	74.33	76.33	125.00	140.67	50.67	64.33
T ₇ (20 S : 30 RS)	74.67	77.33	125.00	143.00	50.33	65.67
T ₈ (25 S : 30 RS)	76.33	78.33	127.33	142.33	51.00	64.00
T ₉ (30 S : 30 RS)	74.67	76.00	123.67	143.00	49.00	67.00
T ₁₀ (Seedlings)	74.00	76.33	123.33	136.33	49.33	60.00
Range	74.00-76.33	75.67-78.33	123.33-127.33	136.33-143.67	49.00-52.33	60.00-67.00
Mean	74.77	76.83	124.97	142.10	50.20	65.27
Result	NS	NS	NS	SIG	NS	SIG
S.E.m+-	0.61	0.73	1.10	0.65	1.22	0.98
C.D. at 5%				1.92		2.92

Table.6 Effect of age of rootstock and scion on fruit length (cm), fruit diameter (cm) and fruit weight (g) of brinjal under polyhouse and open field conditions

Treatments	Fruit length (cm)		Fruit diameter (cm)		Fruit weight (g)	
	Polyhouse	Open field	Polyhouse	Open field	Polyhouse	Open field
T₁ (20 S : 20 RS)	4.11	6.35	3.09	5.39	51.54	79.59
T₂ (25 S : 20 RS)	4.11	6.42	3.05	5.33	50.35	81.27
T₃ (30 S : 20 RS)	4.26	6.36	3.03	5.23	50.10	79.41
T₄ (20 S : 25 RS)	4.01	6.41	3.11	5.39	52.11	82.41
T₅ (25 S : 25 RS)	4.21	6.42	3.08	5.19	52.14	82.50
T₆ (30 S : 25 RS)	4.17	6.41	3.11	5.36	51.40	80.74
T₇ (20 S : 30 RS)	4.18	6.34	3.14	5.36	51.86	78.93
T₈ (25 S : 30 RS)	4.06	6.42	3.09	5.33	51.76	79.81
T₉ (30 S : 30 RS)	4.19	6.39	3.01	5.32	50.91	81.95
T₁₀ (Seedlings)	4.19	6.28	3.06	5.32	51.25	80.93
Range	4.01-4.26	6.28-6.42	3.01-3.14	5.19-5.39	50.10-52.15	78.93-82.50
Mean	4.19	6.38	3.08	5.32	51.34	80.75
Result	NS	NS	NS	NS	NS	NS
S.E.m+-	0.05	0.03	0.04	0.04	0.58	1.05
C.D. at 5%						

Table.7 Effect of age of rootstock and scion on yield per plant (kg) and yield per hectare (t) of brinjal under polyhouse and open field conditions

Treatments	Yield per plant (kg)		Yield per hectare (t)	
	Polyhouse	Open field	Polyhouse	Open field
T ₁ (20 S : 20 RS)	0.33	1.50	5.26	40.64
T ₂ (25 S : 20 RS)	0.32	1.58	5.53	43.80
T ₃ (30 S : 20 RS)	0.33	1.54	5.88	41.85
T ₄ (20 S : 25 RS)	0.34	1.59	5.77	44.11
T ₅ (25 S : 25 RS)	0.34	1.57	5.75	42.58
T ₆ (30 S : 25 RS)	0.34	1.54	5.56	42.76
T ₇ (20 S : 30 RS)	0.35	1.53	6.05	42.57
T ₈ (25 S : 30 RS)	0.35	1.53	5.87	41.62
T ₉ (30 S : 30 RS)	0.34	1.58	5.96	43.03
T ₁₀ (Seedlings)	0.32	1.33	5.12	29.62
Range	0.32-0.35	1.33-1.59	5.12-6.05	29.62-44.11
Mean	0.34	1.53	5.68	41.26
Result	NS	SIG	SIG	SIG
S.E.m+-	0.01	0.03	0.01	0.82
C.D. at 5%		0.09	0.02	2.44

Table.8 Effect of age of rootstock and scion on length of main root (cm) and number of secondary roots of brinjal under polyhouse and open field conditions

Treatments	Length of main root (cm)		Number of secondary roots	
	Polyhouse	Open field	Polyhouse	Open field
T ₁ (20 S : 20 RS)	31.18	39.97	236.67	484.67
T ₂ (25 S : 20 RS)	31.43	39.59	235.67	484.67
T ₃ (30 S : 20 RS)	31.87	40.03	235.73	484.73
T ₄ (20 S : 25 RS)	31.62	39.78	255.05	504.05
T ₅ (25 S : 25 RS)	32.31	40.47	256.03	505.03
T ₆ (30 S : 25 RS)	33.77	41.93	249.40	498.40
T ₇ (20 S : 30 RS)	33.26	41.63	263.57	512.57
T ₈ (25 S : 30 RS)	32.22	40.34	227.33	476.33
T ₉ (30 S : 30 RS)	32.21	40.33	243.03	492.03
T ₁₀ (Seedlings)	25.77	33.80	153.97	402.97
Range	25.77-33.77	33.80-41.93	153.97-263.57	402.97-512.57
Mean	31.56	39.79	235.64	484.54
Result	SIG	SIG	SIG	SIG
S.E.m+-	0.63	0.69	1.52	1.31
C.D. at 5%	1.88	2.04	4.30	3.88

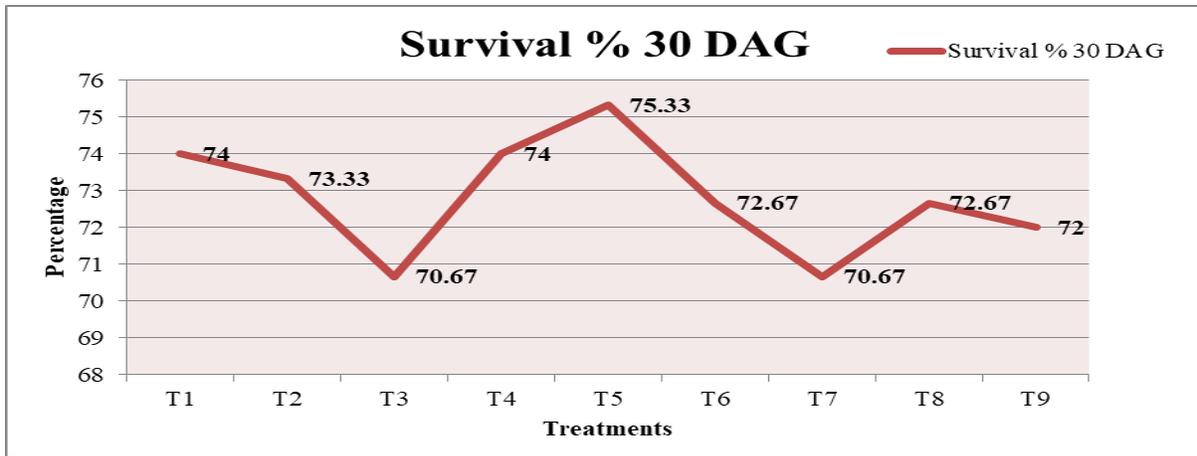


Figure.1 Effect of age of scion and rootstock on survival of brinjal grafts

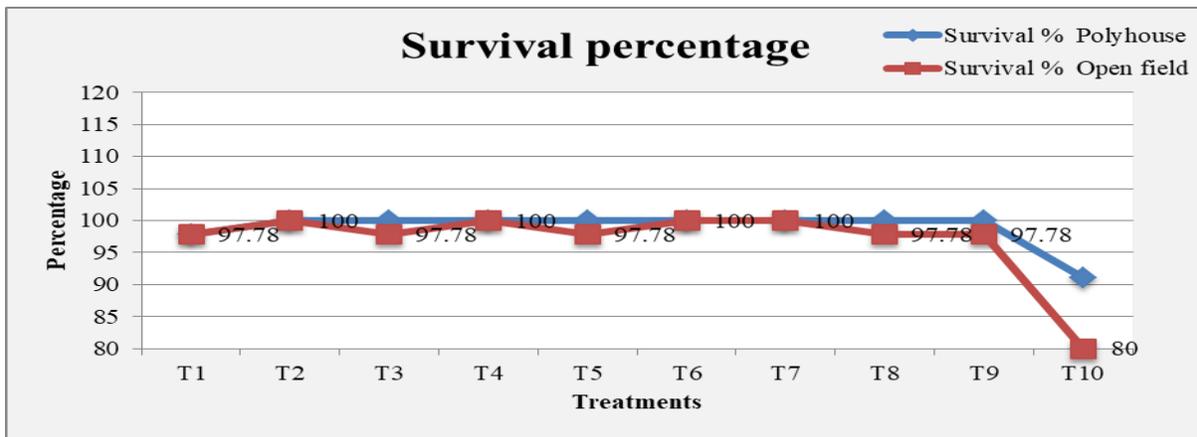


Figure.2 Effect of age of rootstock and scion on survival of brinjal under polyhouse and open field conditions

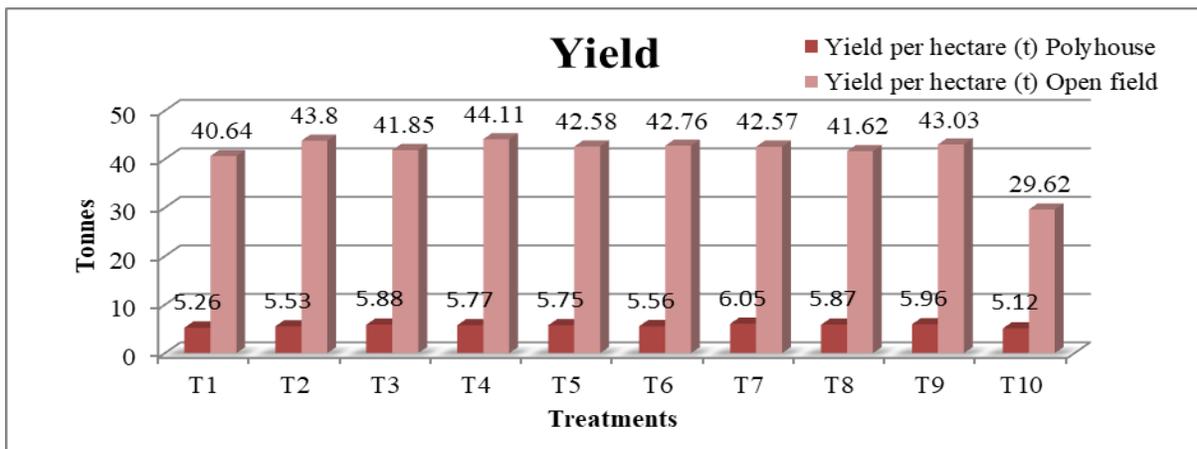


Figure.3 Effect of age of rootstock and scion on yield per hectare (t) of brinjal under polyhouse and open field conditions

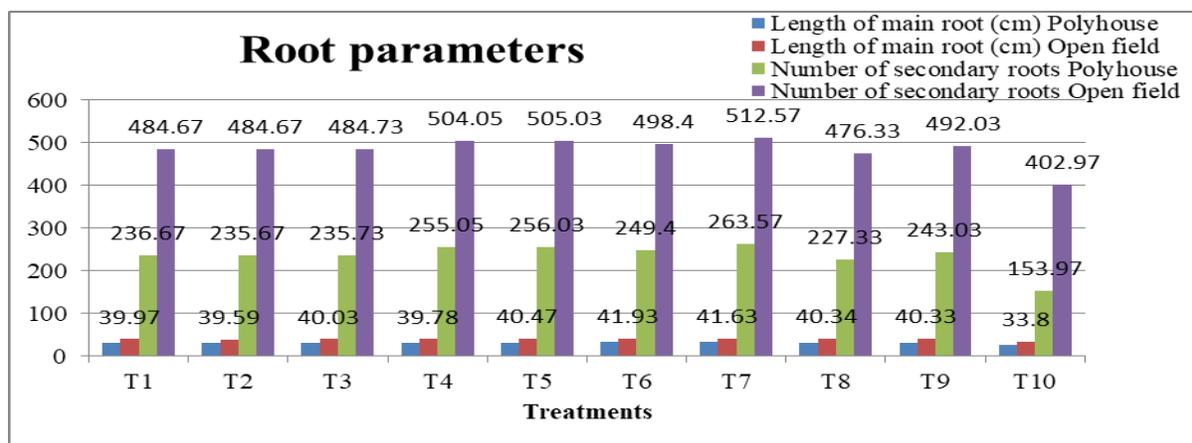


Figure.4 Effect of age of rootstock and scion on length of main root (cm) and number of secondary roots of brinjal under polyhouse and open field conditions

Harvesting span (Table 5) registered in various treatments exhibited non-significant difference in polyhouse and it was in the range of 49.00 days (T₁₀-control) to 52.33 days (T₁) with the mean of 50.20 days whereas significant difference was observed in the harvesting span of various treatments in open field. The highest span of harvest (67 days) was observed in T₉ and was lowest span of harvest (60.00 days) in T₁₀ (control). The various physical parameters of the fruit (Table 6) like fruit length, fruit diameter and fruit weight did not show significant difference among various treatments both in polyhouse and open field.

Overall yield levels (Table 7 and Figure 3) in polyhouse were less (0.34 kg^{-pl}) as compared to yield per plant in open field (1.53 kg^{-pl}). The highest yield in open field was found in T₄ (1.59 kg^{-pl}) and was at par with T₂ (1.58 kg), T₉ (1.58 kg), T₅ (1.57 kg) and T₃ (1.54 kg), T₆ (1.54 kg), T₇ (1.53 kg), T₈ (1.53 kg) and T₁ (1.50 kg) whereas lowest yield (1.33 kg) was recorded in T₁₀. Yield per hectare also followed similar trend. The overall yield levels in polyhouse conditions were very low and were in the range of 5.12 to 6.05 t^{-ha}. However, the substantial yield

was recorded under open field condition in various treatments and it was in the range of 29.62 to 44.11 t^{-ha}. The highest yield per hectare (44.11 t) was recorded in T₄ and was at par with T₂ (43.80 t), T₉ (43.03 t), T₆ (42.76 t), T₅ (42.58), T₇ (42.57 t) and T₃ (41.85 t) whereas lowest yield (29.62 t) was recorded in T₁₀.

The length of main root (Table 8 and Figure 4) exhibited significant variation in various treatments under both conditions *i.e.*, polyhouse and open field. The longest main root was registered in treatment T₆ (33.77 cm and 41.93 cm respectively) and it was at par with T₇ (33.26 cm and 41.63 cm respectively), T₅ (32.31 cm 40.47 cm respectively), T₈ (32.22 cm and 40.34 cm respectively) and T₉ (32.2 cm 40.33 cm respectively) whereas shortest main root (25.77 cm and 33.80 cm respectively) was recorded in T₁₀ (control).

In case of number of secondary roots (Table 8 and Figure 4) produced per plant, significant variation was observed in various treatments in polyhouse as well open field conditions. Maximum number of secondary roots were produced in T₇ (263.57 and

512.57 respectively) and was significantly superior over all other treatments. The range of number of secondary roots produced was 153.97 to 263.57 in polyhouse and 402.97 to 512.57 in open field. Thus, overall magnitude of number of roots produced was higher in open field as compared to polyhouse.

Grafting was done at various growth stages of scion and rootstock. The high grafting success as well as survival recorded in T₅ (77.33 and 77.33) might be due to better compatibility between scion and rootstock. The optimum juvenility of scion and rootstock might have contributed in recording high success as well as survival after grafting. It was also observed that the age of either scion or rootstock beyond 25 days recorded lower success as well as survival which might be due to declining juvenility of the scion and/or rootstock. The grafting success is always dependent on the union of cambium of rootstock and scion. (Hartmann *et al.*, 2001; Kumar, 2011). The above results are in confirmative with Tejashwini Rathod (2017) who observed that graft success was about 85 to 87% which might be due to favorable condition provided in the graft chamber.

The higher girth at collar and at graft union was observed in T₈ and T₉ respectively. Similarly, the higher girth at graft union was also observed in T₇ which indicated that higher the age of the scion and/or rootstock more is the girth at collar and graft union which can be attributed to the initial girth of the seedling which was used for grafting either as a scion or rootstock.

After transplanting, under polyhouse condition the 100 per cent survival was observed in almost all the treatments except T₁ and T₁₀ (control). The survival percentage in open field was slightly less than in

polyhouse which might be due to availability of more congenial conditions for establishment of the seedlings/grafts after transplanting under polyhouse conditions. (<https://agritech.tnau.ac.in>)

The plant height was relatively higher under polyhouse conditions which might be due to higher atmospheric humidity in polyhouse as compared to open field which increase the inter-nodal length of the plants in polyhouse which resulted in production of more plant height. Though the plant height was more under polyhouse condition, the other growth parameters like number of leaves, total leaf area and number of branches were relatively more in the plants grown under open field conditions. During present investigation, the planting was done during *rabi* season. It indicated that the climatic conditions prevailing in open field were more favourable for growth of brinjal grafts as compared to those under polyhouse condition.

Stem diameter above graft union, at graft union and below graft union indicate the sturdiness of the plant grown under respective condition. The higher magnitude of stem diameter in open field as compared to polyhouse also supports the findings that plant growth was more healthier under open field condition as compared to polyhouse. Sebahattin *et al.*, (2009) found that average stem diameter of the grafted plants of both cultivars were found to be 53% greater than of the controls, and the maximum and the minimum average stem diameters were obtained from grafted 'Pala' (40.15 mm) and ungrafted 'Faselis' (18.19 mm) plants, respectively.

Slight early initiation of flowering and fifty per cent flowering in various treatments as well as days required for first harvest under polyhouse condition might be due to less

moisture stress under polyhouse condition. Though, the flowering as well as first harvest was earlier under polyhouse condition, the harvesting span was comparatively more in open field condition as compared to polyhouse. It can be attributed to more number of leaves, total leaf area and number of branches in all the treatments planted in open field as compared to polyhouse. The higher yield per plant (kg) as well as per hectare (t) in open field condition in comparison with polyhouse can be attributed to higher vegetative growth parameters viz. number of leaves, total leaf area (cm²) and number of branches in open field as compared to polyhouse. Similarly, the higher yield in grafted plants in all the treatments might be due to production of more number of leaves, higher total leaf area and higher survival percentage in all grafted treatments as compared to control.

The length of main root as well as number of secondary roots were more in grafting treatments as compared to control and were more in open field condition as compared to polyhouse.

The extensive and well distributed root system of the grafts as compared to seedlings might have contributed in uptake of more nutrients and moisture which resulted in better growth and yield. Similarly, the root system in open field condition was more stronger as compared to polyhouse plants resulted in achieving better growth as well as yield in open as compared to polyhouse.

Thus from present study it can be concluded that the brinjal grafts are more healthier and productive than brinjal seedlings. Similarly the open field conditions prevailing during *rabi* season are more congenial for growth of brinjal as compared to polyhouse conditions.

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