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Studies on of shoot growth characters of some genotypes of ber (*Zizyphus mauritiana* Lamk.)

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Abstract

The present investigation entitled “Studies on genotypes of shoot growth characters of Ber (*Zizyphus mauritiana* Lamk.)” was conducted at H.R.C., Patharchatta, G. B. Pant University of Agriculture and Technology, Pantnagar, Uttarakhand in the year 2010-11. The experiment was comprised of twenty four treatments of ber genotypes i.e., Banarasi Pewandi, Chuhara, Chinese, Dandan, Illaichi, Kaithli, Kala Gola, Narikeli, Nazuk, Noki, Rohtaki Gola, Sanaur 1, Sanaur 2, Sanaur 3, Sanaur 4, Sanaur 5, Sanaur 6, Selected Safeda, Seo, Thornless, Umran, Wallaiti, ZG2 and ZG3. The investigation were carried out with the objective of evaluating shoot growth at fortnightly interval. The experiment was laid out in randomized block design. The results showed that maximum shoot length was observed with Noki which was at par with Kaithali, Kala Gola, Banarasi Pewandi and Nazuk. The maximum number of leaves per shoot was recorded with Sanaur 6 while minimum was observed with Umran. The maximum number of lateral branches per shoot recorded was observed with Sanaur 2 cultivar while minimum was observed with Sanaur 5. The mean data of the fortnightly interval showed that shoot length, number of leaves per shoot and number of lateral branches per shoot were followed the single sigmoid growth curve in all the genotypes.

Keywords: Ber, *Zizyphus mauritiana*, genotypes, shoot growth characters

Introduction

The Ber (*Zizyphus mauritiana* Lamk.) belongs to the family Rhamnaceae and is an indigenous fruit of India. The Ber has very wide climate adaptability and is cultivated all over India. It was one of the prominent fruits on which the sages in ancient India depended for food. The Ber is highly paying crop and has a rich food value. It contains 3.1 to 14.5% eaten fresh as well as dried and processed into the products like candy, jelly, jam, Murabba, sugar, 0.13 to 1.42% n acid, 0.96 to 1.75 % protein, 39 to 166 mg/100g vitamin C and 12 to 21°

Brix. Full ripe fruits have food value of 20.9 calories. Ber fruits are richer than apples in protein, phosphorus, calcium, carotene and Vitamin C (Bakshi and Singh, 1974). The fruits are squash, juice, powder, slices, Tutti-frutti and wine. The byproducts of the processing industries may be utilized for the extraction of the protein. However, commercialization of all the products may not be an economic proposition. A large number of Ber varieties are found scattered all over the county. Singh *et al.*, (1971) [7] characterized 39 jujube varieties. Certain into 3 groups whereas Singh *et al.*, (1972) [8] divided 40 cultivars into 8 sections. The nomenclature of the cultivars has been done very loosely based on individual fancy and choice and on local likings varieties are better when consumed as raw and still others are prized for candying and drying. Quick often even the well known name of the cultivars changes after its migration from its original locality. There are many grafted varieties of Ber in the country which are reputed for the specific traits. Some varieties are preferred for their early or late ripening quality of their fruit pulp. The choice of suitable cultivars is of paramount importance for its successful cultivation. Various cultivars which have given better performance in one locality may not necessarily perform in a similar way under other localities. Looking into the importance of Ber, it is necessary to select the cultivars out of the existing material available in India and describe them for morphological characteristics for their proper identification and classification. Therefore, the present studies were undertaken with the objective to study shoot growth pattern of twenty four genotypes of ber.

Materials and Methods

The experiment was conducted during at Horticultural Research Centre of the University and plant analysis laboratory of Department of Horticulture and Central Laboratory of the College of Agriculture, G.B. Pant University of Agriculture and Technology, Pantnagar, Uttarakhand (India), Pantnagar is situated at 29°8'N latitude, 79.38°E longitude and at an altitude of 243.8

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meters above the mean sea level in foothills of the Himalayas. The soil of the experimental orchard is moderately dark coloured, well drained and developed from loamy alluvial sediments averaging 0.1- to 0.6-m thick over loamy sands or gravel. The region is characterized by humid sub-tropical climate with maximum temperature ranging from 30°C to 45°C in summer and minimum ranging from 0°C to 9°C in winter. The summers are hot and dry, winters are cold and rainy seasons received heavy rainfall (1400mm). The monsoon generally sets in during the fourth week of June and ends by September. The frost can be expected from last week of December to middle of February. For the present study, twenty six year old and uniform trees of Ber genotypes planted at 6 x 6 m spacing in square system were selected for this experiment. The trees were pruned at equal height and uniform intensity in the second week of May every year. Twenty four genotypes of Ber were taken for experiment i.e. Banarasi Pewandi, Chuhara, Chinese, Dandan, Illaichi, Kaithli, Kala Gola, Narikeli, Nazuk, Noki, Rohtaki Gola, Sanaur 1, Sanaur 2, Sanaur 3, Sanaur 4, Sanaur 5, Sanaur 6, Selected Safeda, Seo, Thornless, Umran, Wallaiti, ZG2 and ZG3. The present investigation were carried out with the objective of evaluating shoot growth at fortnightly interval. The observation of data were taken from second fortnight of July to December. The data were recorded for different shoot growth parameter i.e., shoot length, number of leaves per shoot and number of lateral branches per shoot. Twenty four treatments were replicated twice in a Randomized Block Design having one tree per replication.

Results and Discussion

The data presented in Table 1 and figure 1 reveal that various genotypes significantly influence the shoot length with 15 days interval of observation. The data presented in table that maximum shoot length recorded in second fortnight of July was observed with Sanaur 4 while minimum was observed

with ZG2. Bal and Uppal (1992)^[2] reported the variation in shoot growth of different genotypes of Ber. The maximum shoot length in first fortnight in August was recorded with Rohtaki Gola while minimum was observed with Nazuk. The maximum shoot length in second fortnight in August was recorded with Chinese cultivar while minimum was observed in Sanaur 5. The maximum shoot length in first fortnight in September was recorded with Sanaur 2 cultivar while minimum was observed in Selected Safeda. The maximum shoot length in second fortnight in September was recorded with Kaithli cultivar while minimum was observed in Banarasi Pewandi. The maximum shoot length in first fortnight in October was recorded with Sanaur 2. cultivar while minimum was observed in Umran. The maximum shoot length in second fortnight in October was recorded with Chuhara cultivar while minimum was observed in Wallaiti. The maximum shoot length in first fortnight in November was recorded with Kaithli cultivar while minimum was observed in Narikeli. The maximum shoot length in Second fortnight in November was recorded with Nazuk cultivar while minimum was observed in ZG₃. The maximum shoot length in first fortnight in December was recorded with Nazuk cultivar while minimum was observed in Sanaur 4. The maximum shoot length in Second fortnight in December was recorded with Nazuk cultivar while minimum was observed in Sanaur 4. It is clear from the table maximum shoot length was observed with Noki which was at par with Kaithali, Kala Gola, Banarasi Pewandi and Nazuk. In general, shoot length increased with advancement of time. The mean of the fortnight interval showed that shoot length followed the single sigmoid growth curve in all the cultivars. Misra *et al.* (1999)^[3] reported maximum shoot growth in Bael genotypes in the month of August which was maximum in PB10 and minimum in Pant Shivani. Similar result obtained in Bael (Jaiswal, 1997)^[4]. Similarly, Pandey (1999)^[5] and Singh and Ahlawat (1996)^[6] reported maximum shoot length in cultivar Local.

Table 1: Effect of genotypes on shoot length of Ber

Cultivars	Shoot length(cm)											Mean
	15.7.2010	1.8.2010	15.8.2010	1.9.2010	15.9.2010	1.10.2010	15.10.2010	1.11.2010	15.11.2010	1.12.2010	15.12.2010	
Banarasi Pewandi	89.54	101.85	114.00	128.67	138.60	154.87	173.12	180.82	185.65	193.00	197.00	151.10
Chuhara	89.42	104.10	114.25	129.90	139.90	149.30	160.60	167.95	171.40	175.12	195.15	143.37
Chinese	92.80	94.40	122.42	130.05	140.52	154.07	170.57	177.20	182.40	184.40	185.30	148.81
Dandan	92.40	102.67	118.00	129.50	139.45	152.22	169.55	170.15	176.35	180.90	185.05	146.02
Illaichi	93.17	105.65	115.15	129.25	139.65	156.20	166.15	170.80	175.07	188.75	189.55	148.40
Kaithli	81.82	86.43	121.25	129.10	151.20	158.52	173.62	180.95	186.65	191.47	195.32	151.32
Kala Gola	92.67	98.61	120.55	128.77	141.47	157.30	171.80	178.27	184.92	192.47	195.85	151.15
Narikeli	92.09	106.10	115.36	129.60	140.56	147.87	160.95	162.90	170.90	180.12	183.57	144.54
Nazuk	81.05	83.95	118.44	129.25	142.02	160.25	173.10	179.32	188.80	195.15	200.40	150.15
Noki	92.07	102.20	118.77	129.35	145.00	156.51	173.65	179.65	184.25	191.02	195.30	151.47
Rohtaki Gola	93.17	109.25	118.37	129.82	142.90	151.90	166.56	171.00	175.62	181.40	195.50	147.77
Sanaur 1	93.31	95.63	119.55	128.85	142.10	157.20	172.35	173.90	174.40	183.03	183.17	146.68
Sanaur 2	82.80	85.10	104.77	130.27	145.47	168.60	170.70	172.80	177.37	180.92	183.17	144.09
Sanaur 3	92.95	108.40	117.10	130.06	145.47	152.35	162.85	169.32	175.60	187.15	196.80	148.91
Sanaur 4	80.93	104.45	111.27	128.42	143.22	151.15	162.12	167.07	169.17	170.75	171.05	141.78
Sanaur 5	84.25	87.80	93.82	126.40	144.30	155.40	171.05	172.47	175.55	176.00	176.00	142.10
Sanaur 6	95.98	106.57	115.00	127.47	141.40	154.45	164.70	168.70	175.55	180.60	188.90	147.03
Selected Safeda	92.05	108.45	116.15	125.66	140.82	153.30	164.40	169.80	173.60	176.72	188.90	145.55
Seo	93.07	96.10	118.45	128.37	140.05	153.72	170.20	174.45	177.25	176.35	178.60	146.37
Thornless	90.12	96.39	115.85	127.95	139.27	153.72	162.60	174.20	174.37	180.02	179.80	145.92
Umran	80.27	85.45	105.42	128.17	134.12	148.05	169.00	175.15	176.62	179.50	179.75	141.13
Wallaiti	82.67	86.40	115.85	129.27	143.00	161.75	177.25	178.40	181.12	183.67	183.92	147.48
ZG2	83.02	108.00	118.90	128.97	145.85	157.55	175.61	174.60	177.32	179.15	182.40	146.32
ZG3	92.67	96.49	118.40	128.97	140.29	150.85	161.40	163.62	168.00	171.10	173.72	143.44
Mean	89.26	98.49	115.29	128.41	148.18	163.08	170.06	174.51	180.13	183.50	184.67	146.70
	Cultivars											Date

Interaction (cultivar x Date)		
S.Em.±	0.601	0.887
2.944		
C.D. at 5%	1.673	2.472
8.200		

The data presented in table 2 and figure 2 reveal that various cultivars significantly affected the number of leaves per shoot during the years at different dates of observation. The data presented in table 2 that maximum number of leaves per shoot recorded in second fortnight of July was observed with Sanaur 1 while minimum was observed with Wallaiti. maximum number of leaves per shoot was recorded in first fortnight of August was observed with Umran while minimum was observed with Thornless. The maximum number of leaves per shoot was recorded in second fortnight of August was observed with Kaithli while minimum was observed with Umran. The maximum number of leaves per shoot was recorded in first fortnight of September was observed with Noki while minimum was observed with Sanaur 2. The maximum number of leaves per shoot was recorded in second fortnight of September was observed with Sanaur 6 while minimum was observed with Umran. The maximum number of leaves per shoot was recorded in first fortnight of October was observed with Sanaur 6 while minimum was observed with Umran. The maximum number of leaves per shoot was recorded in second fortnight of

October was observed with Sanaur 6 while minimum was observed with Umran. The maximum number of leaves per shoot was recorded in first fortnight of November was observed with Sanaur 6 while minimum was observed with Umran. The maximum number of leaves per shoot was recorded in Second fortnight of November was observed with Sanaur 6 while minimum was observed with Umran. The maximum number of leaves per shoot was recorded in first fortnight of December was observed with Sanaur 6 while minimum was observed with Umran. The maximum number of leaves per shoot was recorded in Second fortnight of December was observed with Sanaur 6 while minimum was observed with Umran. On the basis of mean data of 15 days monthly interval from July to December observed that Sanaur 6 showed maximum number of leaves per shoot while minimum number of leaves per shoot was observed with Umran. In general the number of leaves per shoot increased with advancement in time and followed the single sigmoid growth pattern with all the cultivars Singh (1999)^[9] reported similar pattern of number of leaves /shoot was found in Ber cultivars.

Table 2: Effect of genotypes on number of leaves per shoot of Ber

Cultivars	Number of leaves per shoot											Mean
	15.7.2010	1.8.2010	15.8.2010	1.9.2010	15.9.2010	1.10.2010	15.10.2010	1.11.2010	15.11.2010	1.12.2010	15.12.2010	
Banarasi Pewandi	18.68	20.58	26.73	29.65	32.83	33.99	34.91	37.20	40.93	42.70	46.22	33.1
Chhuhara	18.53	21.40	25.52	29.12	30.84	31.88	33.54	34.43	37.10	40.25	44.87	31.63
Chinese	18.82	20.57	29.25	30.71	32.25	32.92	34.42	36.64	39.45	42.12	47.22	33.12
Dandan	18.57	20.42	25.52	30.85	32.32	32.45	34.65	36.27	38.30	41.60	47.67	32.94
Illaichi	17.97	21.72	25.32	28.91	31.03	32.42	34.10	35.75	38.75	42.50	48.10	32.43
Kaithli	11.31	14.18	29.71	32.06	33.90	35.42	36.95	38.75	43.41	46.42	52.00	34.15
Kala Gola	18.29	20.30	28.05	29.99	31.04	32.81	33.53	36.55	38.60	41.27	44.60	32.1
Narikeli	18.21	21.48	24.45	30.23	32.30	33.74	37.51	39.49	39.66	42.22	45.00	33.11
Nazuk	10.64	12.90	25.27	31.55	33.04	33.66	35.83	36.55	40.73	43.65	47.29	32.36
Noki	18.78	22.17	28.68	30.97	32.35	33.50	33.88	39.49	40.42	41.50	46.15	33.10
Rohtaki Gola	17.52	20.35	23.70	28.33	29.25	31.07	32.20	37.45	41.45	41.45	46.82	31.47
Sanaur 1	18.97	20.53	28.23	29.36	31.77	32.58	33.18	36.45	40.20	43.92	47.83	32.91
Sanaur 2	11.12	14.00	17.48	23.66	26.18	28.60	31.66	34.05	37.26	41.16	47.15	28.50
Sanaur 3	18.77	21.08	25.76	28.89	31.12	33.00	34.95	37.48	38.92	44.26	48.00	32.96
Sanaur 4	18.12	20.62	25.58	28.25	30.64	32.45	34.11	35.23	39.07	43.49	47.92	32.36
Sanaur 5	13.22	14.28	25.68	29.00	30.64	31.57	33.57	37.20	39.11	43.41	49.25	31.21
Sanaur 6	18.12	22.00	25.75	28.58	40.80	43.83	44.20	45.15	50.83	53.48	57.31	48.32
Selected Safeda	18.33	20.71	24.37	29.11	31.05	31.75	33.94	34.50	39.65	43.55	47.27	32.60
Seo	16.97	20.32	28.14	28.85	31.62	32.92	33.40	36.89	41.03	43.97	48.96	33.21
Thornless	18.57	22.40	26.66	27.13	30.22	31.81	32.46	36.45	37.17	41.10	47.07	31.46
Umran	10.51	13.81	17.04	30.73	21.10	23.29	27.85	31.92	34.37	36.22	39.35	25.15
Wallaiti	9.86	12.36	28.87	29.83	32.73	34.48	36.35	38.75	40.45	45.46	49.60	32.69
ZG2	11.13	13.45	29.07	29.11	30.70	34.61	35.30	36.40	42.95	45.90	50.90	33.32
ZG3	18.41	21.08	26.25	28.58	31.62	32.05	32.12	32.32	34.61	40.72	44.66	31.39
Mean	16.27	18.86	26.25	28.79	31.31	32.83	35.23	37.77	40.66	43.91	48.38	32.75
	Cultivars						Date					
Interaction (cultivar x Date)												
S.Em.±	0.162						0.240					
0.798												
C.D. at 5%	0.453						0.670					
2.22												

The data presented in table 3 and figure 3 indicate that various cultivar significantly influenced the number of lateral branches per shoot at different dates of observation during the years 2010 and 2011. The maximum number of lateral

branches per shoot recorded in second fortnight of July was observed with Sanaur 4 while minimum was observed with Wallaiti. The maximum number of lateral branches per shoot was recorded in first fortnight of August was observed with

Nazuk while minimum was observed with Umran. The maximum number of lateral branches per shoot was recorded in second fortnight of August was observed with Chinese while minimum was observed with ZG3. The maximum number of lateral branches per shoot was recorded in first fortnight of September was observed with Chinese cultivar while minimum was observed with ZG3. The maximum number of lateral branches per shoot was recorded in second fortnight of September was observed with Sanaur 2 cultivar while minimum was observed with Illaichi. The maximum number of lateral branches per shoot was recorded in first fortnight of October was observed with Sanaur 2 cultivar while minimum was observed with Sanaur 5. The maximum number of lateral branches per shoot was recorded in second fortnight of October was observed with Sanaur 2 cultivar while minimum was observed with Illaichi. The maximum number of lateral branches per shoot was recorded in first fortnight of November was observed with Sanaur 2 cultivar while minimum was observed with ZG 3. The maximum number of lateral branches per shoot was recorded in second

fortnight of November was observed with Sanaur 2 cultivar while minimum was observed with Sanaur 5. The maximum number of lateral branches per shoot was recorded in first fortnight of December was observed with Sanaur 2 cultivar while minimum was observed with Thornless. The maximum number of lateral branches per shoot was recorded in second fortnight of December was observed with Sanaur 2 cultivar while minimum was observed with Sanaur 5. On the basis of mean data of 15 days interval from July to December observed that Sanaur 2 cultivar was maximum number of lateral branches per shoot while minimum was observed with Sanaur 5. Singh (1999)^[9] The values showed that the number of lateral branches per shoot followed the single sigmoid growth pattern in all the cultivars. The variation is shoot length, number of leaves per shoot and number of lateral branches per shoot in vigorous cultivars might be due to their variation in tree size, root distribution pattern, leaf area, photosynthetic efficiency, number of shoots per tree, number of fruits per shoot and amount of fruits per tree.

Table 3: Effect of genotypes on number of lateral branches per shoot of Ber

Cultivars	Number of lateral branches/shoot											Mean
	15.7.2010	1.8.2010	15.8.2010	1.9.2010	15.9.2010	1.10.2010	15.10.2010	1.11.2010	15.11.2010	1.12.2010	15.12.2010	
Banarasi Pewandi	4.44	6.72	8.80	11.40	12.44	13.25	14.18	16.36	18.83	20.67	23.86	13.72
Chhuhara	4.25	6.14	8.85	11.65	12.54	13.53	14.35	17.52	21.07	22.32	23.11	14.12
Chinese	4.70	6.20	11.32	12.80	13.55	14.29	15.27	18.64	22.02	24.32	25.04	15.29
Dandan	4.58	6.35	10.27	11.97	12.75	13.49	14.25	18.36	20.47	22.63	24.96	14.55
Illaichi	4.18	5.47	7.65	10.22	11.23	12.08	12.44	16.17	19.11	22.03	23.06	13.08
Kaithli	4.51	4.88	9.92	12.24	13.37	13.52	15.23	18.58	21.38	24.66	25.16	14.53
Kala Gola	4.76	6.55	9.34	11.62	12.83	13.09	13.87	18.49	20.00	23.71	23.98	14.38
Narikeli	4.56	6.25	8.37	10.32	11.87	12.91	12.91	14.76	17.99	18.93	22.16	12.77
Nazuk	4.49	6.95	9.70	11.54	13.08	13.85	13.84	17.47	20.53	21.72	22.72	13.54
Noki	4.39	6.32	9.87	12.43	13.57	14.57	14.57	15.74	18.65	20.56	22.06	13.79
Rohtaki Gola	4.86	6.67	9.58	11.50	11.72	13.53	13.53	17.85	21.18	22.33	23.56	14.12
Sanaur 1	4.67	6.47	8.85	12.25	12.75	14.89	14.89	18.26	21.70	23.65	24.66	14.87
Sanaur 2	1.81	4.20	8.14	13.01	14.95	21.05	21.05	25.16	25.82	26.41	28.21	16.87
Sanaur 3	4.88	5.41	9.75	10.83	12.85	14.20	14.20	16.67	18.51	19.47	20.64	13.21
Sanaur 4	4.97	6.64	10.15	11.19	12.43	14.10	14.10	15.99	17.44	18.96	19.94	13.18
Sanaur 5	1.94	3.85	7.30	10.05	11.62	14.07	14.07	14.96	17.72	19.70	19.76	12.09
Sanaur 6	4.61	5.21	8.70	11.13	12.43	15.38	15.38	18.91	20.46	22.21	23.92	14.18
Selected Safeda	4.23	5.88	8.34	9.83	11.55	12.99	12.99	15.21	18.47	20.42	22.22	12.84
Seo	4.41	6.23	9.58	10.05	11.95	13.80	13.80	16.91	19.72	21.70	22.31	13.76
Thornless	4.63	5.85	8.85	11.31	12.91	15.51	15.51	16.00	16.34	17.77	18.73	12.83
Umran	1.78	3.67	8.14	11.27	12.54	16.84	16.84	18.91	20.77	22.21	23.17	14.00
Wallaiti	1.51	4.00	9.74	12.08	12.90	16.05	16.05	19.73	21.76	23.07	23.47	14.39
ZG2	1.95	3.79	10.15	12.02	13.06	15.83	15.83	18.67	21.02	22.77	23.40	14.48
ZG3	4.08	4.93	7.03	9.81	11.73	12.94	12.94	15.30	17.41	19.97	20.18	12.31
Mean	3.67	5.47	9.11	11.44	12.61	14.67	14.67	16.44	17.93	21.83	23.05	13.87
	Cultivars							Date		Interaction (cultivar x Date)		
S.Em.±	0.087							0.119		0.395		
C.D. at 5%	0.224							0.332		1.101		

Conclusion

On the basis of findings, it may be concluded that the mean data of the fifteen days monthly interval showed that shoot length, number of leaves per shoot and number of lateral branches per shoot were followed the single sigmoid growth curve in all the genotypes.

References

1. Bakhshi JC, Singh P. The Ber a good choice for semi-arid and marginal soils. *Indian Horticulture*. 1974; 19:27-30.
2. Bal JS, Uppal DK. *Ber varieties*. New Delhi, Associated Publishing Company, 1992, 90.

3. Misra KK, Singh R, Jaiswal HR. Studies on leaf characters development pattern and shoot growth in Bael genotypes. *Progressive Horticulture*. 1999; 31(3-4):144-150.
4. Jaiswal HR. Studies on morphology and reproductive characters of some strains of Bael (*Aegle marmelos* Correa). Thesis, Ph.D., Dr. B.R Ambedkar University, Agra. 1997, 273.
5. Pandey V. Effect of heading back on vegetative growth and flowering of Ber (*Zizyphus mauritiana* Lamk) cultivars. *Orissa Journal of Horticulture*. 1999; 27(2):57-61.

6. Singh S, Ahlawat JP. Effect of foliar application of urea and zinc sulphate on yield parameters of Ber (*Zizyphus mauritiana* Lamk) cv. Umran. Haryana Journal of Horticulture Science. 1996; 25(2):33-45.
7. Singh P, Bakshi JC, Singh R. Identification of Ber (*Zizyphus mauritiana* Lamk) cultivars through vegetative characters. The Punjab Horticultural Journal. 1971; 11(3/4):176-187.
8. Singh P, Bakshi JC, Singh R. Identification of Ber (*Zizyphus mauritiana* Lamk) cultivars through fruit characters. The Punjab Horticultural Journal. 1972; 11(3/4):176-187.
9. Singh O. Performance of Ber (*Zizyphus mauritiana* Lamk.) cultivars under *Tarai* conditions of Uttarakhand. Thesis, M.Sc. Ag. (Horticulture), G.B. Pant University of Agriculture and Technology, Pantnagar, 1999, 138.