

TECHNOLOGY STANDARDIZATION FOR IMPROVEMENT OF *CARISSA SPINARUM* L. WITH ELITE STRAIN OF *CARISSA CARANDUS* L.

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Carissa spinarum L. (popularly known as 'Garnu') is a weed of abundance in the lower Himalayan region. Studies were conducted for improvement of garnu with elite strain of Karonda (*Carissa carandus* L.). Top working was the methodology adopted for the improvement, for which different grafting and budding procedures were tried. Chip budding was found to be most suitable technique for top working of 'garnu' with elite strain of karonda. As far as time of chip budding was concerned, mid June to mid July was found as the best time. The success of top working was significantly improved when root stocks of garnu were prepared by cutting down the bushes of garnu in winter at 15 cm height from ground level and top working of the newly emerged shoots in June- July. The success of top working through chip budding was significantly influenced by post budding minimum temperature (15-25°C) and relative humidity (60-80%).

Keywords: Chip budding; *Carissa spinarum* and *Carissa carandus*; Top working.

Introduction

Low hill region of Himachal Pradesh lying in the outer Himalayas or Shivaliks has a characteristic feature of rugged and undulating topography coupled with skewed rainfall distribution. Drought or drought like situations is quite common in the region despite of the average annual rainfall of 1200 mm. Under these agro-ecological conditions *Carissa spinarum* locally known as garnu is a plant species of abundance and it is distributed widely across the entire region. It is bushy plant with spiny branches and it bears very small sized fruits of average weight of 642 mg¹. It is treated as a weed; every year farmers have to waste lot of their energy and time for uprooting these plants from their farms and grasslands. On the other hand karonda (*Carissa carandus* L.) is species, which has great potential for its utilization through fresh consumption as well as through processing². A strain of karonda (BK-I) has performed very well at Regional Horticultural and Forestry Research Station, Bhota – Neri, Hamirpur, Himachal Pradesh. It bears pink attractive large fruits (average weight – 12g) with average TSS of 13°B, acidity is 3.76 per cent vitamin C – 18 mg and iron - 0.0065% per 100g of pulp^{3,4}. As stated earlier *C. spinarum* is a weed species growing along the entire lower Himalayan region, if these plants could be improved with the above said elite strain of karonda; it could help in a great way to

turn the grey area green coupled with the socio-economic and nutritional upliftment of the inhabitants of the region. The present studies were therefore designed for standardization of technology for the improvement of local garnu with elite strain of karonda.

Material and Methods

The studies were conducted at the Regional Horticultural and Forestry Research Station, Bhota and Neri during the year 2003 to 2007. For standardization of technology for improvement of garnu the studies were conducted in two successive experiments as detailed below:

Experiment-I: Standardization of top working Technique

The experimental plants of garnu were selected in the barren area of the experimental fields with uniform stem diameter (10mm-20mm). These plants were single stemmed upto the height of 30 cm from ground level and above it two primary scaffolds with four secondary and all tertiary scaffolds were retained in the month of December. The top working was done during mid March to mid April. The scion wood was selected from previous season growth from vigorous productive karonda strain BK-I grown at experimental farm of Regional Horticultural and Forestry Research Station, Bhota and Neri. The scion wood was implanted on the stock with in one hour of separation from mother plants. Following budding and grafting treatment were applied to standardize the method of top

working:

Treatment	Detail
B1	Chip Budding
B2	Patch Budding
B3	Tongue grafting
B4	Cleft Grafting

Time for applying the treatments	: Mid March
Replications	: 5
No. of plants per replication	: 10
No. of buddings/Graftings per plant	: 4
Experimental Design	: RBD

The observations were taken for bud sprouting recorded at the time of bud burst whereas bud take data recorded three months after the budding or grafting operations. The observation on scion length and diameter were recorded in December i.e. after nine months. In order to promote the growth of the scion wood regular desuckering and deshooting of unwanted growth was done. The per cent data on bud sprouting and bud take were subjected to the statistical analysis after its arc sine square root transformation as per standard procedures described by^{5,6}. The data on maximum, minimum and mean temperature (°C) and relative humidity (%) (minimum, maximum and mean) for the period of studies were taken from Automatic weather station (IMD) Hamirpur. Month wise pooled average of this data are presented in Figs.1-3.

Experiment -II :- Stock preparation and time standardization for Chip Budding

After two years of experimentation on methods of top working, it was found that chip budding was a better procedure for top working of garnu but the over all success attained in top working was low therefore, experiment was conducted on standardization of the appropriate time of chip budding for top working of garnu (*Carissa spinarum*) with elite strain of Karonda. The stock was selected as per the procedure described in Experiment - I and was prepared as per the following experimental details in combination with different budding time treatments:

a) Stock Preparation Treatments (Factor-I)

T1 -Single stemming upto 30 cm above ground in December, retaining two

Primary scaffold with four secondary and all tertiary branches. Budding the secondary branches of pencil thickness

T2 - Heading back of the bush at 15 cm above ground in December. Top working the new growth of pencil

thickness

T3 - No Heading back or single stemming, budding secondary scaffolds of pencil thickness

b) Different times of chip budding (Factor-II)

TB1 -	1-15 March
TB2 -	16-31 March
TB3 -	1-15 April
TB4 -	16-30 April
TB5 -	16-30 June
TB6 -	1-15 July
TB7 -	16-31 July
TB8 -	1-15 August
TB9 -	16-31 August
TB10 -	1-15 September
TB11 -	16-30 September

(Time between 1 May to 15 June was skipped due to non conducive environmental conditions)

Experimental Design	: RBD Factorial
Replications	: 5(10x4 observation per replication)

No. of plants per replication : 10

No. of buddings/graftings per plant : 4

The details of observations and the statistical analysis were done as per procedures described in Experiment-I. In order to define the optimum atmospheric temperature and humidity for attaining highest performance of top working through chip budding, the fortnightly averages of the meteorological data were calculated. In order to condense data without losing any information of interest, the meteorological data were converted into continuous frequency distribution in which the magnitude of the class and the class limits were calculated as per known procedures⁷. The correlation of the meteorological parameters with the success of chip budding was worked out as per the statistical methods described⁸.

Results and Discussion

Experiment -I

The pooled data, pertaining to success of different methods adopted for top working of garnu for the years 2003 and 2004, are presented in Table 1. It is evident from the data that chip budding was far superior technique for top working of garnu in comparison to patch budding or other grafting techniques. Both the bud sprouting and bud take (48.1% and 50.3%, respectively) were higher through chip budding than other treatments. The growth of scion wood (6.6cm length and 25mm diameter) was lower

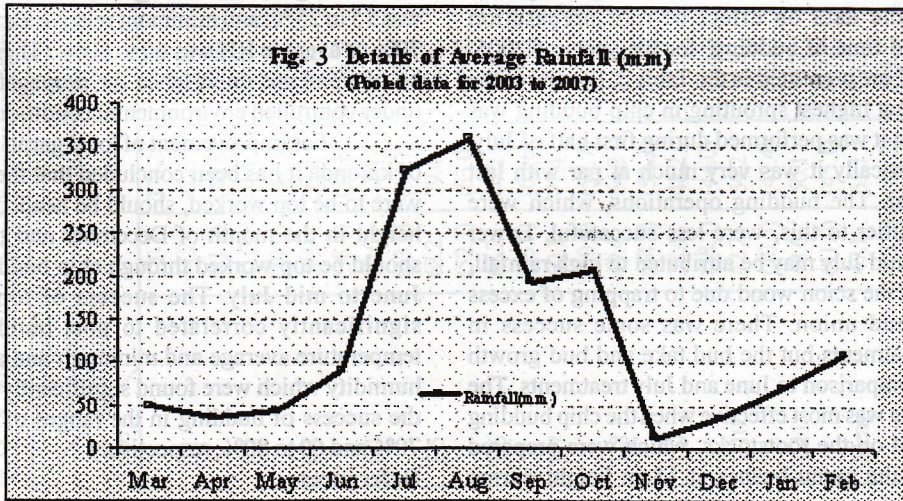
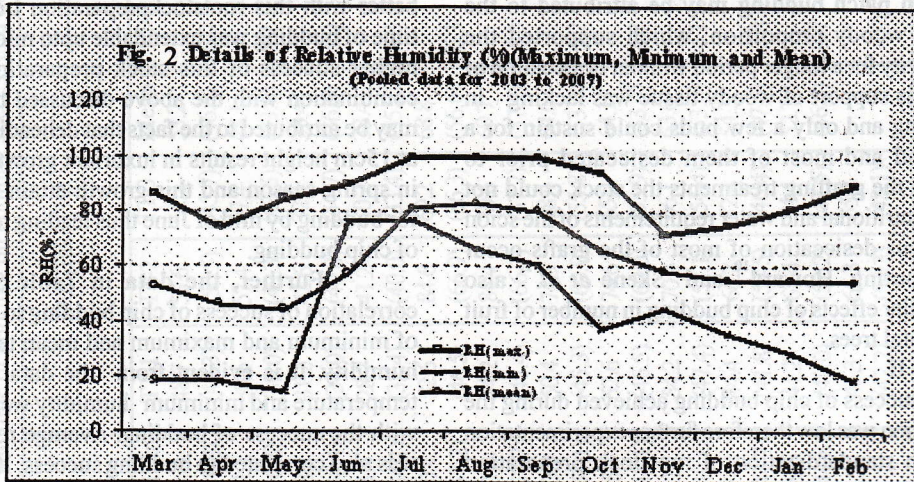
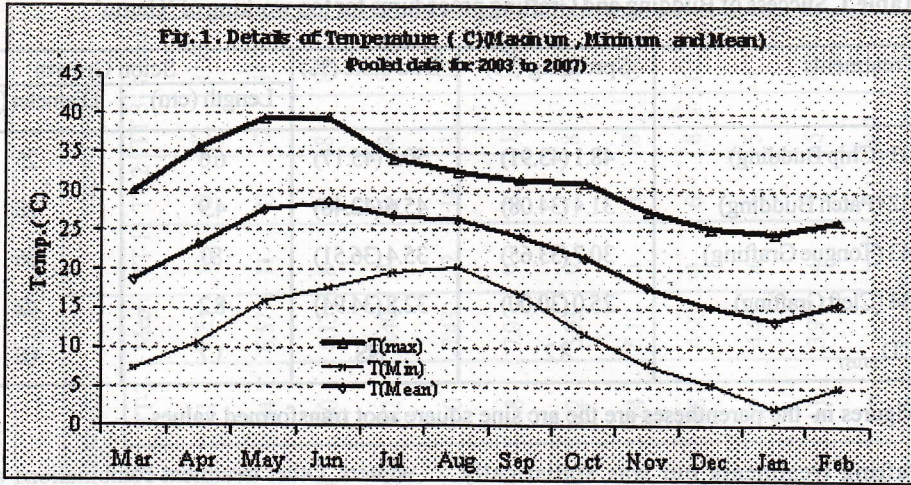


Table 1. Success of Budding and Grafting procedures for top working of 'Garnu'

Treatments	Sprouting (%)	Bud Take (%)	Scion Growth	
			Length (cm)	Diameter (mm)
B1 (Chip Budding)	48.1 (43.91)	50.3 (45.17)	6.6	25
B2 (Patch Budding)	31.4 (34.08)	45.6 (42.48)	4.9	28
B3 (Tongue Grafting)	30.7 (33.65)	35.4 (36.51)	8.0	36
B4 (Cleft Grafting)	25.0 (30.00)	32.8 (34.94)	8.2	42
CD _(0.05)	8.2	NS	1.7	08

Figures in the parentheses are the arc sine square root transformed values

than the grafting treatments but was statistically comparable to these treatments. Higher success of chip budding than patch budding may be attributed to the presence of woody proportion, which supported the cambial activity for a longer period without desiccation of the bud. This support of woody tissue was lacking in patch budding and only a few buds could sustain for a longer period and most of them desiccated prior to sprouting. In the grafting treatments the stock could not support the nutritional and water requirements of the scion wood and thus desiccation of most of the grafts occur prior to sprouting. Howard¹⁰ and Skene *et al.*¹¹ also reported similar effects of chip budding in number of fruit and ornamental trees.

Experiment-II

The overall success of chip budding achieved during the experimentation was low therefore further experimentation was done on standardization of rootstock preparation technique and optimization of time of budding. The pooled averages of the data on effect of root preparation techniques and time of budding, for the years of 2005, 2006 and 2007 are presented in the Table 2. Perusal of the data reveals that highest sprouting in chip budding was achieved when it was performed during first half of July. Though, statistically it was very much at par with last June treatment. The budding operations, which were carried out earlier to this, were less successful. Lower success after mid July may be attributed to high rainfall, which spoiled the scion wood due to trapping of excess moisture at bud union. There was some success in September treatments but the bud take and bud growth were less in comparison to June and July treatments. The time of budding was most effective when the chip budding was performed on the rootstocks, which were prepared by cutting of the garnu bushes at 15cm height during

winters. Other treatment combinations were statistically less effective in performance. Bud take percent was also better with this rootstock preparation treatment but the time of budding was extendable upto mid of August. The higher success of this stock preparation technique in combination with the above discussed time of budding may be attributed to the facts that deheading of the bushes at 15cm height results in luxuriant growth of the sprouts in spring season and this growth attain proper maturity for budding by mid of June thus leading to higher success of chip budding.

Further, the data in Table 3 presents the correlation of success of chip budding to different ranges of minimum and maximum and mean temperatures and humidity. It is evident from the data that minimum temperature and minimum humidity were significantly with the success of budding. Average relative humidity was also correlated to budding success. It has been found that budding success was high when minimum temperature was 15 to 25 °C and minimum relative humidity was 50 to 70% or average RH was 60 to 80%. (These findings may be of immense importance for propagation of karonda under controlled environmental conditions).

For improvement of local garnu with elite strain of karonda it has been concluded that the bushes, which were to be top worked, should be headed back at 15 cm height in the month of December and the new growth should be top worked through chip budding during mid June to mid July. The success of top working was significantly correlated to post budding minimum temperature average and minimum and average relative humidity which were found significantly correlated with the success of budding in the ranges of 15-25°C, 50 to 70% and 60 to 80%, respectively.

References

Table 2. Effect of rootstock preparation technique and time of budding on budding success and bud growth.

Rootstock Preparation Technique	Sprouting (%)				Bud Take (%)				Scion Growth			
	TT-1	TT-2	TT-3	Mean	TT-1	TT-2	TT-3	Mean	TT-1	TT-2	TT-3	Mean
T-1	44.2 (41.7)	42.6 (40.8)	36.2 (37.0)	41.0 (39.8)	48.7 (44.3)	59.6 (50.5)	51.2 (45.7)	53.2 (46.8)	6.0	8.6	11	7.23
T-2	41.2 (39.9)	44.4 (41.8)	41.4 (40.1)	42.3 (40.6)	39.6 (39.0)	57.4 (49.3)	47.4 (43.5)	48.1 (43.9)	5.2	8.1	11	6.57
T-3	38.9 (38.1)	39.2 (38.8)	38.4 (38.3)	38.8 (38.4)	31.2 (34.0)	42.6 (40.8)	32.4 (34.7)	35.4 (36.5)	5.0	7.4	8	6.13
T-4	30.6 (33.6)	32.4 (34.7)	31.2 (34.0)	31.4 (34.1)	28.7 (32.4)	41.2 (40.0)	30.2 (33.4)	33.4 (35.2)	4.8	6.2	8	5.40
T-5	63.2 (52.7)	79.4 (63.0)	68.6 (55.9)	70.4 (57.2)	52.6 (46.5)	84.6 (66.9)	69.2 (56.3)	68.8 (56.6)	6.3	9.0	14	7.43
T-6	65.2 (53.9)	80.2 (63.6)	68.4 (55.8)	71.3 (57.7)	54.2 (47.4)	84.4 (66.7)	70.6 (57.2)	69.7 (57.1)	6.0	8.2	12	7.0
T-7	60.1 (50.8)	71.4 (57.7)	60.1 (50.9)	63.9 (53.1)	50.4 (45.3)	74.9 (60.0)	68.4 (55.8)	64.6 (53.4)	5.2	6.4	8	5.93
T-8	49.4 (44.7)	64.2 (53.3)	52.3 (46.3)	55.3 (48.1)	52.6 (46.5)	74.6 (60.0)	65.2 (53.9)	64.1 (53.4)	4.7	5.2	6	5.10
T-9	38.4 (38.3)	48.2 (44.0)	41.6 (40.2)	42.7 (40.8)	54.2 (47.4)	70.4 (57.1)	66.1 (54.4)	63.6 (53.0)	4.1	5.2	6	4.90
T-10	42.2 (40.5)	54.2 (47.4)	51.8 (46.0)	49.4 (44.7)	44.4 (41.8)	66.2 (54.5)	52.4 (46.4)	54.3 (47.6)	3.8	4.7	5	4.40
T-11	44.6 (41.9)	50.1 (45.1)	54.2 (47.4)	49.6 (44.8)	41.2 (40.0)	62.4 (52.2)	54.4 (47.5)	52.7 (46.6)	3.7	4.1	5	3.97
Mean	47.1 (43.3)	55.1 (48.2)	49.5 (44.7)	44.8 (44.7)	45.3 (42.2)	65.3 (54.3)	55.2 (48.1)	46.6 (48.1)	4.98	6.64	7.60	5.79

CD_(0.05) = T=4.21 TT=6.42 TTT=5.79 T=6.21 TT=NS TT=7.24 T=2.14 TT=NS TTT=1.72 T=4.22 TT=NS TTT=2.37

Figures in the parentheses are the arc sine square root transformed values

Table 3. Correlation of chip budding success with temperature and relative humidity

Temperature (°C)		Correlation with budding success	Relative Humidity (%)		Correlation with budding success
Minimum	5-10	0.21	Minimum	20-30	0.11
	10-15	0.34		30-40	0.17
	15-20	0.85*		40-50	0.64
	20-25	0.74*		50-60	0.89*
	25-30	0.61		60-70	0.78*
			70-80	0.59	
Maximum	25-30	0.50	Maximum	60-70	0.22
	30-35	0.56		70-80	0.48
	35-40	0.47		80-90	0.54
	40-45	0.24		90-100	0.51
Mean	15-20	0.45	Mean	40-50	0.18
	20-25	0.68		50-60	0.34
	25-30	0.61		60-70	0.77*
	30-35	0.44		70-80	0.84*
			80-90	0.65	

*Significant at 5% level of significance

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