



STANDARISATION OF GRAFTING TECHNIQUES OF RAJ HARAR



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Jammu region comprises of subtropical, intermediate and temperate areas. Most of the area under subtropical conditions locally known as Kandi is rainfed, characterized by undulating terrain, unpredictable weather, and prolonged dry spells. Farmers of these kandi villages depend on rain for their farming, with due course of time it has been observed that rainfall has become unprecedented. The farmers use to cultivate agroforestry trees on the bunds of farmer's fields or village common lands popularly known as ghasnies under traditional Maize/Wheat. Harad and Amla are the main trees of agro-forestry, which are being cultivated by the farmers.

It may sound weird that a tree is guarded for round the year for its medicinally important fruit bearing quality. In order to save the fruit from theft a baout 150-year-old tree is being guarded by its owner for round the clock. A village which falls in north-west of Himalayas called Mathwar is situated in Mathwar CD Block of Jammu district lies between 32°70" north latitude and 74°87" east longitude., this village is also known as Harad Village of Jammu, because of large scale trade of Harar from the village. A superior genotype named Raj Harad that have been found existing at

Mathwar village for over 100 years having height of 14.70 m, diameter at breast height of 101.81 cm with crown width of 18.50 m bearing fruits of average weight of 44.60gms whereas the average weight of wild genotype is 6 gms. The average size of this genotype is 10cm, whereas average size of local genotype is 5 cm, the size is exactly double the size of wild genotype. According to its owner and Ex-Surpench Sh. Sudershan Singh, the land where this tree is growing was gifted by the then Raja (King) to their family and he has seen the tree in same guarded situation since his childhood. He stated that one can just sit under its shade and have loose motion, people of the area use to keep its dried fruit under the pillow of children in order to get rid of constipation. It's the only tree of this kind in whole of India, which is now grown old. The genotype bears fruit that develop vertical ribs during drying and possesses very high market value. As per an estimate, there are 7000-8000 wild/planted Harad trees in Mathwar village of alone have a green and dry fruit production trade of more than 350 T and 15-20 T respectively that gets exported to Pakistan and gulf countries through Amritsar border fetching a total income of more than 40 lakhs per annum. The local sources has stated that big sized fruit fetches price ranging from Rs. 2000 to Rs. 5000, there may be 70 to 80 fruit of such size every year. Due to decay in the tree the quantity of fruit is reducing every year.



Photograph showing wild and Raj Harad fruit

Terminalia chebula commonly known as Harad is a medium to large sized tree which has egg shaped 10-20 cm long leaves and dull white flowers in spikes at the end of branches. The fruit, which is 2-8 cm long, has five distinct ribs on its body. The fruit has been in use in the Indian system of medicine since time immemorial. The physicians of ancient India used it in the treatment of diarrhea, dysentery, heartburn, flatulence, dyspepsia and liver and spleen disorders. It contains an

astringent substance, chebulinic acid. It also contains tannic acid, gallic acid, resin and some purgative principles of the nature of anthraquinone. It is used extensively in tanning and dyeing industries.. Fruits of three species are routinely used as a household remedy and in many of the standard preparations such as 'Triphala' and 'Chayvanprash'. The edible tissue of Harar fruit contains 10.3 times more vitamin C, 15.4 % more proteins and three times more energy value than Apple (Borthakur and Arnold, 1991). The fruit contains more than 40 % tannins (Parkash et al, 1992). The fruit pulp of *T. chebula* is also used as dentifrice to cure bleeding and ulceration of gums (Mahantappa, 2012). Aqueous extract of *T. chebula* has been found to possess antiviral activity against duck hepatitis B virus (Chung *et al.*, 1995).

Since the plants raised from the seed are not true to type and come late in bearing, the end user i.e. farmers are reluctant to go for seedling based plantation. The farmer is desirous of having plants, which come into bearing early and produce quality fruit. The study was conducted to raise the Raj Harad from seed but none of the seed germinated, and then vegetative reproduction method was applied to conserve the genotype. Since the mother plant is about 100 year old, its stem has almost become rotten, it has been observed during observation tours that new branch production has almost seized. The fruit production has also been reduced. Keeping in view the health of mother tree, various vegetative reproduction techniques were tested since 2001. During the year 2001-2002 the first plant by way of grafting was produced, a total of 50 plants were grafted at different times but only one plant survived. Since 2001-2002 various methods of grafting at different time was tested and finally during the year 2010-11 90 % survival was achieved. The plants produced during the year 2010-11 were planted at different locations , one plant was planted at Herbal Garden Nowshera Forest Division which is in fruiting stage , other plants were planted at Sacred Groove at Mathwar and few were distributed to locals at Mathwar Village , all the plants has shown good result. During the year 2018-19 50 no of plants were grafted and out of 50 plants grafted 48 have survived and out of 48 grafted plants, 27 were planted in Mahamaya City Forest as Raj Harar Herbal Plot. Chip grafting technique has shown significant result as compared with the other grafting techniques. The following table shows the different techniques used for grafting:

S.No	Grafting method used	Grafting time with survival percentage			
		February	March	April	May
1	Whip and Tongue grafting	0%	0%	0%	0%
2	Cleft grafting	0%	0%	10%	0%
3	T Budding	0%	0%	12%	0%
4	Chip Grafting	0%	5%	90%	3%

The Chip budding method has shown significantly high survival percentage as compared to other methods of grafting. The time of grafting is very important part in the survival of plant, the mother plant grafted during the first week of April has shown significantly higher survival rate as compared with the other time of grafting. Chip grafting method was further done on 15 days gap for three consecutive years and the best result was shown by the plants, which were grafted during the first week of April. The following table shows the survival percentage on 15 days gap during the month of February to May, 2008 to 2010.

Year	Grafting method	Time of Grafting					
		1 st to 15 th March	15 th to 30 th March	1 st to 15 th April	15 th to 30 th April	1 st to 15 th May	15 th to 30 th May
2008	Chip Grafting	0 %	4%	89%	12%	0%	0%
2009	Chip Grafting	0%	7%	92%	16%	0%	0%
2010	Chip Grafting	0%	21%	94%	9%	0%	0%

The plants grafted between 1st to 15th of April have shown significantly higher survival percentage as compared to other timing.

Hence, it is concluded that Chip grafting method when applied between 1st to 15 of April have shown higher survival percentage as compared with the other method as well as timing of grafting.



Photograph showing Raj Harar plant at Herbal Garden Nowshera Forest Division



Photograph showing size of fruit of Raj Harar

The annual demand for the Harad fruit is 6778.4 tonnes, which is growing @ 4.6%. Their fruit both fresh and dried has a ready market and have export potential to Pakistan and Gulf countries. Trees grow naturally on the bunds of farmer's fields or village common lands popularly known as ghasnis. The owners of the trees do not give any extra care to the trees except lopping of the branches every third year.

Traditionally the harvesting of wild fruits starts from Aug- Sept and continues till January. Majority (90%) of the trees bear fruits of inferior quality. The cost of picking, grading and transportation being the same for low as well as good quality fruits, profit margins are far less for

low quality fruits. The fruit is collected by the owners themselves or the trees are sold to the local contractors who gather the fruit through local labour. The practice has been common for all the medicinal tree fruits viz., Aonla and Behra (Choudhary *et al.*, 2015).



Photograph showing size of wild Harar

The average yield per tree from existing plantations was recorded to be 80-110 kg. There are reports of trees bearing 5-7 quintals of fruits/trees generating an average income of Rs. 15000-25000 per tree per year.

With coming up of superior grafting clones of harad, the expected economic returns from these grafted clones at an early bearing age of 7-8 years will Rs 593750 per ha that will be almost double than the existing seedling plantations fetching an amount of Rs 300000 that too after 12-15 years of bearing age. Moreover, fresh weights of fruit per tree will also differ significantly.

Seeds collected in first fortnight of January and sown at last week and third week of March respectively had shown good results. However with seedling-based plantations the profit margins also gets hampered as the cost of picking, grading and transportation being the same for low as well as good quality fruits. For this technology for rapid and uniform production of grafted plant of harar has been standardized. The technique envisages growing of seedling in polybags, grafting, capping with poly caps and hardening of grafts in the green house. By using modified side veneer grafting, 90-98 % success in grafting of harar has been achieved. This new technology will also help farmers in obtaining sustained income gains as well.

Fruit is marketed in two ways. During August- September, the fruit harvested in green stage is sent to Delhi, Hoshiarpur or Amritsar markets. The raw fruit is either exported to Pakistan and

other foreign countries or used for making preserve by the local units. The remaining fruit retained by the farmer is harvested during December- January. The fruit is dried by the farmers, graded according to weight and shape and sent to markets for sale. The fruit has been in use in the Indian system of medicine since time immemorial the large sized fruits from grafted plants will fetch a premium price of minimum three times that of wild variety in the years to come. They will also be used in making 'Murabba' and as 'Murrabi' variety as it is three to five times as large as wild variety and the demand for its fruit has increased tremendously, because of its medicinal value; Its fruits will sold at a price of Rs. 25-60/kg instead of Rs 15/kg as in case of local strains.

Saleem *et al* (2014) studied variation in fruit characteristics of *Terminalia chebula* collected from different areas of Jammu and Himachal Pradesh. They observed that fresh fruit weight (44.6 g), dry weight (21.755g) , fruit length(7.5 cm) and fresh pulp weight (34.78g) of mother tree present in Mathwar village was significantly higher than all other mother trees of Jammu and Himachal Pradesh region. Due to superiority of a majority of fruit characteristics of this mother tree the same was selected for scion material for grafting experiments and is locally called “Raj Harad” i.e. “King of this species” owing to the superiority of its fruit characteristics.



Photograph showing grafting of Raj Harar

Economics of Grafted Harad Plantations as compared to existing plantations

Plantation	Av weight of fruit	Av. Size of fruit	Av. Market rate at farmers door step
Grafted Harad	40 gm	10 cm	Rs. 45.00 per kg
Existing wild genotype	6 gm	4cm	Rs. 15 .00 per kg

Conclusion:

Production of quality fruits will increase the income of the farmers, as their produce will have greater market acceptability hence more income. Standardization of the scientific production technology will boost the adaptation and cultivation of medicinal trees in the district, which in future will, serves as a repository for supply of quality planting material to farming community of Jammu region. With the increase in availability of quality planting material, the farmers will venture into adoption of technology and gradual replacement of inferior planting stock with high value superior clones. Consequently, there will be development of entrepreneurship for commercialization of these medicinal crops among the rural masses.

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