

Propagating arid fruits commercially

The importance of arid fruits is increasing because people are realizing the importance of new useful bioactive compounds, low calories, sweetness, insecticidal compounds and gamma linolenic acid. Planting of these hardy species can stabilize productivity on marginal lands. Looking into the importance of these underutilized fruits, the demand for its planting material is increasing day-by-day. To meet the demand of genuine planting material, procedure of vegetative propagation of underutilized fruits has been standardized for generating quality planting materials. From various studies for optimization of period of vegetative propagation and quality of scion, shoots and rootstocks of these fruit crops have been summarized, particularly the methods which can be used for commercial multiplication of arid and semi-arid underutilized fruits (jamun, bael, tamarind, khirni, chironji, custard apple, wood apple, karonda, gonda, mahua, pilu, ker etc.).

Indian sub-continent holds vast genetic diversity of several arid and semi-arid underexploited fruits. Underutilized fruits provide food, nutrition, and substances to the native communities and are an additional source of income. Many of these species are being used by local people as minor fruits or for formulation of various *Ayurvedic* medicines. These fruits still remain neglected due to the lack of awareness regarding commercial method of propagation techniques and sustainable production technologies as these fruits still grow naturally wild or semi-wild conditions providing livelihood and nutritional support to small and marginal farmers, and tribals women and children. If properly utilized, these underutilized fruits have potential as a source of income, food, fodder and fuel besides meeting multipurpose needs of local communities. Recently, considerable interest has aroused in production of underutilized fruits.

PROPAGATION IN ARID FRUIT CROPS

JAMUN

Soft wood grafting and patch budding in March-April give maximum success, 90.12 and 85.24 per cent, under semi-arid environment. For softwood grafting, a healthy, 35 -45 days old shoot is selected and leaf blade is removed with the help of a sharp knife leaving petiole intact. After 10-15 days, when buds in leaf axils swollen properly and petiole are dropped down after gentle shaking of prepared scion shoots, these scion shoots are cut from mother plants and used for softwood grafting. For patch budding, a healthy bud is selected from axils of leaf. Different sizes of poly bags, 25 cm × 15 cm, 25 cm × 10 cm, 30 cm × 8 cm and 20 cm × 8 cm, are used to budding in March in nursery. The maximum number of buddable rootstocks (98.00 %) is recorded in 25 cm × 15 cm size, followed by 25



Softwood grafting in jamun



In-situ patch budding in jamun



Bael rootstocks in polybags



Softwood patch budding

cm × 10 cm (94.50%). The soft wood grafting and patch budding in March and ideal for commercialization.

BAEL

In patch budding, a healthy bud is selected from axils of leaf. Leaf blade is removed with the help of a sharp knife leaving petiole intact. The upper cut is given 1-1.5 cm above bud which goes downwards up to 1.0-1.5 cm below bud without wood portion and then lower cut is given about 1.0 cm below the bud. The similar rectangle incision is made on 9-10 months old rootstock by placing bud on rootstocks to mark

the exact size of bud on them and after removing the bark of rootstock, the bud is placed at the juncture. The bud is pressed by hand to remove open space if any and tied tightly except the place of bud with white polythene strip (200-gauge thick and 2 cm wide). The rootstock is cut about 10 cm above the bud to facilitate bud to patch budding sprout. Time of budding influences survival of plant in different varieties. Patch budding has been found successful if performed in May-June (before onset of rain) under Gujarat conditions. The plants propagated through *in-situ* patch budding in May and June (before onset of rain) give 94.14% and 90.82%, respectively, whereas in nursery, success has been recorded 84.25 per cent. For getting better success and survival of plant, patch budding may be practised in May-June for multiplication of bael genotypes for establishment of orchards under dryland conditions.

In soft wood grafted, 15-20 cm long mature shoots (4-6 months old) when plants are completely shed their leaves or new shoots (2-3 months old) which are defoliated 10-12 days prior to grafting operation, used for budding. These shoots are detached from mother plants with the help of secateurs or sharp grafting knife for grafting by cleft method. For this, seedling rootstock



In-situ patch budding in bael



Softwood grafting in bael



Softwood grafting in bael

is cut at 20-25 cm height and the top portion is removed. With the help of knife, 5 cm long vertical downward incision is made in the center of the rootstock. A sharp cut of 5 cm is made on both the sides on the base of scion shoot to make wedge shape. Softwood grafting in April–May gives 87.25 per cent success under nursery condition. Thereafter, prepared scion is carefully inserted in vertical slit of rootstock and tightly secured with the help of 200-gauge thick and 2 cm wide polythene strips. This method can be applied for commercial multiplication of bael.

KHIRNI

New concept for khirni multiplication has been developed which resulted in maximum graft success in March (76.66%). It also reduces time taken for sprouting and enhanced growth of plant under rainfed hot semi-arid conditions. Accelerated growth of shoot is observed in March grafted plants.



Softwood grafting in chironji



Softwood grafting in khirni

MAHUA

The maximum graft success in March is 70.00 per cent. It also reduces time taken for sprouting with enhanced growth of plant under rainfed hot semi-arid conditions. Accelerated growth of shoot is observed in March grafted plants.

CHIRONJI

A method of softwood grafting has been developed for commercial multiplication under rainfed conditions of western India. July is the best month, for commercial multiplication of chironji. The softwood grafting is more successful (85.13%) when practised *in-situ* under field condition. However, success in nursery has been recorded 62.23% under rainfed hot semi-arid ecosystem. Growth of scion is better in *in-situ* patch budding than polythene tube budded plants in nursery. Chironji can be propagated through soft wood grafting and patch budding commercially.

WILD NONI

Maximum success (90.49%) is achieved in air layering in July in *M. tomentosa*, followed by August (82.32), September (40%) under rainfed conditions of semi-arid ecosystem. It is the best method of



In-situ softwood grafting in mahua



Mahua rootstocks in nursery

propagation of *Morinda tomentosa*. This species can be propagated commercially through air layering.

TAMARIND

The softwood grafting in April and May (>51.24%) and patch budding in July- August (>45%) give maximum shoot length and number of leaves, success and survival of grafts under rainfed semi-arid environment. Soft wood grafting is best method of propagation. It is economical and gives higher degree of success. It is highly suitable for establishing *in-situ* orchards.

Table 1. Fruit crop and their commercial method of propagation and success and survival under field condition

Fruit crop	Period of multiplication	Propagation methods
Bael	April-June	Soft wood grafting and patch budding
Chironji	July-August	Soft wood grafting
Jamun	April-May	Soft wood grafting, patch budding
Lasora	June-July	Patch budding
Tamarind	July-August	Soft wood grafting and patch budding
Mahua	March-April	Soft wood grafting
Custard apple	April-May	Soft wood grafting
Wood apple	May-June	Soft wood grafting, patch budding
Karonda	June-July	Cutting
Fig	October-November	Cutting
Morinda (Noni)	July-August	Air layering
Manila tamarind	March-May	Patch budding
Khirni	March-April	Softwood grafting
Timru	May-June	softwood grafting
Phalsa	July-August	Cutting
Mulberry	December-January	Stem cutting
Ker	July-August	Suckers and cuttings
Pilu	July-August	Root sucker and layering



Patch budding in tamarind



Chironji rootstocks in nursery

PHALSA

In general phalsa orchards are established through seeds. Seeds lose their viability under ordinary storage after 90-100 days. However, several vegetative methods have been reported for multiplication of phalsa. Among

different types of cuttings, hard wood cutting treated with 100 ppm IBA give 67.65 per cent success under dryland conditions. Treatment of hard wood cutting with IBA increases root biomass and survival under dryland condition of hot semi-arid region.



Cuttings of karonda

WOOD APPLE

The soft wood grafting in March-April with 6-8 months old scion shoots gives 85.13 per cent success on 10-12 months old rootstocks. For better success and survival under field condition *in-situ* grafting is advised.

CUSTARD APPLE

The softwood grafting in March-April with 6-8 months old scion shoots gives 91.45 per cent success on 10-12 months old rootstocks whereas patch budding in April-May with 3-4 months old scion shoots gives highest success (59.20%). The survival of grafts are severely affected after commencement of rain. The soft wood grafting is ideal method of commercial propagation of custard apple.

KARONDA

Seeds from fully matured fruits are extracted and

sown in August-September. Seeds have short viability, hence seeds should be sown just after extraction for better germination. Cuttings from nursery gives best results. The highest rooting in cuttings is observed in November. Under semi-arid condition, highest percentage of success is noted in IBA 5000ppm (60.50 %), followed by IBA 7500 ppm. Hard wood cutting in November treating with IBA5000 ppm is found better for multiplication of karonda.



Seedlings of lasoda in nursery

GONDA

Lasoda plants can be propagated by both sexual (seeds) and asexual (vegetative methods) means of propagation. The choice of propagation method may depend upon raising hybrid progeny under breeding programme or for commercial propagation.

For raising rootstocks, seed should be sown at 2 cm depth in polythene bag. Germination starts in 2-3 weeks and completed within 4-5 weeks. Seedlings should be ready for budding after 8-10 months. Watering at 2-3 days interval also induces early and uniform germination. Patch and I-budding with 3 month old scion during July-September on 8-10 months old seedling rootstocks of *C. myxa* or *C. gharaf* are successful. T-Budding is most successful with 96.7 % success than other method. However, the most suitable period for T-budding is August as plants are physiologically very active during August-September.

MULBERRY

Mulberry can be propagated either through seeds or stem cuttings. Seed should be sown as soon as extracted from fruits. Budding and stem cutting are most common methods for propagation of mulberry. The mature shoots of 6-8 month age with 15-20 cm length, 10-12 mm in diameter, 3-4 healthy buds are selected for cuttings. The cut ends of cuttings should be clean at an angle of 45° with a



Pilu seedlings

sharp knife without bark split. Cuttings are potted in sand beds or pots during winter which start sprouting with increase in temperature during February-March which can be shifted to polythene / earthen pots for growth. Irrigation is done regularly afterwards. By the onset of monsoon season saplings are ready for planting in the main field. Semi hard wood

cuttings give better result in respect of sprouting and survival. Softwood cuttings of white mulberries root easily when taken in mid summer and treated with rooting hormone. Red mulberries are less easily rooted. Black mulberries are also somewhat difficult to propagate since they tend to bleed a lot. *In-situ* budding is feasible in mulberry under arid and semi arid climate during March-September.

PILU

The *Pilu* regenerates by seeds and root suckers. Seedlings of *pilu* can be raised by sowing seeds in polythene tubes/bags of 25 cm × 10 cm size during July-August. Seeds germinate in 7-10 days. Because of slow growth, seedlings take 10-11 months to attain proper size for transplanting. Root suckers emerging around tree bases can be used as planting material. It can also be multiplied by layering.

KER

In nature, *ker* is regenerated from seeds or root suckers. However, it can be propagated by hard or semi-hardwood cuttings during September-October after treatment with a solution of 5000 ppm IBA+1000 ppm thiamine.

Precautions

- The contact between stock and scion should be very fine and there should not be gap between them as it adversely affects the budding success.
- The bud union should be properly tied with polythene band, so that the rain water could not enter in the gap. Rain plays a negative role



Ker seedlings

and creates hindrance for perfect union, through seeping water in between stock and scion.

- Avoid splitting of bark during separation of bud from scion shoots to ensure better success.
- Under dryland condition, mother plant should be irrigated 2 days before detaching scion shoots for better success and survival.
- Scion shoots should be selected from healthy plants having better fruiting record so as to evade the infestation of pests and diseases during the establishment of orchard and also ensure the better productivity.
- Sprouts emerging from the rootstock should be removed except the budded one at periodical interval



Softwood grafting in custard apple

to promote the scion shoots growth.

- Size of bark patch containing bud should be properly matched with the cut portion of the bark on the root stocks for perfect and quick union.
- Polythene strip should not be removed unless it is ensured that scion shoots has started growing.
- *In-situ* grafting, mulching of basin soil should be done regularly to avoid moisture loss through evaporation and also to fill up the cracks developed in basin by spading under dryland condition for better survival.
- Weeding should be done regularly for better growth of saplings in nursery.
- Newly emerging shoots are often damaged by leaf eating caterpillars and hence, the management of the pest should be done using sprays of dimethoate @1.5 ml/l twice at 15 days interval.
- In case, the cuts on rootstock are wider, at least one side bark of scion and stock must match properly.

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