AgriCos e-Newsletter
ISSN: 2582-7049
Volume : 01 Issue : 06 October 2020 Article No: 23

Status and Prospects of Walnut Production in India

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SUMMARY

Walnut production in India is beset with many problems like low productivity, poor fruit quality, non availability of suitable rootstocks, superior scion stock, lack of standard propagation techniques and little bit knowledge of cultural practices. Walnut have long pre- bearing age, high variable in vigour and high shell and kernel ratio. Mostly walnut grown as scattered trees and not in the compact form so scope for bringing more are under walnut regular plantations in the hilly, wasteland are laying vacant, transportation facilities do not exist and the cultivation of other fruits. Besides this, demand from in and out of country of walnut increasing due to its high nutritive value. It contains proteins (15-20%), fats (60-75%), good quantum of carbohydrates, phosphoric acid and vitamins, consumed fresh or in confectionery, bakery, yield high valuable edible oil and omega fatty acids.

INTRODUCTION

Walnut, *Juglansregia* L. belongs to family Juglandaceae and indigenous to the region from Persia to Kashmir. Important nut cultivated in semi cold regions and majorly grown in USA, China, Italy, Turkey, Rumania, Poland, Austria, Yugoslavia and France. Walnut generally known as Akhrot, cultivated Himalayan region with elevation of 1200-2150m above sea level. Jammu Kashmir, Uttarakhand and Himachal Pradesh are major crop growing areas. The total area under walnut in India is about 109 thousand hectare with annual production of 300 thousand MT (NHB 2017-2018).

Climate

Walnut grown successfully in parts of Himalayan region ranged from 1200- 2150 m. The main climatic limitations for walnut growing areas are spring and fall frost, extreme summer, inadequate winter chilling. Plants tolerate low temperature (-11^{0}C) during dormancy, but as soon growth times (Spring) after dormancy temperature (2- 3 ^{0}C) below freezing points, which may favors death of leaves, shoot and flower resulted inferior crop. Likely plants which continue to grow till late subjected to serious foliage damaged by frost. High temperature (38 ^{0}C) causes sun burning of hull and shriveling of kernels which turn into blank nuts. Chilling requirements 700-1500 hours, most of cultivar require about 800 hours of below 7 ^{0}C for normal growth. Walnut well grown with mild climate and moderate rainfall (800m) considered best suited for walnut cultivation.

Soil

Crop are susceptible to poor drainage so heavy soils should be avoided. Crop grown well drained and fertile soil, sandy loam soil are preferable for walnut cultivation atleast 5-6 feet depth. It needed neutral range as than other temperate fruits generally slightly lower pH.Growth include nutrient scarcity, salt accumulation and excess boron. Walnut also exhibits a low tolerance for soluble salts, especially Na and Cl and mostly sensitive to excess boron.

Cultivar Status

Walnut trees are of seedling origin in India except some seedlings locally named as cultivars. Few cultivars introduced from abroad tested at different temperate research stations of State Horticulture Department of Jammu and Kashmir, Himachal Pradesh and Uttarakhand.

Table 1 Walnut Varieties Developed on Different Countries

Country	Institute	Varieties
USA	University of California, Davis, USDA,	Franquette, Waterloo, Midland, Pioneer, Carmello, Adams 10, Howard, Payne, Sunland, Vina, Ashley, Serr, Lompoc, Chico,

		Tehama, Eureka, Gustine, Placentia, Marchetti, Cisco, Chandler, Amigo, Hartley, Tulare, Early Ehrhardt, Conway mayette, Pedro, Trinta, Poe, Weeper, Cascade
India	SKUAST-Shalimar, Kashmir, Srinagar	Hamdan, Sulaiman
	Dr. YS Parmar University of Hort. & Forestry, Nauni, Solan, HP	Partap, Govind K12(Selection)
	Hort. Exp. & Training Centre, Dir. Of Hort., Chaubattia, Uttarakhand	HanaulKagzi, Siri Kagzi, Kuna Kagzi, DablaKagzi, Nada Kagzi, DabraKagzi, BagiKagzi, KandoiKagzi, Chakrata Lehman Kagzi
	Central Institute of Temperate Horticulture, J&K	CITH Walnut 1, 2, 3, 4, 5, 6, 7, 8, 9, 10
Spain		Concha
France	INRA (Iinstitut national delaresearcheagronomique)	Mayette, Lozeronne, Laciniata 93-5, Meylan, Franquette
China		Chinese 85-8, Manregian, Sharkey

Table 2 Walnut major producing districts in different states of India

State	Walnut Major Producing Districts
Jammu and Kashmir	Anantnag, Kulgam, Doda, Poonch, Badgam, Shopian, Kishtwar
Uttarakhand	Almora, Dehradun, Pauri Garhwal
Himachal Pradesh	Sirmaur, Chamb, kinnaur

Rootstocks

Seedling are generally used for rootstocks in India, efforts are continuing to improve/develop rootstocks which may reduce tree size, and long juvenility. Some introduced *J. allardiana*cv. 605, *J. mandshurica* cv.608, *J. major* cv. 607 and Paradox (*J. regia x J. nigra*) are used as rootstocks but out of all of these 'Paradox' founded better than parents in respect of scion growth and tolerance to disease and pest but susceptible to blackline disease.

Propagation

Propagation a method of multiplication of plants. In India walnut are generally propagated by seed therefore referred to as seedling. Although by propagating by seed most economically but not satisfactory due to crop has highly variable producing nut and its take long time to came in bearing. So to avoid such variation walnut are propagated by vegetatively methods like grafting and budding.

Grafting:

Tongue or whip grafting, cleft and veneer grafting during Feb.-early March have give good results.

Tongue Grafting:-

Grafting done during February –March in mid-high hill conditions. Removal of top of rootstocks by giving cut in slanting fashion about 3.0 cm long and same size on scion stick having 2-3 buds. Stocks and scion are then inserted into each other with interlocking.

Veneer Grafting:-

Veneer graftingperformed well during July- August, inward cut 4.0 cm is made in a smooth area on one side of stock plants. At the base of cut, a second short inward and downward cut is made, so remove piece of wood and bark. Scion is prepared with along cut along one side and a very short one at base of the scion one the opposite side. After inserting the scion graft portion wrapped with alkathane.

Budding:

Patch and Chip budding best period is May-June.

Chip budding:

Suitable time for chip budding is summers, usually in May-June & August; during this period rootstock and scion cultivar must be in fully growing stage so that the bark will slip easily. Chip budding is a technique that may be used whenever mature buds are available.

Patch and annular budding:

Rectangular patch of bark 3.5x 2.0 cm, bud in its centre removed from budsticks. Patch of similar size removed from the stocks and fitted on scion. Then wrapped with polythene strips, leaving the bud naked.

Planting

Planting is done at time of December- March, but December is more preferable time. Whereas in warm areas planting should be done during rainy season or where lack of irrigation facilities. In India plant planted on hillslopes, contour design. Lateral bearing cultivars should be planted at 13.3 x 13.3 m and 15-20 m spacing are recommended for terminal bearing cultivars. Fill pits (1 x 1x 1 m^3) with rotton FYM and soil in 1:2 portions.

Training and Pruning

Walnut bear fruits on one year old wood is produced terminally or laterally or both. Tree are headed back at 5-7 buds above graft union at planting and trunks are protected from sunburn with water based white latex paint. The vigorous upright limb is selected after one year growth, leaving one or two small lower limbs on the South- West side to protect the tree. Walnut trees are generally trained after the first year on 'Modified Central leader System'.To avoid narrow crotches, remove all primary buds above 1.5 m from the ground to force secondary buds to grow. Select main scaffold limb 1.6 m above ground. Choose primary scaffold limbs in all directions on the trunk.Pruning is generally practiced in the dormant season but early spring is preferable. Further delay causes excess bleeding. For young tree (16-17 year-old) and middle aged trees (34-35 year-old) cut back 3-year old shoots. For mature trees (40 year-old), cut back 4-5 year-old shoots. Initiate selective thinning out of limbs in the top and sides of the tree before overcrowding becomes serious.

Table 3. Fertilization Schedule in Walnut Crop

	1st yr	2nd yr	3rd yr	4th yr	5th yr	6th yr	7th yr	8th yr	9th yr	10th yr
N	100 g	200 g	300 g	400 g	500 g	500 g	600 g	600 g	700 g	900 g
P	50 g	100g	150 g	200 g	250 g	300 g	350 g	400 g	450 g	500 g
K	50 g	100 g	150 g	200 g	250 g	300 g	350 g	400 g	450 g	500 g
Away From Main Trunk	0.5 m	1.0 m	1.5 m	2.0 m	2.5 m	2.5 m	3.0 m	3.0 m	3.0 m	3.0 m

Source: POP

Harvesting and Postharvest Management

Walnut commercial production starts 8-10 years from planting. A fully grown, big size tree produces as high as 100-150 kg nuts but the average yield is 40-60 kg per tree. Walnuts are usually harvested when hull colour changes from green to yellowish with cracks or when splitting starts at suture from pedicel end. Nuts should be harvested at PTB stage (when packing tissue turns brown). For better nut recovery, the orchard floor should be cleaned and tarpaulin or polythene sheets may be spread on the floor beneath trees prior to knocking of the nuts.The lightest kernel colour commands higher price in the international market. The nut maturity could be judged by splitting or dehisce of hull.In Himachal Pradesh harvesting commences from August and extends up to last week of September, whereas in Kashmir walnuts are harvested in September.

Storage

Optimum temp: 0-10 ^{o}C, RH- 50-65 % will maintain walnuts at 4% moisture (Beuchat, 1978).Stored in gunny bags,for export double gunny bags.

Pest and Disease

Walnut Twig Beetle:

Yellow sticky trap, use of systemic insecticides to control transmission of the fungus to new hosts before substantial infection occurs.Rapid detection and removal of infected trees currently remains the primary means of managing thousand cankers disease.

Codling Moth:

'*Laspeyresiapomonella*', this moth can destroy the nut kernels early in the fruiting season and also stain both shell and kernel later. Pheremone traps to catch male moths are effective from early-mid Spring.

Walnut Blight-

Bacterial blight.'*Xanthomonascampestris*pv. juglandis'

Disease affect the new growth and nuts, and infection occurs only in wet weather. The most damaging circumstances are wet, cool periods around flowering time.The bacteria will survive overwinter in apparently healthy dormant buds, leading to new infection of young growth varieties which leaf early are most at risk.
Infected parts should be cut out a good way back from visible damage and burnt.

- Bordeaux mixture spray may help.
- Defense against blight include keeping soil pH above 6.
- Avoiding wetting the foliage with spray irrigation.
- Guarding against excessive nitrogen feeding and pruning enough to give an open structure for aeration

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