Evaluation of some Walnut (*Juglans regia*) Seedling Germplasm in Himachal Pradesh

DD Sharma and JN Sharma

Dr YS Parmar University of Horticulture and Forestry, Temperate Horticultural Research Station, Kotkhai, Shimla-171 202 (Himachal Pradesh)

In the present study 30 seedlings with desirable traits were selected from total 104 populations. Maximum nut weight, nut length, suture and cheek diameter were recorded in KW 020. KW 012 had the minimum shell thickness (1.44 mm). It also had excellent shelling quality with light yellow kernel colour and excellent taste. Highest shelling percentage (58.5%) was also recorded in KW 012. Therefore, out of 30 seedlings, KW 012 was found to be the most promising selection having all the characters matching with international standards.

Key Words: *Juglans regia*, Seedlings, Shell Nut, Walnut

Walnut is a priced nut crop and grown in India in North-western Himalayas. At present 41,840 ha area is under walnut cultivation in India and the production is 22,000 metric tonnes (FAO, 1998). Still most of the walnuts are grown as scattered seedling trees and not in the form of a well laid-out orchard. The major hurdle in the expansion of area under walnut is non-availability of vegetatively progagated plants of superior strains/ cultivars. Though, some efforts have already been made to select superior walnut seedlings (Nauriyal *et al.*, 1970; Lal and Singh, 1978; Chauhan and Sharma, 1979; Sharma and Chauhan, 1980; Pandey and Sinha, 1984) and to introduce improved cultivars from abroad, seedling selections/cultivars of international standard are available only to a limited extent. The present studies were undertaken to evaluate best seedlings available in the Kotkhai and Theog area of Shimla district of Himachal Pradesh in India. This study is an effort to find out any seedling selection which can meet all the standards needed for the export of walnuts.

Materials and Methods

A survey on walnut was conducted during 1999 in the Kotkhai and Theog area of Shimla district located at an altitude ranging between 1800 to 2000 msl. Out of 104 seedlings, the detailed studies were conducted on 30 seedlings having desirable characters. The others were rejected on the basis of preliminary observations. Data was compiled on 30 nuts selected randomly from the whole harvest of the tree after the nuts were dried to edible stage. The results were expressed on the basis of averages of triplicate sampling and analysed statistically in a completely randomised design. Nut size represents the nut length, suture diameter and the cheek diameter in mm, which were measured with the help of Vernier Callipers. Weight (g) of the in-shell nuts, kernel weight (g) were also recorded from the same nuts. Shelling quality and taste grades were rated on numerical scale such as 5 – excellent, 4-very good, 2 – fair, 1– poor. Shelling percentage was also calculated.

Results and Discussion

The data on nut and kernal characters are presented in Table 1.

Nut Weight

The average nut weight varied from 9.5 g to 21.4 g (Table 1). The highest nut weight was found in KW 020 followed by KW 02. Gouzhen and Yang (1990) reported a variation in nut size in China between 5.8 g to 27 g. For international market an ideal nut should weigh between 12 to 18 g (McGranahan and Leslie, 1990).

Nut Length

The maximum nut length (47.1 mm) was recorded in KW 020 which was significantly higher than all other seedlings.

Suture Diameter

Suture diameter was found to be maximum (38.9 mm) in KW 020 which was statistically at par with KW 013. The minimum suture diameter (29.2 mm) was recorded in KW 05. For commercial grading suture diameter should not be less than 3.13 mm (Serr and Ford, 1956). A suture diameter above 3.7 mm is not considered good, as there are chances of poor filling of larger nuts.

Cheek Diameter

Nuts with maximum cheek diameter (39.1 mm) were

Table 1. Variation in nut characters of different walnut seedlings

Seedling No.	Nut characteristics								Kernel characteristics		
	Weight (g)	Length (mm)	Suture diameter (mm)	Cheek diameter (mm)	Shape	Surface	Shell thickness (mm)	Shelling quality (grade)	Colour	Taste (grade)	Shelling percentage
KW 01	10.7	35.2	31.4	29.2	Conical	R	2.52	3	V	2	37.5
KW 02	20.2	44.1	37.2	39.7	Ovoid	R	1.91	4	Y	4	42.3
KW 03	14.6	38.4	33.2	31.9	Oblong	S	2.15	3	LY	5	38.3
KW 04	12.9	33.2	28.4	29.0	Ovoid	S	1.97	5	Y	4	35.3
KW 05	9.5	30.4	29.2	30.5	Ovoid	R	2.34	4	DY	4	39.3
KW 06	15.7	40.3	32.8	34.2	Oblong	R	2.12	4	Y	3	41.8
KW 07	11.5	36.5	33.4	32.2	Oblong	S	1.84	4	V	2	32.4
KW 08	13.4	42.2	29.5	31.0	Concial	R	2.01	4	Y	3	46.5
KW 09	14.6	39.5	34.3	31.8	Ovoid	R	2.52	3	Y	3	38.4
KW 010	12.4	38.2	31.9	28.8	Conical	S	1.95	2	V	4	35.2
KW 011	10.8	35.1	32.6	33.4	Oblong	R	2.46	3	DY	3	32.4
KW 012	15.4	35.2	36.3	38.4	Ovoid	S	1.44	5	LY	5	58.5
KW 013	19.4	42.5	38.8	38.7	Ovoid	R	2.31	3	LY	5	34.5
KW 014	12.2	38.2	30.4	31.2	Oblong	R	2.18	4	Y	4	37.3
KW 015	9.8	29.2	31.2	30.4	Conical	R	1.91	3	Y	4	33.4
KW 016	14.3	35.0	36.4	32.2	Ovoid	R	2.13	4	LY	5	42.2
KW 017	19.2	41.4	38.4	33.4	Oblong	S	1.88	5	V	3	48.4
KW 018	11.3	33.4	32.2	30.7	Ovoid	S	2.08	5	Y	2	40.4
KW 019	10.2	38.2	32.4	31.4	Oblong	R	1.95	4	Y	4	35.2
KW 020	21.4	47.1	38.9	39.1	Oblong	R	2.28	4	V	3	47.3
KW 021	15.7	39.2	30.2	31.4	Conical	S	2.02	5	Y	4	31.7
KW 022	14.8	37.2	34.4	33.2	Oblong	S	2.62	2	LY	5	28.3
KW 023	13.3	36.5	33.0	32.1	Oblong	R	2.55	3	DY	3	29.4
KW 024	11.7	38.2	30.2	29.4	Conical	R	1.83	4	Y	4	43.7
KW 025	15.3	35.4	33.8	34.2	Ovoid	R	2.57	3	V	2	33.4
KW 026	12.8	37.4	30.2	28.7	Conical	S	1.62	5	DY	3	44.2
KW 027	13.7	35.0	33.2	32.4	Ovoid	R	2.44	4	LY	5	35.2
KW 028	18.4	40.4	35.3	34.7	Oblong	S	2.36	4	DY	4	39.4
KW 029	12.7	37.2	30.4	29.2	Conical	R	2.25	4	Y	3	41.4
KW 030	11.2	33.4	32.2	31.4	Ovoid	S	1.81	4	LY	5	42.3
$CD_{0.05}$	3.62	2.46	3.84	4.27	-	-	0.33	-	-	-	7.84

Nut surface: R-Rough; S-Smooth
Kernel colour: V-Violaceous; DY-Dark yellow; Y-yellow; LY-Light yellow
Shelling quality: 5-Excellent; 4-Very good; 3-Good; 2- Fair; 1-Poor

obtained from KW 020. The minimum cheek diameter (29.0 mm) was found in KW 04.

Nut Shape

Three prominent shapes were recorded in the nuts of different seedlings such as conical, oblong and ovoid. Great variation in the shape of nuts is found in the seeding germplasm. Sharma and Sharma (1998) also found various nut shapes in a survey conducted on 125 walnut seedlings.

Nut Surface

Out of 30 seedlings the nut surface of 18 seedlings was rough and that of 12 was smooth. Shell surface varied from slightly grooved to deeply grooved. Nuts having minimum grooved surface were more desirable. Sharma and Sharma (1998) in a study on 125 seedlings reported that shell surface of nuts of 72 trees were slightly grooved, 46 moderately grooved and 7 deeply grooved.

Shell Thickness

Highest shell thickness (2.62 mm) was recorded in KW 022 whereas it was lowest (1.44 mm) in KW 012. Medium shell nuts can be marketed as in shell and thin shelled nuts as kernels. Bhat *et al.* (1992) found that out of 20 seedlings, 4 were designated as hard shelled, 14 as medium shelled and 2 as thin shelled.

Shelling Quality

Shelling quality is a very important parameter as it determines whether the whole kernel is removed neatly or as broken pieces. Excellent shelling quality was observed in KW 04, KW 012, KW 017, KW 018 and KW 026. Fair shelling quality was found in KW 010 and KW 022.

Kernel Colour

For good quality walnuts, light yellow kernel is a desirable character. KW 03, KW 012, KW 013, KW 016, KW 022, KW 027 and KW 030 all hadlight yellow coloured kernels. Bhat *et al.,* (1992) reported that light amber coloured kernel is not a serious handicap but dark and black kernels are very objectionable.

Kernel Taste

Five local seedlings KW 03, KW 012, KW 013, KW 022 and KW 027 were found to have an excellent taste with numerical value of 5. Taste of KW 01, KW 07, KW 018 and KW 025 was observed to be fair in taste.

Sheelling Percentage

Highest shelling percentage (58.5%) was recorded in KW 012 which was significantly higher than other seedlings. The lowest percentage (29.4%) was, however, recorded in KW 023. According to Serr and Ford (1956) an ideal nut should have above 50% kernel, however, 50 to 60% is desirable. Bhat *et al.* (1992) reported three seedlings namely Wossan-4, P-1 and V-1 having a shelling percentage of 63.60, 63.0 and 62.0, respectively.

The variability in all the characters is mainly due to the heterozygous nature of plants obtained from seeds. Hansche *et al.* (1972) have reported that shell thickness, nut weight and kernel weight have high heritabilities. Therefore, these traits should be considered for the selection programme of seedlings. For international market an ideal nut should weigh between 12-18 g with a clean, strong and thin shell with tight seal and easily removeable light clear and plump kernel weighing at least 50% of the in-shell nut (Mc Granahan and Leslie, 1990). In the present study the nut size of KW 012 was found to be medium (15.4 g) with the highest shelling percentage (58.5%). It is thin shelled (1.44 mm) and also possesses excellent shelling quality and taste. Its hull splits so well that it leaves no stain on the nut. Therefore, KW 012 was found to be the most promising selection for international standard.

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