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Studies on the Variability in Nuts of Seedling Walnut (*Juglans regia* L.) in Relation to the Tree Age[1]

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Abstract

In the present studies of 125 seedling trees selected from a population of 500, the nut weight varied from 6.3 to 18.6 g, nut length 2.3 to 4.8. cm, nut width 2.1 to 3.9 cm, nut breadth 2.0 to 4.1 cm, index of roundness 0.6 to 1.3, pad (portion of nut where two halves are attached together) width 0.2 to 0.9, pad thickness 0.2 to 0.7 cm and shell thickness from 0.07 to 0.5 cm. The variation was also observed for nut shape, shape of base and apex of nut, pistil point (apical portion of nut), position of pad on suture, structure of shell surface, groove along pad on suture, adherence of two halves, primary and secondary inner dividing membranes, persistence of hull on tree after nut fall and time of nut maturity. The age of tree exerted some influence on these characters but differences were non-significant and inconsistent. Thirty trees with the most promising characteristics were selected and are described here.

Key words: *Juglans regia,* nut, seedlings, variation, walnut.

Introduction

Walnut is the most important nut among temperate nuts grown in India. The seedlings of walnut are found growing in all parts of Himalayan region between the elevation of 1200-2200 meters above mean sea level. Walnut production in India during 1993 was 19,500 metric tons by unofficial figure whereas in 1994 it was 19,800 metric tons (3). Some studies to select superior walnut seedlings have already been made by (7, 5, 1, 13, 9). However, some areas still remained unexploited although a large number of seedling trees, quite different from each other in age, with a considerable variation in nut characters are found growing in such areas. Hence the present studies were undertaken to evaluate the variation in nuts of these seedling trees in relation to tree age in the Jaunaji area of Solan district of Himachal Pradesh in India.

Materials and Methods

A survey on walnut was conducted during 1995 and 1996 in the Jaunaji area of Solan district in Himachal Pradesh which is located at latitude 30°50'N 77°8'E, ranging between 1400-1600 meters above mean sea level. Out of a total population of 500 seedling walnut trees, 125 were selected on the basis of preliminary information obtained from the owners in different villages. The detailed studies were made on these 125 seedlings and finally 30 seedlings with desirable characters were selected.

The age of the seedling trees on the basis of planting year was recorded as per information given by the owners. These seedling trees were categorized into three groups. The trees in first group were less than 20 years old and those in second group are between 20 to 40 years. In the third group, the trees were older than 40 years. Observations on various nut characters were recorded as per guidelines given by (11). Data on thirty nuts selected randomly from the whole harvest of tree after the nuts were sun dried to edible stage and results were expressed on the basis of the averages of triplicate sampling and analyzed statistically in a completely randomized design. The data were analyzed as per methods suggested by (10).

Results and Discussion

Nut weight. The average nut weight in the population of 125 seedlings varied from 6.3 g to 18.6 g (Table 1). The average nut weights in the 1, 2 and 3 age groups were 10.88, 10.82 and 11.48 g, respectively.

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Table 1. Variation in nut characters of seedlings walnut trees in relation to tree age.

Nut characters	Mean	Range	Coefficient of variation	Standard deviation	Standard error	Critical differences
		Age Group 1 (Up to 20 years)				
Weight (g)	10.88	6.8 - 18.6	25.5	2.77	0.41	0.83
Length (cm)	3.72	2.4 - 4.5	11.5	0.42	0.06	0.13
Width (cm)	3.11	2.1 - 3.6	9.4	0.29	0.04	0.09
Breadth (cm)	3.13	2.7 - 3.9	8.0	0.25	0.04	0.07
Index of roundness	0.85	0.7 - 1.2	10.2	0.09	0.01	0.03
Pad width (cm)	0.53	0.4 - 0.9	25.1	0.12	0.02	0.04
Pad thickness (cm)	0.38	0.3 - 0.5	18.0	0.07	0.01	0.02
Shell thickness (cm)	0.17	0.1 - 0.3	27.6	0.05	0.01	0.01
		Age group 2 (21-40 years)				
Weight (g)	10.82	6.3 - 14.7	17.37	1.88	0.28	0.57
Length (cm)	3.66	2.3 - 4.8	13.75	0.50	0.07	0.15
Width (cm)	3.12	2.7 - 3.9	8.87	0.28	0.04	0.08
Breadth (cm)	3.12	2.7 - 4.1	10.31	0.32	0.05	0.10
Index of roundness	0.87	0.6 - 1.3	21.00	0.18	0.03	0.05
Pad width (cm)	0.52	0.2 - 0.7	22.39	0.12	0.02	0.30
Pad thickness (cm)	0.43	0.3 - 0.7	23.95	0.10	0.01	0.03
Shell thickness (cm)	0.19	0.1 - 0.5	31.31	0.06	0.01	0.04
		Age group 3 (> 40 years)				
Weight (g)	11.48	7.1 - 16.7	20.03	2.30	0.40	0.82
Length (cm)	3.67	2.5 - 4.5	11.13	0.41	0.07	0.14
Width (cm)	3.21	2.1 - 3.8	11.41	0.37	0.06	0.13
Breadth (cm)	3.15	2.0 - 4.0	11.60	0.37	0.06	0.13
Index of roundness	0.86	0.7 - 1.0	11.28	0.10	0.02	0.03
Pad width (cm)	0.54	0.3 - 0.7	19.95	0.11	0.02	0.04
Pad thickness (cm)	0.40	0.2 - 0.6	22.49	0.09	0.01	0.03
Shell thickness (cm)	0.20	0.07 - 0.5	35.92	0.07	0.06	0.12

Nut length. Two trees produced the longest nuts (4.8 cm). The shortest nuts in the seedling population were 2.3 cm. The mean values in age groups 1, 2 and 3 were 3.72 cm, 3.66 cm and 3.67 cm, respectively (Table 1).

Nut width. Nuts with minimum width of 2.1 cm and with maximum width of 3.9 cm were obtained. The mean values for nut width were 3.11 cm, 3.12 cm and 3.21 cm, respectively for age groups.

Nut breadth. Nuts with minimum breadth of 2.0 cm and with maximum breadth of 4.1 cm were obtained in the seedling population. The mean values for nut breadth in age groups 1, 2 and 3 were 3.13 cm, 3.12 cm and 3.15 cm, respectively (Table 1).

Index of roundness. Roundness indexes ranged from 0.6 to 1.3. The index mean values for the 1, 2 and 3 age groups were 0.85, 0.87 and 0.86, respectively (Table 1).

Pad width. The width of pad varied from 0.2 cm to 0.9 cm. The mean values in 1, 2 and 3 age groups were 0.53, 0.52 and 0.54 cm, respectively.

Pad thickness. Pad thickness ranged from 0.2 cm to 0.7 cm. The mean values for 1, 2 and 3 age groups were 0.38 cm, 0.43 cm and 0.40 cm, respectively (Table 1).

Shell thickness. The lowest shell thickness was 0.07 cm and highest was 0.5 cm. The means for 1, 2 and 3 age

groups were 0.17, 0.19 and 0.20 cm, respectively (Table 1).

The visual observations on other nut characters were also recorded and described as follows:

Nut shape. The nut shapes were determined based on longitudinal section perpendicular to suture and cross section perpendicular to suture.

Out of 125 trees, 22 produced nuts with ovate shape, 31 circular, 14 short trapezoid, 9 long trapezoid, 12 obovate, 15 elliptic, 8 broad elliptic, 5 broad ovate and 2 cordate shaped nuts when expressed on the basis of longitudinal section perpendicular to the suture. Five had narrow elliptic, 52 circular and 68 trees having broad elliptic shaped nuts when expressed in cross section.

Shape of base and apex of nut. The shapes of base and apex, perpendicular to suture were observed. The nuts of 89 trees were round, 22 pointed, 7 truncate and 7 emarginate shapes of their bases. In respect of shape of apex of nut, 47 trees produced nuts having round apex, 38 pointed, 36 truncate and 4 having emarginate.

Pistil point. The pistil points of nuts harvested from 88 trees were weak, 24 were medium and 13 were strong.

Position of pad on suture. The nuts of 24 trees were with pad position in the upper half, 52 in upper 2/3 and 49 trees produced nuts that covered the whole length.

Structure of shell surface. The structure of shell surface varied form slightly grooved to deeply grooved. Among the total population, 72 trees had nuts which were slightly grooved and 46 moderately grooved and 7 deeply grooved shell surface.

Groove along pad on suture. Out of 125 trees, 38 produced nuts that were shallow, 41 medium and 46 deeply grooved along the pad on suture.

Adherence of two shell halves. In a population of 125 trees, 5 had very strong, 26 strong, 49 medium,42 weak and 3 very weak adherence of the two halves.

Primary and secondary inner dividing membranes. Out of 125 trees, 39 had thin, 46 medium and 40 thick primary and secondary inner dividing membranes.

Persistence of hull on tree after nut fall. The persistence of hull on tree was present in the nuts of 105 trees whereas in the nuts of the remaining 20 trees, the hull did not persist after nut fall.

Time of nut maturity. In seedling population, the earliest nut maturity was observed in third week of August. The latest was in third week of October. Among 125 trees, 4 were early (August), 98 mid (September) and 23 trees late (October) in nut maturation.

In the present studies, there was a considerable variation in respect of nut characters. Similar variations were earlier reported by many workers (1, 13, 9, 12, 14). However, (2) studied the samples from 251 trees and found that the shell and overall suture thickness had low variability. An ideal nut would have weighed between 12-18 g, a clean, strong and thin shell with tight seal and easily removable light kernel, clean and plump kernel weighing at least 50 percent of the in-shell nut (6).

Nut maturity, as judged by harvest date, is a highly heritable trait (4). In the present study the seedling trees exhibited early to late nut maturity ranging from the third week of august to third week of October. In earlier reports from India the nut harvesting dates were reported to vary from the first week of august to third week of October (1, 7, 9, 13, 14). This range is too wide in view of different locations spread in moderate to extreme temperature ranges.

Normally walnuts have two halves (bilocular) but in the present study the occurrence of trees with multilocular nuts were observed. Some trees produced bi, tri and tetralocular nuts. The owners of these trees have revealed that this is a rare phenomenon. There was no tree which produced only tri or tetralocular nuts. These tri and tetralocular nuts producing trees were also reported in Kullu Valley (14).

These studies indicate that the nut characters are not influenced by the age of the

trees, although there were minor and inconsistent differences. However, (8) studied the size, shape and total weights of nuts in *J. regia* L. and found that the populations of different ages showed the species to be very polymorphic. He observed a clear tendency for the number of large nuts, weight and thickness of shell to diminish with age.

In conclusion, these studies show that there is extreme variation in almost all nut characters. These characters are least affected with age of the trees. Thirty promising seedlings having desirable attributes have been selected for further multiplication and planting in the collection block of the Department of Fruit Breeding & Genetic Resources.

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Performance of Nine European Plum Cultivars on Two Rootstocks in East-Central Ontario

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Abstract

Nine plum (*Prunus domestica* L.) cultivars were assessed over a 10-year period for growth, yield, fruit weight, bloom, petal fall and fruit harvest dates and cold temperature injury. The highest yields were obtained from 'Veeblue' and 'Vision'. 'Veeblue' had a higher yield efficiency and a lower cold temperature injury rating compared to 'Vision'. Cropping inconsistency encountered over the period of this trial would make commercial plum production in the east-central region of Ontario marginal. Cold temperatures during the winter of 1993-94 resulted in considerable injury to the trees. With the exception of 'Veeblue', the other cultivars tested from the breeding program at the Horticultural Research Institute of Ontario, Vineland Station, Ontario, suffered more cold temperature injury than did 'Italian' and 'Stanley'. Trees grown on 'Brompton' (*P. domestica* L.) rootstock were about 20% smaller compared to trees on 'Myrobalan B' (*P. cerasifera* Ehrh.).

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