SHORT COMMUNICATION

Walnut Selections from Chamba District of Himachal Pradesh

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Walnut (*Juglans regia* L.), a nut par excellence grown in India since antiquity especially in North-Western Himalaya, which is considered to be one of the secondary centre of diversity of cultivated walnut as maximum variability for primitive types is present in this region (Sharma and Kumar, 1994). Seedlings are found growing as scattered trees in the dry and wet temperate regions of India. The major walnut comes from these seedling trees of unknown origin, from natural forests and plants raised in farmers backyards (Pandey *et al.* 2001). Many of these local plantings have evolved through natural and human selection and represent distinct ecotypes and landraces. Meagre efforts have been made for selection of superior walnut genotypes with desirable traits from these seedling trees. In order to make use of this variability, efforts must be made to survey different seedling walnut growing areas to select the promising types.

Keeping in view the existing variability of seedling walnut trees, the present investigations were undertaken with the objective to select superior walnut genotypes from naturally occurring population of seedling tree stands.

A field survey was undertaken during the year 2003 and 2004 in remote and wet temperate areas of Chamba district in Himachal Pradesh. As a result of sustained exploration with the co-operation of local inhabitants a total of 450 walnut trees of seedling origin of varying age (ranging between 9 and 87 years) growing scattered in three locations namely Pangi, Bharmour and Tissa were surveyed. The location and geographical features of the study area are represented in Figure 1.

On the basis of growth, yield, nut and kernel characters, 20 trees were pre-selected for further studies. A random sample of 30 nuts from each tree was taken and observations on various tree growth, nut and kernel characters were recorded as per UPOV guidelines (UPOV, 1988). Nut and kernel weight was weighed on digital balance whereas kernel percentage was calculated as under:

$$\text{Kernel (\%)} = \frac{\text{Kernel weight}}{\text{Nut weight}} \times 100$$

Shell thickness was measured at near centre of half shell with the help of digital Vernier's Caliper (Mitutoyo, Japan–CD–6" CS). For the estimation of kernel protein, the nitrogen content was estimated following the Kjeldahl method as described by McKenzie and Wallace (1954). Protein content was worked out by multiplying N content with a factor of 5. 3 suggested for tree nuts (Khanizadeh *et al.,* 1995). Kernel oil was determined by following the method of Folch *et al.* (1957).

Observations on growth habit (Table 1) of selected walnut trees indicate spreading type of growth habit

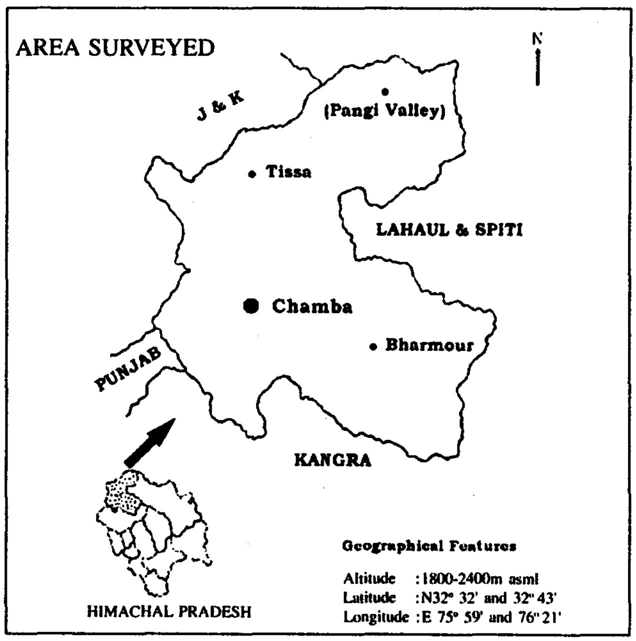

Fig. 1. Geographical features of the area surveyed

Table 1. Tree characters of walnut selections

	Tree characters				
Selection No.	Growth habit	Nut yield (kg/tree)	Age (years)	Flowering season	Date of maturity
Tree No.1P	Spreading	450	80	First week of May	Last week of September
Tree No.2P	Spreading	400	65	First week of May	Last week of September
Tree No.3P	Spreading	150	20	First week of May	Last week of September
Tree No.4P	Spreading	500	75	First week of May	Last week of September
Tree No.5P	Spreading	400	60	First week of May	Last week of September
Tree No.6P	Spreading	375	50	First week of May	Last week of September
Tree No.7P	Spreading	350	46	First week of May	Last week of September
Tree No.8P	Spreading	200	38	First week of May	Last week of September
Tree No.9P	Spreading	400	65	First week of May	Last week of September
Tree No.10P	Spreading	500	70	First week of May	Last week of September
Tree No.1B	Spreading	500	87	First week of April	Last week of August
Tree No.2B	Erect	180	36	First week of April	Last week of August
Tree No.3B	Spreading	150	18	First week of April	Last week of August
Tree No.1T	Spreading	25	9	First week of May	First week of October
Tree No.2T	Spreading	45	15	First week of May	Last week of October
Tree No.3T	Spreading	90	18	First week of May	Last week of October
Tree No.4T	Spreading	250	25	First week of April	First week of October
Tree No.5T	Spreading	175	20	First week of April	Last week of September
Tree No.6T	Erect	150	22	First week of April	Last week of September
Tree No.7T	Spreading	250	45	Last week of April	Last week of September

in most selections except erect habit in Tree No. 2B and Tree No. 6T. As regards, season of flowering it varied from as early as first week of April (Tree No.1B, Tree No.2B, Tree No.3B, Tree No. 4T, Tree No.5T, Tree No. 6T) to first week of May (Tree No. 1P, Tree No.2P, Tree No. 3P, Tree No.4P, Tree No. 5P, Tree No. 6P, Tree No. 7P, Tree No. 8P, Tree No.9P, Tree No. 10P, Tree No. 1T, Tree No. 2T, Tree No.3T) with Tree No. 7T recording peak flowering in last week of April. Similarly nut maturation time extended from last week of August (Tree No.1B, Tree No. 2B, Tree No. 3B) to last week of October in Tree No. 2T and Tree No. 3T with two selections namely Tree No. 1T and Tree No. 4T exhibiting nut maturity in first week of October. Data from Table 1 show that out of these 20 seedling trees selected, Tree No.4P, Tree No. 10P and Tree No. 1B gave highest yield (500kg/ tree) whereas lowest nut yield was recorded in Tree No. 1T (25 kg/ tree).

Data from Table 2 reveals that nut weight (g), shell thickness (mm), kernel weight (g), shelling (%), kernel oil (%), and kernel protein (%) vary from 7.1g (Tree No. 1P) to 22.3 g (Tree No. 4P), 0.71mm (Tree No. 2P) to 2.54 mm (Tree No. 6T), 3.91g (Tree No. 7P) to 9.58g (Tree No. 4P), 30.13 % (Tree No. 6P) to 72.95 % (Tree No. 1P), 47% (Tree No. 2T) to 63.2 % (Tree No. 8P) and 15.2 % (Tree No. 2P) to 22.3 (Tree No. 2T), respectively.

The perusal of data presented above revealed a considerable variation in tree nut, kernel and yield characters of seedling trees at the three locations under present study. Variations in nut, kernel and yield characters have also been reported from the various walnut growing areas of Himachal Pradesh by Chauhan and Sharma (1979), Sharma and Sharma (1998, 2001), Sharma and Kumar (2005). It is clear from present and past studies that there are differences between variation among different nut and kernel characters of different locations in seedling trees where these studies were carried out. These differences may be attributed to genetic constitution of the particular seedling and environmental conditions at a particular locality, and thus represent valuable gene sources. In the present study, some of the selections bear heavily up to 500 kg/ tree, some bear exceptionally large nuts (up to 22.30 g), and still some of the selections are extremely thin shelled (0.71 mm) and record up to 72 % of kernel recovery.

All the twenty seedling tree selections initially marked and studied here have extreme variation for individual character and can be utilized in walnut improvement work for incorporating such traits in existing commercial cultivars. But all these marked seedling trees do not fulfill commercial requirement and only six genotypes (Tree No. 4P, Tree No. 1B, Tree No. 2P, Tree No. 1P, Tree No. 8P and Tree No. 2T) produce moderate to high nuts and kernels of

Table 2a. Nut characters of walnut selections

Selection No.	Nut shape longitudinal section to suture	Nut shape through suture	Shell colour	Shell texture	Nut diameter to suture	Nut length (mm)	Shell seal	Nut wt. (g)	Shell thickness (mm)	Shell strength
Tree No.1P	Ovate	Ovate	Light	Medium	25.20	33.26	Strong	7.10	1.63	Intermediate
Tree No.2P	Elliptic	Elliptic	Light	Medium	26.31	41.13	Intermediate	8.50	0.71	Weak
Tree No.3P	Trapezoid	Triangular	Medium	Medium	35.24	36.65	Strong	15.50	2.10	Intermediate
Tree No.4P	Trapezoid	Ovate	Brown	Rough	40.47	48.94	Intermediate	22.30	2.06	Strong
Tree No.5P	Trapezoid	Ovate	Dark brown	Very rough	36.97	36.76	Strong	12.50	1.80	Intermediate
Tree No.6P	Trapezoid	Triangular	Light	Intermediate	36.99	32.88	Strong	14.80	2.39	Strong
Tree No.7P	Circular	Ovate	Intermediate	Intermediate	25.62	29.18	Strong	9.00	2.35	Strong
Tree No.8P	Trapezoid	Triangular	Intermediate	Intermediate	35.32	33.76	Strong	14.10	1.97	Intermediate
Tree No.9P	Trapezoid	Ovate	Dark	Intermediate	31.14	36.76	Strong	11.00	1.52	Intermediate
Tree No.10P	Trapezoid	Ovate	Brown	Rough	34.34	33.69	Strong	14.30	1.54	Weak
Tree No.1B	Circular	Ovate	Light	Smooth	32.48	34.12	Intermediate	12.13	1.44	Intermediate
Tree No.2B	Trapezoid	Ovate	Medium	Rough	38.28	38.24	Strong	14.86	2.47	Strong
Tree No.3B	Elliptic	Elliptic	Medium	Medium	27.85	34.60	Strong	12.95	1.71	Intermediate
Tree No.1T	Trapezoid	Ovate	Dark	Medium	31.46	32.93	Strong	16.50	2.48	Strong
Tree No.2T	Circular	Elliptic	Dark	Medium	27.50	28.84	Strong	11.70	1.58	Intermediate
Tree No.3T	Trapezoid	Ovate	Dark	Rough	36.60	38.24	Strong	12.60	2.23	Intermediate
Tree No.4T	Elliptic	Ovate	Medium	Rough	34.00	38.29	Intermediate	12.10	1.74	Intermediate
Tree No.5T	Elliptic	Elliptic	Medium	Smooth	30.50	37.16	Intermediate	16.90	2.30	Intermediate
Tree No.6T	Trapezoid	Circular	Dark	Medium	33.90	35.21	Strong	18.40	2.54	Strong
Tree No.7T	Ovate	Ovate	Dark	Medium	39.00	41.70	Strong	15.40	2.17	Strong

Table 2b. Kernel characters of walnut selections

Selection No.	Kernel colour	Kernel weight (g)	Shelling (%)	Kernel oil (%)	Kernel protein (%)
Tree No.1P	Light	5.18	72.95	58.20	15.60
Tree No.2P	Very light	4.12	48.47	52.30	15.20
Tree No.3P	Medium	8.54	55.09	61.00	16.40
Tree No.4P	Dark	9.58	42.95	49.50	16.00
Tree No.5P	Medium brown	4.30	34.40	60.00	18.70
Tree No.6P	Light	4.46	30.13	60.10	19.00
Tree No.7P	Medium	3.91	43.44	56.80	18.00
Tree No.8P	Medium	6.80	48.22	63.20	18.65
Tree No.9P	Dark	4.85	40.72	51.50	18.40
Tree No.10P	Brown	8.50	59.44	50.90	19.50
Tree No.1B	Medium	6.10	50.28	50.00	20.70
Tree No.2B	Medium	6.80	45.76	49.70	20.00
Tree No.3B	Dark	7.25	55.98	52.00	19.60
Tree No.1T	Medium	8.10	49.09	54.20	19.80
Tree No.2T	Dark	6.09	52.05	47.00	22.30
Tree No.3T	Dark	5.25	41.66	47.50	21.80
Tree No.4T	Medium	5.10	42.14	57.50	17.50
Tree No.5T	Light	7.80	46.15	53.40	18.00
Tree No.6T	Medium	8.80	47.82	50.30	20.90
Tree No.7T	Light	6.85	44.48	49.55	21.10

desirable quality. They have been selected and recommended for field conservation, mass multiplication and testing under standard field conditions in diverse agro-climatic zones.

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