

Collection and Characterization of Walnut (*Juglans regia* L.) from Himachal Pradesh

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The physico-chemical variation in nut and kernels of walnut germplasm collected from Himachal Pradesh was studied. The promising accessions identified for high kernel/nut ratio, shell softness, high oil and protein content and kernel sweetness were NIC-20110, NIC-20942, NIC- 20109, NIC-20118, NIC-20116 and NIC-20111. These genotypes can serve as useful parents in genetic improvement programme as most of the traits described are highly heritable.

Key words : Characterization, Germplasm, *Juglans regia*, Physico-Chemical, Walnut

The potential of *Juglans regia* (locally known as *akhrot*) as an important nut fruit has been recognized globally. This species is widely distributed through out the dry, cold and alpine regions of Himachal Pradesh, including hills of Uttaranchal and Jammu and Kashmir in India. The major walnut production comes from seedling trees of primitive populations from natural forest and plants raised in farmers backyards without any standard cultural operations and agro-techniques. Walnut cultivation has not changed from the practices used for centuries and seed propagation is still common. Many of these local plantings have evolved through natural and human selection and represent distinct ecotypes or landraces. No efforts, whatsoever, are made to conserve these genetic resources (Srivastava *et al.*, 1977; Joshi and Pandey, 1996). Low productivity due to seedling habit biotic and abiotic stresses (spring frosts, hailstorms, rain) during flowering and sparse fruiting through terminal bearing behaviour are the main causes of low productivity which has led to dis-interest amongst the walnut growers. Thus there is strong need to conserve this important germplasm and to explore the possibilities to select the viable cultivars to promote walnut plantation as a commercial proposition in Himalayan regions of India (Joshi and Pandey, 1966).

Materials and Methods

A survey of Himachal Pradesh (30° 34'N latitude and 74° 79'E longitude) was made to collect indigenous walnut seedling trees for *ex situ* conservation. Sufficient nuts and bud wood of 33 accessions were collected in the month of September-October during the year 1994 from the forest, farmers backyards as well as seedling plantation. The places covered were Sahi, Anni in Kullu; Mooring,

Sangla, Jangi, Pooh, Tangling in Kinnaur; Purthi, Lunj (Pangi valley) in Chamba and Udaipur in Lahaul and Spiti district of Himachal Pradesh. The scion wood collected were budded/grafted on walnut seedlings. Fifteen nuts of each accession were characterized for physico-chemical traits (Table 1). The oil content of kernel at 5 per cent moisture level of each accession was measured by non-destructive method using Newport NMR analyser, model-4000 from Oxford Analytical Instruments Ltd. Nitrogen content of the digested material was determined by conventional Kjeldahl method in Kjeltac Auto 1030 analyser from Tecator, Sweden. The factor 6.25 was used to convert nitrogen into protein.

Results and Discussion

Nut Characters

Significant differences for all the physical characters amongst the germplasm accessions were recorded. The nut length ranged from 2.85 cm (NIC-20068) to 4.20 cm (NIC-20114) whereas fruit diameter varied from 2.71 cm (NIC-20059) to 4.02 cm (NIC 20939). The maximum fruit weight (19.67g) was recorded for the accession NIC-20939 collected from Moorang and minimum (5.70g) for the accession NIC-20073 from Sangla. The minimum and maximum fruit weight were recorded for the collection from Kinnaur. Three different nut shape namely round, oval and oblong with slightly pointed at the distal end were observed in 33 accessions studied. Shell colour intensity varied from light brown, brown, slightly blackish to light golden colour. Similar observations have been recorded in nut and kernel characters of seedling walnut trees grown in Chakrata hills of Uttar Pradesh (Lal and Singh, 1978).

Table 1. Physico-chemical characteristics of walnut germplasm

Accessions	Nut length (cm)	Nut width (cm)	Nut weight (gms)	Kernel (%)	Kernel oil (%)	Kernel protein (%)	Kernel/nut ratio	Taste	Shell Characters
NIC-20105	3.29	3.14	12.38	24.49	43.81	13.19	0.59	Good	Thin shell
NIC-20106	3.38	3.21	11.76	50.16	67.15	22.73	0.87	Good	Thin shell
NIC-20107	3.89	3.51	15.19	27.22	65.76	18.21	0.960	V. Good	Thin shell
NIC-20108	3.72	3.15	13.03	29.76	67.36	16.46	0.59	V. Good	Thin shell
NIC-20109	3.40	3.05	12.12	28.72	72.37	13.75	0.57	Good	Thin shell
NIC-20110	3.43	3.01	11.79	38.19	72.27	16.20	0.68	V. Good	Thin shell
NIC-20111	3.45	3.15	11.31	30.93	66.57	18.77	0.92	V. Good	Thin shell
NIC-20112	3.78	3.30	15.58	29.11	52.36	17.47	0.59	V. Good	Thin shell
NIC-20113	3.61	3.15	10.55	43.70	69.12	18.59	0.62	V. Good	Thin shell
NIC-20114	4.20	2.89	12.40	42.84	69.71	15.69	0.70	V. Good	Semi hard
NIC-20115	3.93	3.45	17.05	32.82	68.97	16.46	0.73	Good	Semi hard
NIC-20116	3.42	3.22	13.17	46.94	72.09	15.67	0.97	Good	Thin shell
NIC-20117	3.63	3.42	12.50	32.26	70.45	15.71	0.68	Good	Thin shell
NIC-20118	3.52	2.80	8.64	46.78	72.82	14.29	0.79	V. Good	Thin shell
NIC-20119	3.64	3.19	12.49	33.92	68.69	19.28	0.75	V. Good	Thin shell
NIC-20057	3.70	2.90	15.52	26.07	68.67	13.81	0.36	Good	Hard shell
NIC-20059	3.63	2.71	6.96	41.72	53.18	23.39	0.72	V. Good	Thin shell
NIC-20065	3.65	3.36	9.50	26.44	52.54	17.52	0.38	V. Good	Semi hard
NIC-20066	3.44	2.88	13.59	12.73	46.30	26.89	0.24	Good	Thin shell
NIC-20068	2.85	2.85	7.96	32.19	65.77	13.68	0.63	V. Good	Thin shell
NIC-20069	3.21	2.92	10.46	6.46	44.75	24.48	0.26	V. Good	Hard shell
NIC-20070	3.11	3.22	12.82	27.45	64.19	18.32	0.30	V. Good	Hard shell
NIC-20071	3.93	3.24	11.59	34.21	62.22	20.28	0.57	Fair	Semi hard
NIC-20073	2.87	2.79	5.70	46.37	63.36	19.22	0.73	V. Good	Thin shell
NIC-22075	3.34	3.24	14.49	20.75	61.08	19.32	0.30	V. Good	Thin shell
NIC-20939	4.17	4.02	19.67	27.44	69.66	17.86	0.48	Good	Thin shell
NIC-20940	3.49	2.78	7.77	45.95	70.68	16.68	0.85	V. Good	Thin shell
NIC-20941	3.62	3.31	13.39	34.23	69.79	15.38	0.48	Good	Semi hard
NIC-20942	3.45	3.29	13.92	19.50	74.92	11.81	0.33	Fair	Semi hard
NIC-20943	4.15	3.82	12.58	37.55	67.84	16.31	0.80	V. Good	Thin shell
NIC-20944	3.82	3.37	14.80	24.71	64.94	17.68	0.28	Good	Hard shell
NIC-20945	3.16	3.18	15.34	13.65	71.24	14.21	0.20	Fair	Hard shell
NIC-20946	3.69	3.48	16.33	17.76	63.32	19.24	0.27	Good	Semi hard
S. Em+ Range	0.05	0.02	0.14	0.40	0.21	0.06	0.01		
Min.	2.85	2.71	5.70	6.46	43.81	11.81	0.20		
Max.	4.20	4.02	19.67	50.16	74.92	26.89	0.98		
C.D. at 5%	0.14	0.07	0.39	0.12	0.59	0.15	0.03		

Kernel Characters

Significant differences were recorded amongst the accessions for kernel percentage and kernel/nut ratio. The maximum kernel percentage (50.16%) along with very good kernel/nut ratio (0.87%) was observed in NIC-20106 and minimum kernel percentage (6.46%) coupled with poor kernel/nut ratio (0.26%) was recorded in NIC-20069. Kernel/nut ratio (as depicted by weight of kernel/weight of shell) was lowest (0.20) in NIC-20045 and highest (0.97) in NIC-20116.

Kernel Oil and Protein Characterization

Significant differences in kernel oil and kernel protein were recorded amongst the 33 accessions studied. Highest kernel oil (74.92%) was recorded in NIC-20942 which

is significantly higher than the NIC-20118 (72.82%), NIC-20109 (72.37%) and NIC-20110 (72.27%). The lowest kernel oil was recorded in NIC-20105 (43.81%). The highest (26.89%) and lowest (11.81%) protein was recorded in the accessions NIC-20066 and NIC-20942 respectively. It is evident from the Table-1 that higher oil content in the accession coupled with lower protein and vice versa. All the 33 germplasm accessions studied could easily be divided into three distinct group of shell softness, namely thin shell, semi hard and hard shell. Organoleptic taste of kernel was fair to very good in different accessions studied and in most of the cases was sweet except for few bitter (NIC-20071) and few mildly bitter (NIC-20945).

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