

Original Research Article

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Nut and Kernel Characteristics of Exotic and Indigenous Almond (*Prunus amygdalus* Batsch.) Genotypes under Temperate Conditions of Kashmir Valley

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ABSTRACT

Investigations were carried out on nine almond varieties/selections (three exotic and six indigenous) to study their nut and kernel quality planted at experiment farm of Dryland Agriculture Research Station (DARS), SKUAST-Kashmir. Maximum nut weight (2.24 and 2.19 g) and nut length (39.88 mm and 40.69 mm) was recorded in Primorskij during 1st and 2nd year of study, respectively, however nut breadth was maximum in Waris (20.42 mm and 20.17). Kernel weight was recorded highest Primorskij (1.29 g and 1.26 g) along with kernel length (28.62 mm and 29.04 mm) during both the years whereas minimum kernel breadth was registered in Waris (12.68 mm and 12.44 mm), respectively. Minimum values for nut weight (1.11 g and 1.19 g) and nut length (26.37 mm and 25.27 mm) was recorded in KD-05 and KD-06, respectively. Nut breadth (17.00 mm and 16.86 mm), kernel weight (0.73 g and 0.80 g), kernel length (18.53 mm and 18.04 mm) was recorded minimum in KD-03 whereas minimum kernel breadth was minimum in Waris (10.85 mm and 10.53 mm). Maximum shelling percentage (57.58 % and 52.05 %) was recorded in Primorskij during both the year of study. Primorskij had papery shell with intermediate kernel and shell colour. From the present investigation it is concluded that Primorskij performed best under temperate conditions of Kashmir.

Keywords

Almond, Nut, Kernel, Exotic, Indigenous, Genotypes

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Introduction

Almond (*Prunus amygdalus* Batsch) is an important nut crop of the world that is

cultivated from the desert areas of Western China to the Mediterranean basin (Ladizinsky, 1999). It is one of the major and oldest tree-nut crops known to the mankind

with wide-spread popularity throughout the world and is mainly grown under rainfed conditions in India with very low productivity (Sharma and Joolka, 2000). Almond kernels are concentrated sources of energy with a significant share of fat, protein and fibre. Fats are primarily non saturated, mostly oleic and linoleic fatty acids. Non saturated fatty acid is an important in maintaining low cholesterol levels in the blood and significant amount of micro-nutrients (Aslanta *et al.*, 2001). The kernel contains water (5.93-7.27 %), ash (8.03-8.13 %), oil (53.67-54.26 %), protein (23.03-23.98 %), total sugars (4.15-5.29%), potassium (1546-1685 mg/100 g), phosphorous (253-259 mg/100 g), calcium (640-678 mg/100 g), magnesium (447-494 mg/100 g), copper (24.30-25.80 ppm), zinc (76.33-80.50 ppm), iron (54.83-65.33 ppm) and manganese (37.67-37.83 ppm) (Aslanta *et al.*, 2001, Adyin, 2003). In India, Jammu and Kashmir state ranks first with production of 10326 MT from an area of 5588 hectare in which Pulwama and Budgam districts are the leading producers (Anonymous, 2019). The commercial cultivation of almond on marginal lands under non-irrigated conditions could not spread much on account of intrinsic problems like spring frosts and hail storms during the blossoming time. However, still majority of the almond production comes from seedling trees of primitive population grown under rainfed conditions of Kashmir valley with different morphological and biological characteristics. In order to select varieties among these diverse types, characterization and evaluation of these genotypes is indispensable. Most of the commercial almonds cultivars grown throughout the world have been selected by chance from the diverse gene pool of almond seedlings (Kester *et al.*, 1990). In varietal selection of almond the main objective is the introduction of superior seedlings with desirable traits like good growth habit, late bloom, frost and disease resistance, self-

fertility and high yield. Introduction of few cultivars from abroad and selection released from SKUAST, attempts have been made to evaluate germplasm comprising various almond selections and cultivars so as to assess proper choice of varieties for almond growing belts of Kashmir.

Materials and Methods

Experimental material and location

The present investigations were carried out on nut and kernel quality characters of almond varieties planted in 1988 at Dryland Agriculture Research Station, (DARS),SKUAST-Kashmir, Jammu and Kashmir. The experimental farm is situated at a latitude of 34°05'N and longitude of 74°50' E and at an altitude of 1640 m amsl with temperate region having cold conditions from November to February. The experimental was comprised of nine almond varieties viz. three exotic (Pranyaj, Merced, Primorskij) and six indigenous (Mukhdoom, Waris, Shalimar, KD-3, KD-5 and KD-6). Plants of uniform size and vigour were selected randomly and all the trees were kept under similar cultural practices to ensure uniform growth. The experiment was laid out in the randomized block design with four replications for each treatment.

Observation recorded and data analysis

Observations were recorded on nut and kernel characters. Nut weight and kernel weight of fifteen nuts was taken with the help of top pan balance, averaged value was worked out and expressed in grams. Nut (length and breadth) and kernel (length and breadth) was measured of fifteen nuts and kernels, averaged was worked out and expressed in mm. Kernel colour was visually observed and divided into classes (extremely light, light, intermediate, dark and extremely dark) whereas shell colour

was visually observed and divided into (extremely light, light, intermediate, dark) as per descriptor (UPOV, 1985). Shell hardness was examined by force required to break the shell and grouped as (extremely hard, hard, intermediate, soft and papery). Shelling percentage was calculated by the formula.

$$\text{Shelling percentage} = \frac{\text{Kernel weight}}{\text{Nut weight}} \times 100$$

Organoleptic evaluation was done through sensory analysis with the panel of judges on the basis hedonic scale (Piggott, 1998). Data collected on various parameters for two consecutive years were computed and statistically analyzed as per the procedure given by Snedecor and Cochran (1994).

Results and Discussion

All the almond varieties and selections showed significant differences with respect to all the nut and kernel characters (Table 1 and Fig 1). Maximum nut weight in both the years was recorded in Primorskij (2.24 g and 2.19 g) which was statistically at par with Waris (2.12 g), Pranyaj (2.04 g) and Mukhdoom (1.97 g) in the first year whereas in the second year Primorskij was statistically at par with Mukhdoom (2.11 g), Pranyaj (2.10 g), Waris (2.07 g) and Merced (1.95 g) (Fig 1). Minimum nut weight in both the years was recorded in KD-5 (1.11 g and 1.19 g, respectively). Primorskij (39.88 mm and 40.69 mm) measured maximum nut length in both the years which was significantly higher among all the varieties however maximum breadth of nut was registered in Waris (20.42 mm and 20.17 mm) which was significantly higher among all the varieties. Minimum nut

length and nut breadth in both the year of study was measured in KD-6 (26.37 mm and 25.27 mm) and KD-3 (17.00 mm and 16.86 mm). The maximum nut weight and nut size in Primorskij variety might be due to inherent characters of cultivars. Aydin (2003), Strikic *et al.*, (2010) and Colic *et al.*, (2012) also reported similar results for nut weight and nut size.

During both the year of study, highest kernel weight was observed in Primorskij (1.29 g and 1.26 g) which was statistically at par with Pranyaj (1.15 g and 1.20 g) whereas minimum kernel weight was recorded in KD-3 (0.73 g and 0.80 g) (Fig 1). Significantly higher values were recorded by Primorskij (28.62 mm and 29.04 mm) for kernel length and by Waris (12.68 mm and 12.44 mm) for kernel breadth as compared to all the varieties in both the years of study. Minimum kernel length and kernel breadth during both the years was recorded in KD-3 (18.53 mm and 18.04 mm) and Shalimar (10.85 mm and 10.53 mm), respectively. Waris almond registered dark colour of kernel whereas Merced and KD-5 had light kernel colour. Rest all the varieties had intermediate in kernel colour. Earlier Karadeniz *et al.*, (2003), Wang *et al.*, (2004) and Kumar and Ahmed (2015) also reported similar results for kernel characters however variation for different nut and kernel characters might be due to the genetic makeup of the varieties and prevailing environmental conditions of area.

Shelling percentage and organoleptic evaluation depicts significant results among all the varieties (Table 2). Highest shelling percentage was recorded in Primorskij (57.58 %) which was statistically at par with Pranyaj (57.52 %) in the first year however in the second year Merced (54.05 %) was significantly higher in shelling percentage among all the varieties. In both the years, lowest shelling percentage was recorded in

KD-3 (28.74 % and 33.61 %). In the earlier studies, Kumar and Sharma (2005) also reported 53.79 per cent of kernel recovery in Telangi Selection from Kinnaur district of Himachal Pradesh. Present results are in accordance with the earlier results reported by Kaska *et al.*, (1994), Ak *et al.*, 2005 with respect to shelling percentage. Among different almond varieties/selections studied Merced, Primorskij and Shalimar had papery shell whereas Pranyaj and Waris had soft

shell. Mukhdoom and KD-5 had semi-soft shell however KD-3 and KD-6 were hard in shelling. Soft, moderate and hard type of shell was also reported by earlier workers (Nieddu *et al.*, 1994, Talhouk *et al.*, 2000, Sepahvand *et al.*, 2015). Light (Mukhdoom, Waris and Shalimar), intermediate (Merced and Primorskij, KD-3, KD-5 and KD-6) and dark (Pranyaj) shell colour was obtained in different almond varieties/selections.

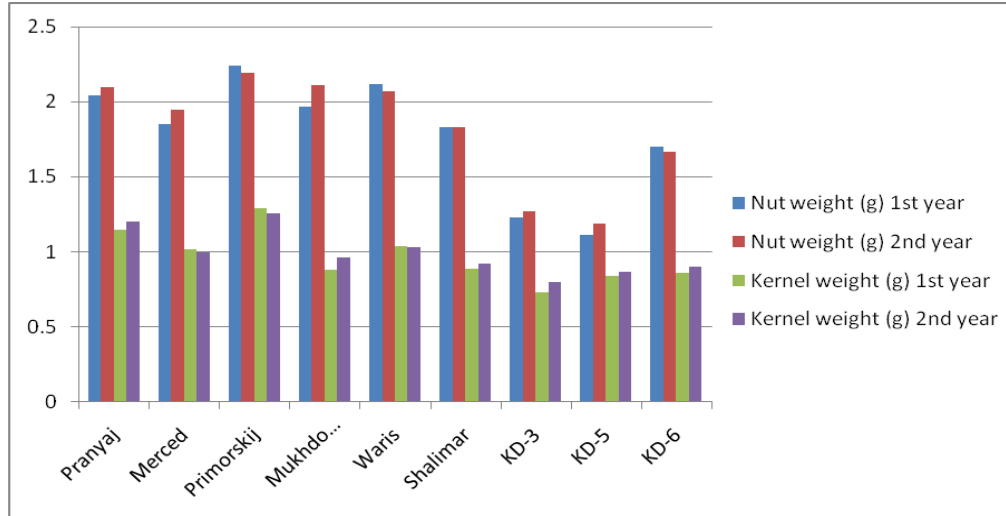
Table.1 Nut and kernel characters of exotic and indigenous almond genotypes

Genotypes	Nut size (mm)				Kernel size (mm)				Kernel colour
	Length		Breadth		Length		Breadth		
	1 st year	2 nd year	1 st year	2 nd year	1 st year	2 nd year	1 st year	2 nd year	
Pranyaj	36.88	37.66	19.50	19.26	26.86	27.00	12.11	11.97	Intermediate
Merced	35.97	35.00	18.00	18.24	26.65	26.26	11.60	11.34	Light
Primorskij	39.88	40.69	18.79	18.97	28.62	29.04	11.80	11.63	Intermediate
Mukhdoom	30.32	31.24	19.44	19.58	22.15	23.00	10.94	11.18	Intermediate
Waris	32.40	33.00	20.42	20.17	22.77	23.01	12.68	12.44	Dark
Shalimar	34.59	35.72	17.14	17.50	25.77	26.30	10.85	10.53	Intermediate
KD-3	26.44	26.11	17.00	16.86	18.53	18.04	11.41	11.12	Intermediate
KD-5	26.80	27.00	17.82	17.90	19.12	18.12	10.98	11.02	Light
KD-6	26.37	25.27	19.11	19.00	19.53	20.07	11.24	11.39	Intermediate
CD_{0.05}	0.54	1.87	0.47	0.56	0.18	0.24	0.28	0.18	

Table.2 Shell characters and organoleptic evaluation of exotic and indigenous almond genotypes

Genotypes	Shelling percentage		Shell hardness	Shell colour	Organoleptic evaluation	
	1 st year	2 nd year			1 st year	2 nd year
Pranyaj	57.52	51.06	Soft	Dark	7.0	8.0
Merced	49.27	54.05	Papery	Intermediate	8.0	8.0
Primorskij	57.58	52.05	Papery	Intermediate	7.0	7.0
Mukhdoom	39.59	45.07	Semi-soft	Light	9.0	9.0
Waris	49.05	47.50	Soft	Light	8.0	7.0
Shalimar	48.60	50.27	Papery	Light	9.5	9.5
KD-3	28.74	33.61	Hard	Intermediate	5.0	4.0
KD-5	36.36	39.54	Semi-soft	Intermediate	3.0	4.0
KD-6	38.05	48.12	Hard	Intermediate	5.0	6.0
CD_{0.05}	0.64	0.32			0.39	0.05

Fig.1 Nut weight and kernel weight of exotic and indigenous almond genotypes



Based upon organoleptic evaluation, Shalimar (9.5 and 9.5) got significantly higher number in both the year followed by Mukhdoom (9.0 and 9.0) and Merced (8.0 and 8.0), however minimum number for organoleptic evaluation was scored by KD-5 (3.0 and 4.0) during both the years, respectively.

From the above discussion, it is concluded that Primorskij performed best under temperate conditions of Kashmir for nut weight, nut length, kernel weight, kernel length, shelling percentage and shell hardness followed by Pranyaj.

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