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Effect of locations on the yield and quality of oil from promising cultivars of olive (*Olea europaea* L.) in Himachal Pradesh

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Abstract

Performance of four cultivars of olive (*Olea europaea* Cv. Pendulino, Ascolano,Coratino and Frantoio), growing in Mandi and Chamba regions of Himachal Pradesh was studied in respect of their oil yield potentiality. Maximum pulp recovery was observed in *Coratino* (75.20 and 74.35 %) cultivar of Chamba and Mandi regions, respectively. The highest oil yield (43.08%) on moisture free basis was recorded in *Frantoio* cultivar of Mandi followed by *Coratino* cultivar of Chamba (42.70%) and Mandi (41.68%). Iodine value, which is a measure of degree of unsaturation of oil or fat, varied from 78.87 to 82.30 in oils of various cultivars grown under different regions. The cultivar *Pendulino* grown in either of the location showed higher degree of unsaturation (Iodine Value) as compared to other cultivars. Saponification value among different cultivars ranged between 189.20 and 192.60. Oil of various cultivars contained 0.69 to 0.72 percent free fatty acids. The quality characteristics of oil of different cultivars under present study were well within the prescribed limits specified for olive oil under the Prevention of Food Adulteration Act. The effect of location on quality characteristics of olive oil of various cultivars showed non- significant variations.

Key Words: Olive, Olive oil, Vegetable oil.

Introduction

Olive, a member of family Oleaceae, is relatively a small evergreen tree with silvery leaves, known for its longevity and liquid gold-*oil*. The Mediterranean and its surroundings are considered as the home of olive, from where it spread to other parts of the world. Olive oil is one of the vegetable oils, which can be used in crude form without refining, thus conserving the essential vitamins, fatty acids and other natural elements of dietetic importance. Besides its rapid digestibility, olive oil is also known for its anti-ulcer and plasma cholesterol lowering properties. In addition, it is also used for manufacturing various industrial products such as soaps, textiles, lubricants, cosmetics and skin applications (Christakis *et al.* 1980, Katiyar *et al.* 1989).

The annual world production of olive fruits is approximately 14.05 million tonnes from an area of 9.15 million ha, with total annual olive oil production of about 2.45 million tonnes (FAO 2003). In India, olive is marginally grown in the temperate regions comprising of Himachal Pradesh, Uttaranchal and Jammu & Kashmir. However, our demand for olive oil is met entirely through imports. In order to fulfill the country's demand for olive oil, some exotic Italian and Spanish cultivars of olive have been introduced in Himachal Pradesh, Uttaranchal and Jammu & Kashmir. Some of the olive cultivars introduced in Himachal Pradesh under the Indo-Italian Olive Development Project during late eighties, have now come into bearing and hence need to be evaluated and recommended for oil production. Therefore, this study was undertaken to evaluate some cultivars grown under different agro-climatic regions/locations of Himachal Pradesh for oil extraction purposes.

Material and Methods

Olive fruits: Four cultivars of olive (*Olea europaea* L. cv. Ascolano, Frantoio, Pendulino and Coratino) were collected from two different locations of Himachal Pradesh i.e. Olive Development Station, Kigus, Panarsa, Distt. Mandi (1300 m amsl) and Progeny cum Demonstration Orchard, Department of Horticulture, Lanji, Sarol, Distt. Chamba (1045 m amsl).

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Oil Extraction: The oil was extracted by using solvent extraction method (Ranganna 1997). A 100 g fruit (mesocarp) sample of each variety at one time was dried in a hot air oven (70°C ± 2°C) to a constant weight. The oil was extracted from the moisture free mesocarp in soxhlet apparatus using petroleum ether (40-60°C) as solvent. Excess of solvent was removed from the oil by placing it in an oven at 50°C till it was free from solvent. Sufficient oil extracted by repeating the process was used for further analysis.

Physico-chemical characteristics of fruit: The physical characteristics studied were average fruit weight, fruit volume and pulp recovery. Moisture and ash contents were determined according to AOAC (1984) methods.

Quality parameters of oil: Butyrorefractometer reading, free fatty acids, peroxide value, iodine value and saponification value were determined following the methods of AOAC (1995). The quality of oil of various cultivars was compared with PFA standards and the standards of Codex Alimentarius commission (CAC 1993).

Statistical analysis: Data pertaining to physico-chemical characteristics of fruit and quality parameters of oil were analyzed by Completely Randomized Block Design (CRD) as described by Cochran and Cox (1967).

Results and Discussion

Physico-chemical characteristics of fruit: Data presented in Table 1 indicate that the mean fruit weight of different olive cultivars irrespective of locations ranged between 2.28 (*Pendulino*) and 2.64 g (*Ascolano*) and that of the fruits collected from Mandi (1300 m amsl) and Chamba regions (1045 m amsl) were 2.60 and 2.45 g, respectively. Similarly, the fruit volume of these cultivars varied from 2.18 to 2.39 cc and that of fruits collected from Mandi and Chamba regions were 2.40 and 2.27 cc, respectively. The mean values for pulp recovery (Table 1) and oil yields (Table 2) of different cultivars varied from 70.68 to 74.78 and 33.22 to 42.19 per cent, respectively and that of the fruits collected from Mandi and Chamba regions were 73.34 and 73.38 per cent (pulp recovery) and 38.64 and 38.65 per cent (oil yield), respectively. The effect of location on pulp and oil yields was found to be non-significant. While among various cultivars, *Coratino* and *Frantoio* had significantly higher pulp and oil contents than the other cultivars under study. The variations in pulp and oil yields of various olive cultivars growing under different regions may be due to varietal characteristics and agro-climatic differences. Further, the mean moisture content of different olive cultivars irrespective of region varied from 66.73 (*Frantoio*) to 69.78 (*Pendulino*) per cent and that of fruits grown in Mandi and Chamba regions

Table 1. Effect of different locations and cultivars on the physical characteristics of olive fruits

Cultivars	Fruit Weight (g)			Fruit Volume (cc)			Pulp Recovery (%)		
	Mandi	Chamba	Mean	Mandi	Chamba	Mean	Mandi	Chamba	Mean
Pendulino	2.35	2.20	2.28	2.28	2.08	2.18	70.50	70.85	70.68
Ascolano	2.65	2.62	2.64	2.40	2.38	2.39	74.20	72.86	73.53
Coratino	2.58	2.52	2.55	2.42	2.35	2.39	74.35	75.20	74.78
Frantoio	2.80	2.46	2.63	2.48	2.26	2.37	74.30	74.60	74.45
Mean	2.60	2.45		2.40	2.27		73.34	73.38	
		$CD_{0.05}$			$CD_{0.05}$			$CD_{0.05}$	
Variety (V)		0.23			0.109			0.921	
Location (L)		0.14			0.068			NS	
V x L		NS			NS			NS	

Table 2.Effect of different locations and cultivars on the physico-chemical characteristics of olive fruits

Cultivars	Oil yield (%)*			Ash (%)			Moisture (%)		
	Mandi	Chamba	Mean	Mandi	Chamba	Mean	Mandi	Chamba	Mean
Pendulino	31.75	34.69	33.22	2.46	2.56	2.51	70.09	69.47	69.78
Ascolano	38.05	37.10	37.58	2.66	2.68	2.67	69.00	68.75	68.88
Coratino	41.68	42.70	42.19	2.65	2.60	2.63	69.07	66.10	67.59
Frantoio	43.08	40.10	41.59	2.50	2.58	2.54	66.20	67.25	66.73
Mean	38.64	38.65		2.57	2.61		68.59	67.89	

	$CD_{0.05}$	$CD_{0.05}$	$CD_{0.05}$
Variety (V)	2.03	NS	0.521
Location (L)	NS	NS	0.368
V x L	2.87	NS	0.737

*Oil yield calculated on moisture free basis.

was 68.59 and 67.89 per cent, respectively which might also be attributed to the variation in varietal and agro-climatic conditions of the region. Similarly, the mean value of total ash content of different olive cultivars irrespective of region ranged from 2.51 to 2.67 and that of the fruits collected from Mandi and Chamba regions were 2.57 and 2.61 per cent, respectively. However, the differences for varieties as well as locations were found to be non-significant (Table 2). Our results for various physico- chemical characteristics of different olive cultivars are conformity with those reported by Singh *et al.* (1986) and Katiyar *et al.* (1989).

Quality parameters of oil: Perusal of data presented in Table 3 indicate that although the mean butyrorefractometer reading of different olive oils ranged from 54.00 to 55.10, the effect of region/ location on butyrorefractometer reading was found to be non-significant. Irrespective of region, the mean free fatty acid content of oils of various olive cultivars varied from 0.55 to 0.64 per cent with mean values for Mandi and Chamba regions as 0.63 and 0.53 per cent, respectively, which were well below the maximum limit specified by the Prevention of Food Adulteration Act (Anon. 1996). Further, the peroxide, iodine and saponification values of oil of different olive cultivars under study were also well within the limits specified by PFA and Codex Alimentarius Commission (CAC 1993). Overall, the effects of region/ location on quality characteristics viz. peroxide value (PV), iodine value (IV) and saponification value (SV) were observed to be non-significant. However, the slight differences in various quality characteristics of olive oils of different cultivars collected from Mandi and Chamba regions of Himachal Pradesh might be attributed to varietal and agro- climatic causes.

Conclusion

Conclusively, it emerges that the cultivars *Coratino* and *Frantoio* procured from both Mandi and Chamba regions of Himachal Pradesh had significantly higher percentage of oil yields than rest of the cultivars under study and thus these cultivars may be recommended for commercial cultivation in Himachal Pradesh. The effect of growing region/ location on pulp and oil yields was found to be non-significant. Further, the effect of location on quality characteristics of olive oil i.e. peroxide value, iodine value and saponification value was also found to be non-significant. However, all the cultivars under study had their oil quality fit for human consumption according to Prevention of Food Adulteration Act and Codex Alimentarius Commission.

Table 3. Effect of different locations and cultivars on the quality characteristics of olive oil

Cultivars	Butyrorefractometer reading (40°C)			Free fatty acids (%)			Peroxide value (meq/kg)			Iodine value			Saponification value		
	Mandi	Chamba	Mean	Mandi	Chamba	Mean	Mandi	Chamba	Mean	Mandi	Chamba	Mean	Mandi	Chamba	Mean
Pendulino	55.20	55.00	55.10	0.57	0.52	0.55	5.08	5.78	5.43	82.30	81.50	81.90	189.20	190.80	190.00
Ascolano	54.00	54.00	54.00	0.69	0.58	0.64	5.58	6.05	5.82	78.87	79.78	79.33	192.90	191.80	192.40
Coratino	54.80	54.50	54.65	0.60	0.49	0.55	5.10	5.86	5.48	79.63	80.50	80.07	190.20	190.00	190.10
Frantoio	54.50	54.00	54.25	0.66	0.51	0.59	5.20	5.90	5.55	79.51	80.00	79.76	192.60	191.80	192.20
Mean	54.63	54.38		0.63	0.53		5.24	5.90		80.08	80.45		191.22	191.10	

	$CD_{0.05}$	$CD_{0.05}$	$CD_{0.05}$	$CD_{0.05}$	$CD_{0.05}$
Variety (V)	0.728	0.04	0.170	0.744	0.835
Location (L)	NS	0.07	NS	NS	NS
V x L	NS	NS	NS	NS	1.180

Parameters	**PFA Standards**	**Codex Alimentarius Commission (1993)**
Butyrorefractometer reading	53-56	-
Saponification value	185-196	184-196
Iodine value	79-90	75-94
Free fatty acids	Not more than 3.3 %	-
Peroxide value	-	Not more than 20 meq O_2 per kg

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