Indian J. Plant Genet. Resour. 33(3): 367–371 (2020)
DOI 10.5958/0976-1926.2020.00051.0

SHORT COMMUNICATION

Growth Habit, Foliage and Fruiting Characteristics of Different Olive Cultivars Grown in Mid Hills of Jammu and Kashmir

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(Received: 11 November, 2019; Revised: 22 July, 2020; Accepted: 24 September, 2020)

Present investigation reports the vegetative, foliage and fruiting behavior of sixteen olive cultivars. Observations were recorded on different growth habits, foliage and fruiting characters recorded at Advanced Centre of Horticulture Development, Department of Horticulture, Govindpura, Ramban during two consecutive years i.e. 2014 and 2015 on twenty year old trees. Cultivar Itrana recorded maximum plant height (5.73 m), plant spread (4.44 m) and plant volume (59.19 m^3). Erect and spreading growth habit along with medium and sparse plant canopy was observed among the cultivars. Cultivar Cipressino registered maximum number of fruiting shoots, whereas cultivar Nocellara Messinese recorded maximum yield (38.90 and 39.60 kg $plant^{-1}$, respectively) in both the year of study.

Key Words: Cultivars, Foliage, Fruiting, Growth, Kashmir, Mid-hills

Introduction

Olive (*Olea europaea* L.) represents a group of evergreen trees and shrubs distributed in the warm temperate and tropical regions of the world. Olive is a unique subtropical fruit crop, which requires chilling for fruiting (Bandelj *et al.*, 2004, Singh *et al.*, 2006; Caballero and Rio 2008). It can withstand high summer temperatures and drought, and is adapted to a wide range of edaphic situations from heavy and clayey soils to light and sandy soils (Rugini *et al.*, 2000; Caballero and Rio 2008). Olives are grown for their fruits, which are extensively used for extracting olive oil for cooking cosmetics and pharmaceuticals. The olive oil has a high content of monounsaturated fat (mainly oleic acid) and polyphenols which are beneficial for health. It is a rich source of polyunsaturated fatty acid (PUFA) and is absolutely free from cholesterol. The major olive producing countries of the world are Spain, Italy, Greece, France, Austria and Argentina. The olive cultivation in India is still in its infancy stage and restricted to a few pockets in the Union Territory of Jammu and Kashmir (parts of Baramulla, Kupwara, Udhampur and Ramban districts) with an annual production of 67 MT from an area of 17 ha. (Anonymous, 2019). Olive cultivation has tremendous scope in the entire Himalayan mountainous regions. Under an Indo-Italian Fruit Development Programme some promising cultivars were introduced in Jammu and Kashmir during the years 1984-1987 but till date these varieties were not evaluated and without any information regarding various aspects *viz.* vegetative and fruiting behavior, these varieties cannot be used in breeding programme and even distributed among farmers for increasing the olive production in the Union Territory. Keeping in view of these facts, the present study was carried out on sixteen different olive cultivars to study their vegetative and fruiting behavior.

Materials and Methods

Experimental Area and Material

The present investigation was carried out at the Advance Centre for Horticulture Development, Department of Horticulture, Govindpura, Distt. Ramban (Jammu and Kashmir) during two consecutive years i.e. 2014 and 2015. The experimental farm is situated at a latitude of 33°14'N and longitude of 75°17'E and at an altitude of 1156 m above mean sea level. The average maximum (40-42°C) and minimum (15-16°C) temperature with a rainfall of 268-290 mm was recorded during the study. Vegetative and fruiting behavior of sixteen different olive cultivars introduced from abroad (Table 1) was studied.

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Observations Recorded

Plant height and plant spread were measured with the help of measuring pole whereas plant spread was measured in two different directions (North-South and East-West) and mean was worked out and expressed in meters. Plant volume was calculated from the height and spread measurement according to the formula (Westwood 1993). Growth habit of the plant was categorized on the basis of geometrical pattern of the tree crown and identified as erect (60^o), spreading (90^o) and drooping (120^o) (UPOV, 2011). Plant canopy was recorded by counting the number of leaves per 20 cm length of the shoot from the plant periphery and categorized as dense (above 30 leaves), medium (between 20-30 leaves) and sparse (below 20 leaves) (UPOV, 2011). Leaf length and breadth of ten randomly taken leaves were measured with the help of Vernier caliper, averaged and expressed in cm. Leaf area of same ten leaves was measured by using Systronics leaf area meter and averaged was worked out and expressed in cm^2. Leaf blade twisting was observed visually on fully developed leaves from the central part of one year old shoot in full growth. Number of fruiting shoots was recorded on five fruiting branches on each plant and average value was worked out. Yield of individual plant was calculated at the time of harvest by weighing total fruits of the plant and expressed in kg $plant^{-1}$.

Statistical Analysis

Observations were recorded from individual plants in each cultivar having three replications. The data generated from these investigations were computed, tabulated and pooled data of two years were analyzed by applying Randomized Block Design Factorial. The level of significance was tested for different variable at 5 per cent (Panse and Sukhatme, 1989). Data were analysed using analysis of variance OPSTAT, HAU, Hissar, Haryana (India).

Results and Discussion

Significant results were obtained with respect to all studied vegetative characters among different olive cultivars and are presented in Table 1. Pooled data of two years depict that maximum plant height was recorded in cultivar Itrana (5.73 m) which was statistically at par with cultivars Tonda Iblea (5.62 m), Nocellara Messinese (5.50 m) and Nocellara del Belice (5.43 m) whereas cultivar Coratina registered minimum plant height (4.28 m). Cultivar Itrana (4.44 m) registered maximum plant spread which was statistically at par with cultivar Nocellara Messinese (4.11 m) and minimum plant spread was measured in cultivar Ottobratica (2.37 m). Maximum and minimum values for plant volume was scored in cultivar Itrana (59.19 m^3) and cultivar Leccino (13.59 m^3), respectively in former case being statistically higher among all other studied cultivars. Earlier studies conducted by Tous *et al*. (2002) showed that the plant canopy volume ranged from 42.9 m^3 to 70.8 m^3 in different olive cultivars whereas Moutier *et al*. (2008) reported the mean plant height ranged from 3.1 m to 4.9 m, plant spread from 3.0 m to 5.2 m while plant volume varied from 33.0 to 134.4 m^3. Since the tree size and vigour are influenced by genetic makeup of the plant and different environmental factors, the difference in tree height in these cultivars may be attributed to these factors. Differences in results of the present study are also due to the adaptation of cultivars to the climatic zone and other cultural operations as also suggested by Hermoso *et al.* (2014).

Among all other studied cultivars only cultivars Brancolilla, Moraiolo and Ottobratica have spreading type of growth habit, while all the other cultivars have erect growth habit (Table 2). Arquero *et al*. (2014) also

Table 1. Origin of olive cultivars under study

S.No.	Name of cultivar	Origin	S.No.	Name of cultivar	Origin
1	Azapa	Northern Chile	9	Itrana	Latina
2	Brancolilla	Italy	10	Leccino	Italy
3	Carolea	Italy	11	Moraiolo	Tuscany
4	Cerignola	Italy	12	Nocellara del Belice	Italy
5	Cipressino	Italy	13	Nocellara Etnea	Central & Eastern part of Sicily
6	Coratina	Italy, Croatia	14	Nocellara Messinese	Italy
7	Cornicobra Attica	Spain	15	Ottobratica	Italy
8	Frantoio	Italy	16	Tonda Iblea	Italy

reported erect growth habit for Frantoio, Cornicobra Attica and Leccino. With respect to plant canopy character cultivars Azapa, Carolea, Cerignola, Moraiolo and Nocellara Messinese have sparse plant canopy whereas other cultivar have medium plant canopy. Arquero *et al*. (2014) also observed medium canopy for Frantoio and Cornicobra Attica.

All the foliage characters presented in Table 3 show significant results among different olive cultivars. Maximum leaf length was measured in cultivar Nocellara

Table 2. Vegetative growth characters of different olive cultivars

Cultivars	Plant height (m)	Plant spread (m)	Plant volume (m^3)	Plant growth habit	Plant canopy
Azapa	4.31	2.50	14.16	Erect	Sparse
Brancolilla	4.57	2.53	15.41	Spreading	Medium
Carolea	4.86	2.62	17.55	Erect	Sparse
Cerignola	5.41	2.90	23.76	Erect	Sparse
Cipressino	4.43	2.56	15.30	Erect	Medium
Coratina	4.28	3.05	20.86	Erect	Medium
Cornicobra Attica	5.08	4.13	45.57	Erect	Medium
Frantoio	4.74	2.51	15.64	Erect	Medium
Itrana	5.73	4.44	59.19	Erect	Medium
Leccino	4.39	2.43	13.59	Erect	Medium
Moraiolo	4.38	2.52	14.73	Spreading	Sparse
Nocellara del Belice	5.43	3.71	38.16	Erect	Medium
Nocellara Etnea	5.34	3.68	38.00	Erect	Medium
Nocellara Messinese	5.50	4.11	48.80	Erect	Sparse
Ottobratica	4.67	2.37	13.75	Spreading	Medium
Tonda Iblea	5.62	3.83	43.08	Erect	Medium
$CD_{0.05}$	0.52	0.36	4.41		

Table 3. Foliage characters of different olive cultivars

Cultivars	Leaf length (cm)	Leaf breadth (cm)	Leaf area (cm^2)	Leaf blade twisting
Azapa	5.76	1.24	5.26	Weak
Brancolilla	5.31	1.15	4.55	Moderate
Carolea	7.06	1.34	7.93	Moderate
Cerignola	5.41	1.09	4.93	Weak
Cipressino	5.23	1.07	4.37	Weak
Coratina	6.64	1.24	6.67	Moderate
Cornicobra Attica	5.74	1.45	5.70	Moderate
Frantoio	5.11	1.05	4.26	Moderate
Itrana	6.76	1.16	6.49	Moderate
Leccino	5.71	1.24	6.38	Moderate
Moraiolo	4.33	1.12	4.48	Weak
Nocellara del Belice	7.08	1.56	8.81	Moderate
Nocellara Etnea	6.88	1.00	6.41	Moderate
Nocellara Messinese	7.43	1.18	7.54	Weak
Ottobratica	3.75	1.09	3.20	Weak
Tonda Iblea	6.12	1.21	6.46	Weak
$CD_{0.05}$	0.12	0.08	0.51	

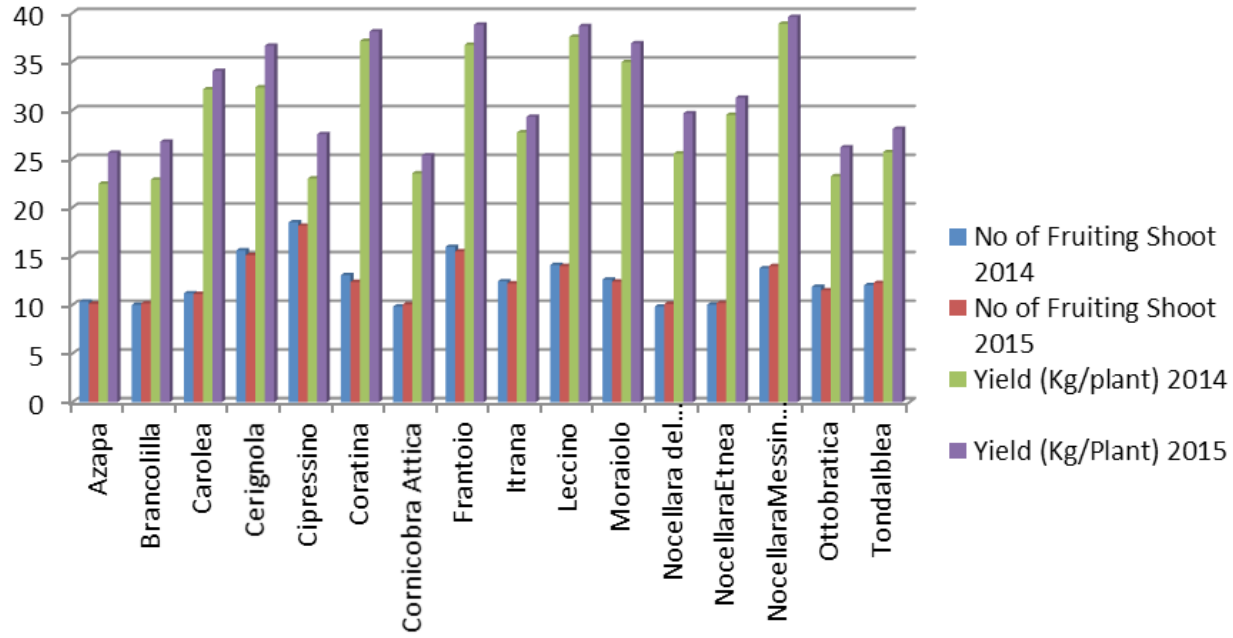

Fig. 1. Number of fruiting shoots and fruit yield of different olive cultivars

Messinese (7.43 cm) which was statistically higher than all other cultivars whereas minimum leaf length was measured in cultivar Ottobratica (3.75 cm). Maximum leaf breadth was recorded in cultivar Nocellara del Belice (1.56 cm) which was statistically at par with all other cultivars. Leaf area was also higher in cultivar Nocellara del Belice (8.81 cm^2) which was also statistically higher than other cultivars under study. Minimum leaf breadth and leaf area were recorded in cultivar Nocellara Etnea (1.00 cm) and cultivar Ottobratica (3.20 cm^2), respectively. These differences in foliage characters may be due to the genotype of the varieties, cultural practices and site of cultivation, moderate or under hot dry conditions (Padula *et al.*, 2008). Leaf blade twisting of cultivars Azapa, Cerignola, Cipressino, Moraiolo and Tonda Iblea was found weak while the other cultivars had moderate leaf blade twisting (Table 3). Ulas and Gezerel (2008) reported a range of 5.33 cm^2-9.05 cm^2 leaf area however, Hegazi (2012) reported 2.85 cm^2-5.68 cm^2 leaf area in different cultivars of olive.

The maximum number of fruiting shoots in both the year of study were recorded in cultivar Cipressino (18.49 and 18.14, respectively) closely followed by cultivar Frantoio (15.96 and 15.50, respectively) and cultivar Cerignola (15.62 and 15.12, respectively). Minimum number of fruiting shoots were recorded in cultivar Nocellara del Belice (9.84) in the first year of study and in cultivar Cornicobra Attica (10.05) in the second year of study (Fig. 1). Cultivar Nocellara Messinese registered maximum yield in both the year of study i.e. 38.90 and 39.60 kg $plant^{-1}$, respectively which was closely followed by cultivar Leccino (37.56 and 38.66 kg $plant^{-1}$, respectively) and cultivar Coratina (37.13 and 38.10 kg $plant^{-1}$, respectively). Minimum yield during both the years was recorded in cultivar Azapa (22.46 and 25.64 kg $plant^{-1}$, respectively). Present results are in conformity with the findings of Hermoso *et al.* (2014) who also reported 33.8-37.4 kg fruits per tree. The difference in yield among and within the cultivars may be mainly due to prevailing environmental conditions of the study area during the periods of flowering, fruit set, fruit development and maturity, coupled with the tendency of olive cultivars to alteration in bearing.

Conclusion

Thus it is concluded that cultivar Itrana was more vigorous whereas cultivars Nocellara del Belice, Cipressino and Nocellara Messinese had large and better foliage essential for higher fruiting and better yield characters and can be recommended for commercial cultivation in mid hill regions of Jammu and Kashmir.

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