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Study on Lipid Changes of Leaves and Fruits Olive Adapted to High Temperature Condition Inkhuzestan

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Abstract: The present study investigated the quantitative changes of olive leaves and fruits lipid during fruit ripening in olive cv. Manzanillo and cv. Dezful. Total lipids were measured and analyzed fatty acids by gas chromatography (GC) in on and off years. Present results showed that; Major fatty acids of leaves and fruits were palmitic, oleic and linoleic acid. In spite of fruit, means total lipid of leave were significantly difference between on and off years; although total lipids and fatty acids increase during ripening but there are negative regression between palmitic and oleic acid content of leaves and fruits. Oleic and palmitic acid ratio to total fatty acid gradually increased in fruit and leave respectively. Fruit size of Dezful cv. smaller than Manzamillo cv. But its lipid amount was more than Manzamillo cv. Oleic content was equal in both fruit cultivar. Comparisons of these results with our previous results on Olive cv. zard from Guilan show those climate dose not have important effect on lipid accumulative and alternate bearing. But regard to saturated fatty acid of two mentioned cultivar in this research the result showed that it is higher than considerably in the Dezful and Manzanillo cv. The great amount of saturated fatty acids is a suitable character for plant grown in high temperature conditions.

Key words: High temperature, fatty acid, lipid, olive

INTRODUCTION

Olea europaea L. is one of the most important and widespread crops of the Mediterranean basin, which has longevity and adaptation to climatic conditions, also the olive fruits, are commercially valuable for oil content or for edible flesh. The biochemical process of oil accumulation and their precursors during fruit ripening has considered in recent years.

Leaves carbohydrates are always important as precursors for oil synthesis. For this purpose we studied lipid and carbohydrate component of leave and fruit in two successive years. Changes of leaves and fruits fatty acid in two Manzanillo and Dezful cv. was studied during fruit ripening. As far as we know this investigation was performed for the first time in Khuzestan in Iran. During fruit ripening, total lipids of leaves and fruits was determined and amount of fatty acid was measured with GC. traditional techniques of olive production that have persisted for thousands of years maybe optimal for local cultivars in local areas but the can not be confidently extended to new locations or new forms of cultivation. One key to progress is to understand the physiological basis of those response to different environmental conditions.

MATERIALS AND METHODS

Leaf and fruit samples of olive cv.Manzamillo and cv. Dezful collected from region of safi abad garden in Dezful in Khuzestan province of Iran at 2001-2002. The samples were prepared during fruit ripening at 3 months intervals from 75 to 165 days after fruit set. Then they were lyophilized for 48 h, powdered in omni mixer and maintained at -20°C (Hamilton and Hamilton, 1992). Average weight of olive fruit was determined by weighting. For flesh separation, fruit were cut in half horizontally with a stainless-steel knife and seed were removed and weighted. The flesh content was calculated by subtracting the seed weight from the whole fruit weight. The flesh to seeds of the fruits weight ratio (F/S) was determined by dividing the flesh weight by the seed weight (Nergiz and Engez, 2000).

Oil content was extracted by mixture consisting of chloroform-methanol (2:1 v/v) (Hamilton and Hamilton, 1992). Fatty acid content of leaves released by saponization because most of leave lipid are structural type Derivation from of lipid obtained by mix of extracted with 1 mL methanolic HCl (1.5 M) and 1 mL methanol for 10 min at 80°C in the bath. This step repeated twice, then adds 3 mL distil water and centrifuged for 4 min

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in 2700 rpm (www.cyberlipid.org/fatty/fat 0001.htm). Gc by derivative form was performed on a 50% phenyl- polysilphenylen-siloxane capillary column with flame ionization detector. Temperature program carried on first 150°C for 5 min, then followed by 180°C for 26 min. One microliter samples was injected in to a Gc. injection and detection was at 200 and 250°C, respectively. Nitrogen was used as carrier gas with a flow rate of 50 bar.

RESULTS AND DISCUSSION

The proportion of lipid constituent in organ plant is strongly modified during growth and developmental stages by environmental conditions mainly temperature (Connor and Fereres, 2005). Growth of olive fruit lasts for 4 to 5 months and involves cell division, cell expansion and storage of metabolites dominantly (Manrique *et al*., 1999). Present result showed that the size and weight of fruits during ripening increased in two years but weight of fruits in off-year was more than on-year. Also the weight of Dezful fruits that is a endemic cultivar was less than non-endemic cultivar (Manzanillo), (Table 1).

During ripening total lipids of leaves and fruits increased in both cultivar at two years (Table 2). In comparison between on and off years, there are significant difference on lipid content of leaves. Amount of total lipid in off years was higher than on year (9.3 g dw^{-1} against 6.2 g dw^{-1} in Manzamillo) but in the fruit no significant differences observed. Goldschmidt and Monselise (1982) reported that total lipid of leave were shown differences between on and off year because of the consumption of its food resources of its food and transferring of carbohydrate to fruit lead to reduction of total lipid in on year also plant repairs lipid storage of leaves in the off-year. Maximum amount of lipid content observed after 165 day after fruit set.

Quantitative analysis revealed that major fatty acids were palmitic (a 16:0 saturated fatty acid), oleic (a 18:1 fatty acid mono-un saturated fatty acid) and linoleic acid (a 18:2 fatty acid di-unsaturated fatty acid) in the leave and fruit (Table 3, 4).

In present research lipid analysis of leaves showed that high temperature induced a decrease in un saturated fatty acid (18:1 and 18:2). Compensated mainly by an increase in saturated fatty acid (16:0). Same results obtained by Davy De Virville *et al*. (2002).

In plants submitted to a change in the environmental temperature, changes in fatty acid desaturates activity (Los and Murata, 1998) leading to an increase (conversely decrease) in the un saturation degree at low (conversely high) temperature were reported (Davy De Virville *et al*., 2002).

At the membrane level, a number of changes related to lipid content and/or lipid metabolism have been reported according to the growth temperature (Hui-Chan and Heshen, 1985).

Table 1: Changes of fruit weighting

	Flesh to seed of fruit ratio				Weight of seed of fruit (g)				Weight of flesh (g)				Weight of 1000 grain (g)			
	Manzanilo		Dezful		Manzanilo		Dezful		Manzanilo		Dezful		Manzanilo		Dezful	
Day after fruit set	On	Off	On	Off	On	Off	On	Off	On	Off	On	Off	On	Off	On	Off
75	3.40	3.75	2.90	3.30	735	820	549	650	2515	3080	1631	2150	3250	3900	2180	2800
90	3.66	3.74	3.12	3.80	750	950	604	680	2750	3550	1886	2570	3500	4500	2490	3250
105	4.30	4.20	3.10	3.80	760	960	666	730	3060	3990	2035	2770	3820	4950	2701	3500
120	4.41	4.62	3.70	4.26	785	950	750	780	3458	4390	2750	3320	4243	5340	3500	4100
135	5.10	4.90	4.52	4.50	790	970	765	820	4009	4830	3465	3680	4799	5800	4230	4500
150	5.44	5.30	4.51	4.84	820	980	780	830	4460	5170	3520	4020	5280	6150	4300	4850
165	5.53	5.70	4.86	5.24	860	980	785	850	4760	5660	3815	4450	5620	6640	4600	5300

Table 2: Total oil of leave and fruit from Dezful and Manzanillo

	Dezful				Manzanillo			
	Fruit		Leave		Fruit		Leave	
Day after fruit set	On	Off	On	Off	On	Off	On	Off
75	4.6	4.3	4.0	7.0	3.9	3.8	3.5	6.4
90	4.7	4.4	4.5	7.8	4.0	4.0	3.8	6.9
105	5.4	5.0	4.8	8.2	4.8	4.5	4.2	7.0
120	6.3	5.9	5.1	8.4	5.6	5.0	4.3	7.3
135	9.5	8.9	5.3	8.5	8.1	7.9	5.3	8.2
150	5.5	8.3	5.8	9.0	7.5	7.2	5.8	8.9
165	9.3	9.1	6.3	9.5	8.5	8.3	6.2	9.3

Table 3: Percent of Fruit fatty acid from Dezful and Manzanillo

	Fruit											
	Manzanilo						Dezful					
	Linoleic		Oleic		Palmitic		Linoleic		Oleic		Palmitic	
Day after fruit set	On	Off	On	Off	On	Off	On	Off	On	Off	On	Off
75	17.05	1.11	14.63	28.18	66.18	70.00	19.55	0.10	16.99	12.200	61.93	87.50
90	28.66	0.10	33.00	33.68	40.00	66.20	14.00	1.30	37.16	31.300	46.12	66.30
105	10.23	2.15	59.33	39.98	24.04	53.85	18.30	2.77	55.00	17.000	22.00	80.23
120	15.91	9.28	55.29	54.30	24.87	35.00	21.74	18.59	53.00	49.020	25.00	34.00
135	8.62	2.05	61.71	54.40	16.31	42.14	12.53	6.25	69.17	58.890	16.31	27.45
150	10.77	10.96	72.15	62.12	14.73	28.20	8.77	12.14	76.87	64.193	12.50	21.54
165	8.75	7.25	77.10	76.00	10.15	16.61	5.78	10.11	79.00	70.600	10.15	17.20

Table 4: Percent of Leave fatty acid from Dezful and Manzanillo

	Leave											
	Manzanilo						Dezful					
	Linoleic		Oleic		Palmitic		Linoleic		Oleic		Palmitic	
Day after fruit set	On	Off	On	Off	On	Off	On	Off	On	Off	On	Off
75	1.69	17.93	80.11	64.29	17.77	17.61	10.98	0.89	72.54	83.00	16.00	15.81
90	5.19	24.45	61.12	46.19	31.82	129.1	24.10	12.98	54.64	65.61	21.10	19.94
105	21.94	12.12	50.34	47.17	25.65	40.64	32.27	11.70	33.75	64.00	33.76	22.07
120	22.00	18.81	35.16	35.44	53.09	43.44	22.88	14.98	29.54	52.61	45.71	30.88
135	16.73	16.47	21.17	36.78	61.32	52.19	12.16	10.72	21.17	45.11	66.00	43.11
150	18.61	13.70	14.00	19.30	67.33	68.11	10.24	12.71	17.19	34.58	71.91	51.09
75	1.69	17.93	80.11	64.29	17.77	17.61	10.98	0.89	72.54	83.00	16.00	15.81

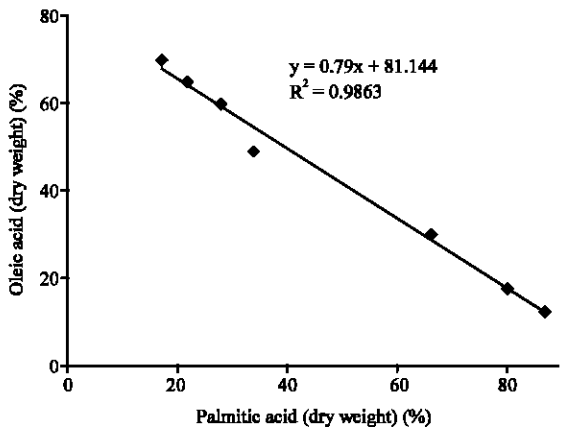

Fig. 1: Negative correlation between palmitic and oleic acid of fruit (Dezful off-year)

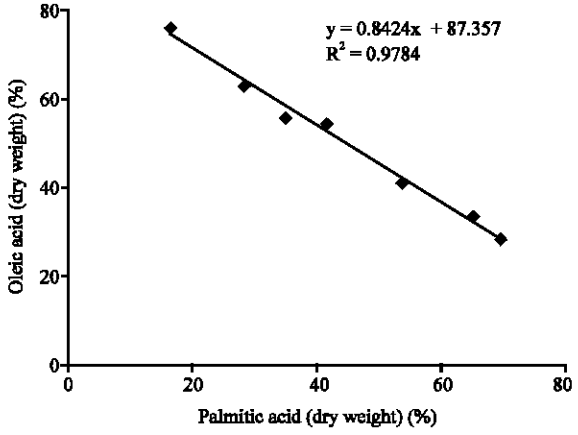

Fig. 2: Negative correlation between palmitic and oleic acid of fruit (Manzanillo off-year)

Saturated fatty acid elevated in leaves in last summer corresponding to increasing temperature. Fatty acid profile help to adaptation of plant to high temperature condition. Hui-Chan and Heshen (1985) emphasized that there are closed relationship between temperature of environmental and fatty acid composition. They reported that by increasing temperature, oleic acid rate reduce and palmitic acid and stearic acid increased.

In fruit amount of oleic acid increased and palmitic acid decreased during ripening. This was opposite leave pattern.

Fatty acid biosynthesis is take placed in fruit tissue from organic acid precursors. Carbohydrates substances specially manitol (alcoholic sugar) exported from leaves to fruit. Then, this sugar transformed to organic acid by several enzymic process. According the previous work

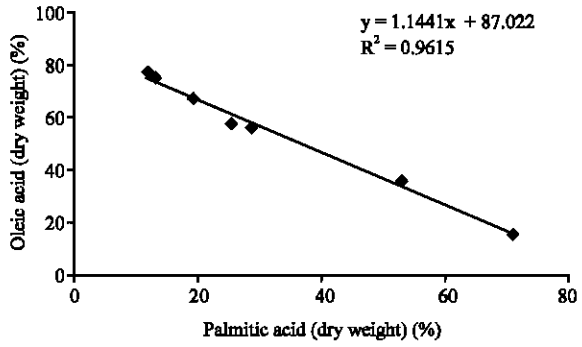

Fig. 3: Negative correlation between palmitic and oleic acid of fruit (Dezful on-year)

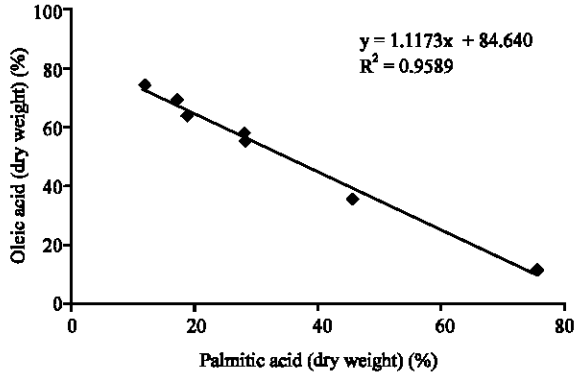

Fig. 4: Negative correlation between palmitic and oleic acid of fruit (Manzanillo on-year)

(Donaire *et al*., 1975), elevation of amount and transporting manitol was observed in leaves by ripening of fruit. Thus increasing of total lipid accured in fruit by supply manitol biosynthesis in leaves. Total lipids and fatty acids increase during ripening but there are negative regression between palmitic and oleic acid content of leaves and fruits (Fig 1-4).

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