

# OIL AND SATURATED/UNSATURATED FATS GATHERING IN THE PATH OF CORIANDER (*CORIANDRUM SATIVUM L.*) FRUIT RIPENING BENEATH NATURAL CULTIVATION

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## ARTICLE INFO

## ABSTRACT

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To examine the buildup of oil and fatty acids in coriander for the duration of fruit ripening, an area test become performed below natural cultivation situations in Such (close to Toulouse, southwestern France) for the duration of the 2009 cropping season. The percent and composition of the fatty acids of coriander had been decided with the aid of using fuel line chromatography. Our outcomes confirmed that fast oil accumulation began out in early stages (2 days after flowering, DAF). Twelve fatty acids had been identified. Saturated and polyunsaturated acids had been the dominant fatty acids at in advance stages (2–12 DAF), however, reduced after this date. After this stage, petroselinic acid multiplied to its maximum quantity at 18 DAF. In contrast, palmitic acid observed the alternative trend. Saturated and polyunsaturated fatty acids reduced markedly and monounsaturated fatty acids multiplied for the duration of fruit maturation. It seems that the fruit of coriander can be harvested earlier than complete maturity.<sup>[19]</sup>

## KEYWORDS:

Oil Content; Petroselinic Acid; Coriander; Saturated; Unsaturated Fats; Cultivation;

## I. INTRODUCTION

Coriander (*Coriandrum sativum L.*), a yearly plant of the Umbelliferae family, is a plant native to the Mediterranean region<sup>[1]</sup>. The species is grown typically in temperate regions across the Mediterranean basin and in India, China, Thailand, and Eastern Europe<sup>[2]</sup>. It is used as a natural condiment in lots of culinary preparations. The plant is cultivated for its seeds, which can be used for lots of functions together with aromatherapy, meals, drugs, cosmetics, and perfumery. Seeds also have medicinal uses for rheumatism, gastrointestinal complaints, flatulence and stomach pain, worms, insomnia, anxiety, loss of appetite, and blood sugar<sup>[3], [4]</sup>. In the industry, the main products made from coriander are distilled oils and solvent-extracted oleoresin to produce flavors and aromas<sup>[5]</sup>. Coriander oils are acquainted now no longer simplest within side the perfumery, meals, beverage, and pharmaceutical industries,

however additionally in medicine. They are used as antioxidants, in remedy of apprehensive disorders, for intestine modulation, blood strain lowering, and diuretic activity, as an anti-diabetic and antimicrobial agent, and in lots of conventional treatments for diverse diseases<sup>[6], [7], [8]</sup>. Coriander seeds are widely used as spices. Coriander represents 25–40% of curry powder and is used to taste liqueurs, being an critical flavoring agent in gin manufacturing. Coriander seeds also are used within side the instruction of baked items and tobacco products<sup>[1], [19]</sup>

Interest in coriander seed oil has extended because the European Union legal the usage of coriander oil as a meals supplement. The accumulation of oil in coriander seed is consequently of terrific hobby for meals use. Knowledge of its seed oil accumulation with the intention of maximizing oil manufacturing has ended up critical.<sup>[19]</sup>

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Petroselinic acid is an uncommon fatty acid that happens more often than not in seeds. This fatty acid composes almost 85% of the overall fatty acids of Apiaceae seeds [9]. It may be oxidatively cleaved to provide a aggregate of lauric acid, a compound beneficial within side the manufacturing of detergents, and adipic acid, a C6 dicarboxylic acid used within side the synthesis of nylon polymer [10]. [19]

To our knowledge, other than reports [10], [11], the buildup of lipids and fatty acids throughout the seed improvement of *C. sativum* L. has been little studied. Moreover, each research have been accomplished beneath-neath traditional cultivation or with inside the greenhouse. No examine of the buildup of fatty acids in coriander seeds beneath-neath natural situations has been reported. The intention of this examine turned into the assessment of oil content material and fatty acid composition from flowering to adulthood of coriander culmination beneath-neath natural cultivation. [19]

## MATERIALS AND METHOD

### 1. Location And Plant Experiment

A subject trial turned into carried out in south-western France on the Regional Centre of Experimentation in Organic Agriculture at Auch (close to Toulouse, southwestern France, 43°38'47" N, zero°35'08" E) in the course of the 2009 cropping season. Sowing turned into finished on March 23, 2009. Seeds of the French coriander variety Diourou (GSN, Riscle, France) were immediately sown manually in this sector with a strength of 3 cm and a force of 1.2 g m<sup>-2</sup>. [19]

The plants had been controlled below absolutely natural and rain fed situations with-out chemical addition. Weeds had been robotically eliminated. The soil turned into a clay loam (natural depend content material: three.2%; pH 8.1) with a intensity of approximately 1.2 m. Flowering began out on the stop of May and maturation came about at the start of August. [19]

Table 1 suggests temperatures and rainfall in the course of the plant cycle in evaluation to climate records for the ultimate fifty-five years. Indeed, rainfall turned into at the least 50 mm decrease than the half-century precipitation determined for the equal length on this area. The 2009 developing season turned into much less wet and warmer than the imply values of fifty-five years. [19]

**Table 1 – The prevailing weather condition during the 2009 plant cycle.**

Month	Rainfall		Temperature	
	2009	55 years	2009	55 years
January	95.4	65.0	4.9	5.7
February	40.4	55.9	5.8	6.9
March	23.6	57.1	8.7	9.2
April	105.4	66.6	11.7	11.5
May	44.4	77.2	16.8	15.3
June	39.4	61.1	20.1	18.9
July	41.2	47.1	21.7	21.5
August	20.0	58.3	22.7	21.3
September	46.8	55.9	18.9	18.5
October	35.6	56.8	15.0	14.4
November	102.2	57.2	10.9	9.0
December	34.6	68.1	5.9	6.2
Mean: sum over year	629.0	726.3		
Mean: sum Mar.–Sept.	320.8	423.3		
Mean: sum May–July	125.0	185.4		

### 2. Measurement Of Oleic Acid And Fatty Acid Composition

Seed sampling turned into finished each five (on average) days from flowering to maturity. Harvesting persevered from 2 days after flowering (DAF) to fifty-three DAF. The fruit's shadeation and relative moisture content material had been followed as ripening criteria. Seed water content material (SWC in % of the seed dry depend) turned into measured for every pattern as a hallmark of degree of physiological maturity. Moisture contents had been decided through heating in an air oven at 60 °C to regular weight.

Dry coriander seeds had been floor in an electric-powered grinder (IKA MF-10-simple Micro fine grinder, Sigma Aldich, Frankfurt, Germany). Triplicate samples of 20–30 g had been subjected to standard extraction for five h with cyclohexane within side the dark. The solvent turned into eliminated in a rotary evaporator below low stress at 35 °C. The vacuum device turned into used to dry the oil at 35 °C

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overnight. The oil yield turned into decided. Oil (20 mg) turned into extracted in a Soxhlet extractor for five h, after which 1 mL tert-butyl methyl ether turned into introduced. The aggregate turned into filtered thru a tumbler fiber filter (GHP, zero. forty-five µm, small diameter). At this step one hundred µL of filtrate turned into introduced to 50 µL of trimethylsulfonium hydroxide zero. five mol L<sup>-1</sup> in methanol and stirred gently. Fatty acid evaluation turned into finished through fueloline chromatography (GC-3900) with a flame ionization detector with a CP-pick CB for FAME fused silica WCOT column of length: 50 m, inner diameter: zero.25 mm, and movie thickness: zero.25 µm. The service fueloline turned into helium with a glide fee of 1.2 mL min<sup>-1</sup> and the cut-up ratio turned into 1:one hundred. The preliminary oven temperature turned into programmed to 185 °C for forty min, growing at 15 °C min<sup>-1</sup> to 250 °C and held for 10. sixty-eight min. (evaluation time: fifty-five.zero min). The injection and detector temperature had been held at 250 °C for fifty-five min. Analyses had been finished in triplicate.

All records had been subjected to variance evaluation the use of the GLM manner of SAS (SAS Institute, Cary, NC, USA). Mean comparisons had been finished with a Duncan take a look at on the zero.05 chance level.<sup>[19]</sup>

**RESULTS AND DISCUSSION**

The adjustments in oil yield of coriander from flowering duration to maturity (fifty-three days) are offered in Table 2. Water content material reduced markedly from flowering to maturity (Table 2). Oil yield various among 4.6% and 25.1% at exclusive ranges of fruit ripening (Table 2). Oil content material multiplied progressively from flowering to maturity. Oil content material multiplied threefold from 2 to twelve DAF. At maturity, the oil content material reached its maximum degree (25.1%). The oil yield within side the mature degree of ripening changed into barely decrease than that formerly pronounced for coriander beneath-neath traditional agriculture<sup>[10], [12]</sup> however better than the values pronounced through Angelini et al.<sup>[9]</sup>. This end result

changed into expected, for the reason that natural cultivation is taken into consideration a pressure condition<sup>[13]</sup>. Moreover, it's miles widely recognized that oilseeds produce and gather much less oil beneath-neath drought than beneath-neath favorable conditions<sup>[14], [15]</sup>. This distinction can be defined through the genetic origins of the cultivars utilized in those studies<sup>[13]</sup>. The oil yield multiplied hastily from days 10 to 34 after the flowering sampling duration and reached its most degree at maturity, whilst the oil yield changed into maximal and its cost changed into much like the ones of different reviews describing mature coriander fruit<sup>[10],[11]</sup>. This developmental fashion in oil accumulation in coriander fruit changed into much like that pronounced for different species<sup>[14], [16]</sup>.

**Table 2- Changes in fatty acid and water content and oil yield during seed maturation in coriander (*Coriandrum sativum* L.) fruit in 2009 from flowering to maturity.**

Fatty acid (%)	Days after flowering								
	2	5	10	12	14	18	25	35	53
<i>Saturated fatty acid (SFA)</i>									
C14:0 (myristic acid)	4.6 <sup>a</sup> ± 0.9	4.2 <sup>a</sup> ± 0.7	3.6 <sup>a</sup> ± 0.4	1.6 <sup>b</sup> ± 0.3	1.6 <sup>b</sup> ± 0.4	0.9 <sup>c</sup> ± 0.2	0.3 <sup>d</sup> ± 0.1	0.2 <sup>d</sup> ± 0.0	0.3 <sup>d</sup> ± 0.1
C16:0 (palmitic acid)	20.5 <sup>a</sup> ± 0.7	21.1 <sup>a</sup> ± 1.1	20.9 <sup>a</sup> ± 1.3	10.9 <sup>b</sup> ± 0.8	7.6 <sup>c</sup> ± 0.9	4.0 <sup>bc</sup> ± 0.6	3.5 <sup>c</sup> ± 0.7	3.7 <sup>c</sup> ± 0.4	5.1 <sup>c</sup> ± 0.9
C18:0 (stearic acid)	5.8 <sup>a</sup> ± 0.5	5.1 <sup>a</sup> ± 0.3	6.2 <sup>a</sup> ± 0.3	1.7 <sup>b</sup> ± 0.2	1.4 <sup>b</sup> ± 0.1	0.6 <sup>c</sup> ± 0.1	0.8 <sup>c</sup> ± 0.1	0.8 <sup>c</sup> ± 0.1	1.0 <sup>c</sup> ± 0.1
C20:0 (arachidic acid)	0.1 <sup>a</sup> ± 0.0	0.2 <sup>a</sup> ± 0.0	0.3 <sup>a</sup> ± 0.1	0.3 <sup>a</sup> ± 0.1	0.3 <sup>a</sup> ± 0.1	0.2 <sup>b</sup> ± 0.0	0.1 <sup>c</sup> ± 0.0	0.2 <sup>b</sup> ± 0.0	0.1 <sup>c</sup> ± 0.0
C22:0 (behenic acid)	1.6 <sup>b</sup> ± 0.5	1.5 <sup>b</sup> ± 0.3	4.0 <sup>a</sup> ± 0.6	0.0 <sup>c</sup> ± 0.0	0.0 <sup>c</sup> ± 0.0	0.0 <sup>c</sup> ± 0.0	0.0 <sup>c</sup> ± 0.0	0.0 <sup>c</sup> ± 0.0	0.0 <sup>c</sup> ± 0.0
Total	32.6 <sup>a</sup> ± 1.4	32.0 <sup>a</sup> ± 1.5	34.9 <sup>a</sup> ± 1.3	14.4 <sup>b</sup> ± 0.7	10.8 <sup>c</sup> ± 0.7	5.7 <sup>d</sup> ± 0.3	4.6 <sup>e</sup> ± 0.5	4.9 <sup>bc</sup> ± 0.6	6.6 <sup>d</sup> ± 0.9
<i>Monounsaturated fatty acid (MUFA)</i>									
C18:1n12 (petroselinic acid)	2.8 <sup>a</sup> ± 0.3	3.6 <sup>a</sup> ± 0.4	7.8 <sup>a</sup> ± 0.9	48.8 <sup>a</sup> ± 1.5	59.3 <sup>b</sup> ± 1.7	74.4 <sup>a</sup> ± 2.1	76.4 <sup>a</sup> ± 2.1	74.7 <sup>a</sup> ± 2.3	71.9 <sup>a</sup> ± 2.2
C18:1n9 (oleic acid)	2.8 <sup>a</sup> ± 0.2	3.1 <sup>a</sup> ± 0.2	3.5 <sup>a</sup> ± 0.5	6.4 <sup>a</sup> ± 0.9	6.4 <sup>a</sup> ± 0.7	4.6 <sup>b</sup> ± 0.5	4.6 <sup>b</sup> ± 0.4	4.8 <sup>b</sup> ± 0.5	6.2 <sup>b</sup> ± 0.5
Total	5.6 <sup>a</sup> ± 0.6	6.7 <sup>a</sup> ± 0.6	11.3 <sup>a</sup> ± 0.8	55.2 <sup>a</sup> ± 1.2	65.7 <sup>b</sup> ± 1.9	79.1 <sup>a</sup> ± 1.8	81.1 <sup>a</sup> ± 1.9	79.5 <sup>a</sup> ± 2.3	78.2 <sup>a</sup> ± 2.8
<i>Polyunsaturated fatty acid (PUFA)</i>									
C18:2n6 (linoleic acid)	44.2 <sup>a</sup> ± 2.1	45.1 <sup>a</sup> ± 1.9	36.0 <sup>b</sup> ± 1.8	26.9 <sup>c</sup> ± 1.5	22.1 <sup>d</sup> ± 1.6	15.4 <sup>e</sup> ± 1.0	14.3 <sup>e</sup> ± 0.9	15.0 <sup>e</sup> ± 1.3	15.0 <sup>e</sup> ± 1.2
C18:3n3 (linolenic acid)	17.6 <sup>b</sup> ± 0.9	20.3 <sup>a</sup> ± 1.1	21.4 <sup>a</sup> ± 1.6	5.2 <sup>c</sup> ± 0.5	3.0 <sup>d</sup> ± 0.1	0.7 <sup>e</sup> ± 0.0	0.3 <sup>f</sup> ± 0.0	0.7 <sup>e</sup> ± 0.0	0.6 <sup>f</sup> ± 0.1
Total	61.8 <sup>b</sup> ± 2.2	65.4 <sup>a</sup> ± 2.3	57.4 <sup>a</sup> ± 1.9	32.0 <sup>c</sup> ± 1.6	25.1 <sup>d</sup> ± 1.5	16.1 <sup>e</sup> ± 2.1	14.6 <sup>e</sup> ± 2.0	15.7 <sup>e</sup> ± 1.6	15.6 <sup>e</sup> ± 2.0
SFA/PUFA	0.5 <sup>a</sup> ± 0.1	0.5 <sup>a</sup> ± 0.1	0.6 <sup>a</sup> ± 0.1	0.5 <sup>a</sup> ± 0.1	0.4 <sup>b</sup> ± 0.1	0.4 <sup>bc</sup> ± 0.0	0.3 <sup>c</sup> ± 0.0	0.3 <sup>c</sup> ± 0.0	0.4 <sup>bc</sup> ± 0.0
Water content (%)	95.3 <sup>a</sup> ± 3.4	90.3 <sup>a</sup> ± 4.5	80.6 <sup>b</sup> ± 3.9	74.8 <sup>b</sup> ± 3.4	74.0 <sup>b</sup> ± 5.6	63.9 <sup>c</sup> ± 2.9	55.1 <sup>d</sup> ± 2.8	30.3 <sup>e</sup> ± 2.0	10.6 <sup>f</sup> ± 1.8
Oil yield (%)	4.6 <sup>a</sup> ± 0.2	8.4 <sup>a</sup> ± 0.2	10.9 <sup>a</sup> ± 0.3	12.8 <sup>b</sup> ± 0.2	14.2 <sup>b</sup> ± 0.3	18.6 <sup>c</sup> ± 0.5	21.0 <sup>c</sup> ± 0.4	22.8 <sup>c</sup> ± 0.5	25.1 <sup>d</sup> ± 0.4

For each line (each fatty acid) means followed by the same letter are not significantly different based on Duncan's test at the 0.05 probability level.

Large accumulations of fatty acids commenced at 2 DAF. Different traits had been determined for the fatty acids. Contents of saturated fatty acids had been excessive from 2 till 10 DAF however declined through 1/2 of through 12 DAF. This decline endured till complete maturity. The consultant fatty acid of this class in coriander changed into

palmitic acid, which accompanied the equal fashion because the saturated fatty acids. Myristic and stearic acids had been additionally found in better quantities at 2 DAF and reduced after 10 DAF (Table 2). In contrast, monounsaturated fatty acids, represented specifically through petroselinic acid (50% at 2 DAF and achieving greater than 92% at maturity) had been found in low quantities at the increased after onset of seed formation (2 DAF) and 10 DAF. Indeed, the petroselinic acid quantity multiplied tenfold from 2 to twelve DAF and endured this rise, achieving its maximum degree at 18 DAF (Table 2). The polyunsaturated fatty acid content material changed into maximum at 2 DAF and reduced till 18 DAF, closing solid from this factor to maturity (Table 2). Higher ranges of polyunsaturated and saturated fatty acids had been pronounced at in advance ranges of fruit ripening <sup>[10], [11]</sup>. The ratio of saturated to polyunsaturated fatty acids reduced markedly at some point of fruit maturation. Similar effects had been pronounced in different oilseed species <sup>[14], [17]</sup>. The degree of petroselinic acid changed into in accord with values formerly pronounced for coriander starting from 51.6% to 90.7% <sup>[5], [6], [7]</sup>. The maximum quantity of petroselinic acid changed into reached among 18 and 35 DAF, in settlement with effects of Msaada et al. <sup>[10]</sup> which emphasised that a duration of 32 DAF changed into enough to be used of coriander fruits. In our take a look at, contrary developmental traits had been determined for palmitic acid (reducing with fruit ripening) and petroselinic acid (growing with fruit ripening). This statement may be defined through the function of palmitic acid as a precursor of petroselinic acid <sup>[18]</sup>.

In summary, this takes a look at constitutes the primary to research oil and fatty acid accumulation in coriander at some point of fruit ripening beneath-neath natural cultivation. Highest oil yield changed into done at complete maturity. Fatty acid profiles various substantially at some point of fruit ripening. At in advance ranges, saturated and polyunsaturated fatty acids had been better and reduced with fruit maturation. Petroselinic acid changed into the foremost fatty acid after 12 DAF, displaying an inverse dating with

palmitic acid that helps a purposeful correlation among the 2 fatty acids. This take a look at furnished facts to be used of coriander oil and its composition of fatty acid, mainly petroselinic acid, for commercial applications.<sup>[19]</sup>

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