IJAFLS
e-ISSN: 2602-4381
International Journal of
Agriculture, Forestry and Life Sciences
Review Article www.ijafls.org Int J Agric For Life Sci 3(2): 378-386(2019)

Organic fig (*Ficus carica* l.) growing: determination of pesticide residues

Nilda ERSOY

Akdeniz University, Vocational School of Technical Sciences, Program of Organic Farming, Antalya/Turkey

Corresponding author email: nildaersoy@akdeniz.edu.tr

Abstract

Food production has very important strategy in today's world. While half the world struggle with famine, the other half wants food stuffs they produce and consume to be secure. When it is said secure food, foods which is not harmful to health, do not contain any physical, chemical and microbiological residues and also of which traceability provided come to mind. Traceability of agricultural products has become the most important issue to provide food security. In organic farming based on traceability principles, pesticide residue analyzes are carried out in the final products and certified if the pesticide problem does not occur in the product. In this study, the pesticide residues on fig fruit, *Ficus carica* L., grown by organic agricultural methods was examined. The fig trees were grown in İsafakılar village of İncirliova district of Aydın city in Western Part of Turkey. The residue analyses were done by GC-MS/MS and LC-MS/MS chromatographies. 506 active substances in used pesticides during the cultivation period were analyzed by LC-MS/MS chromatography meanwhile 113 active substances of pesticides by GC-MS/MS chromatography device were analyzed in fig fruit. This study was conducted in years of 2017 and 2018 consecutively. Detactable pesticide residues have not been measured in the samples.

Key words: Fig, Organic Farming, Pesticides, Residues

Received: 27.11.2019 **Accepted: 23.12.2019** **Published (online): 23.12.2019**

Introduction

The fig tree (*Ficus carica* L.) is one of the unique *Ficus* species widely spread in tropical and subtropical countries which has edible fruits with high commercial value (İrget et al. 2008). Turkey is one of the most important genetic origins of fig in the world, Around 60 thousand farmers have been producing figs in Turkey. The sector employs about 250-300 thousand people. The most favourable areas for the cultivation of figs which is one of the rare fruits mentioned in the name holy books and the highest quality and the most grown in Turkey are big and small Menderes basins where dried fig production is widely common (Yılmaz et al., 2017).

Turkey is the world leader in fig production and export issues. Especially the superiority of the dried fig quality is undisputed. Generally more than half of world exports are covered in dried figs from Turkey Overall, more than half of world exports is provided in dried figs from Turkey (%55) (Anonymous 2019).

Turkey's figs mainly produced in Aydın and İzmir provinces where 60% and 14% of national production were obtained respectively in 2017. Additionally, Marmara, Mediterranean, Black Sea and Southeast Anatolia regions are able produce fresh figs for consumers. The most favourable areas for the cultivation of figs are Big and Small Menderes basins where dried fig production is widely common. Organic fig production started in Turkey in 1984–1985 and showed an increasing trend parallel to the demand from European companies (Mordoğan et al., 2013). Generally, 30% of fig productions are consumed as fresh figs and the rest (70%) are sold as dried figs either in national or export to international markets. According to Turkish Statistical Instute (TÜİK) data of 2018, fig production was 306.499 tons. 93.005,4 tons of this production is organic. Therefore 1/3 of the figs we produce are organic. This ratio is on an upward trend and it is likely that we will be producing more organic figs in the coming years.

Organic crop production has begun to play an important role because of vital danger caused by environmental pollution through synthetic chemicals (Altındişli and Ertem, 1998). In organic agriculture, in order to obtain the organic certificate of the final product, the residual analysis of many pesticides, for example fig fruits, must be performed in accredited laboratories. If residual problems occur, the product is not certified to be organic. In this research, pesticide residues on fig fruit that grown in İsafakılar village of İncirliova district of Aydın city are analysed.

Cite this artile as:
Ersoy, N. 2019 Organic fig (Ficus carica l.) growing: determination of pesticide residues. *Int. J. Agric. For. Life Sci*., 3(2): 378-386.

Material and Methods

Materials

The experiment was carried out in the fig garden in İsafakılar village of İncirliova district, Aydın, Turkey. The garden was established in 1969 with Sarılop fig variety. The experiment was set up to have 3 replications and 15 trees in each replication, according to the design of randomized block design. Farmer didn't use any pesticides to fig orchard. Necessary samples were taken at the harvest time from the trees included in the experiment and analyzes were carried out.

In the experiment, pesticides given in Table 1 and 2 are searched in the examples of fig fruit, which are the materials. All extraction studies and residue analysis of the examples made in Proanaliz Food Control Laboratory.

All the solvents and chemicals (water, acetonitrile, methanol, formic acid, acetic acid and ammonium formate) used as mobile phases in example extractions are chosen in accordance to a profound quality. Pesticide standards are prepared at least a 90% rate of purity. Extractions and clearance of the examples are generalized in accordance with AOAC (International Official Methods of Analysis) methods (Lehotay, 2007).

Table 1. Active substances examined in fig fruit examples on LC-MS/MS device.

No	**Analit**	**Detection Limit µg/kg**	**No**	**Analit**	**Detection Limit µg/kg**
1	1-Naphthyl acetamide(0.010)	0.010	254	Fosthiazate	0.010
2	2,4-D (0.010)	0.010	255	Fuberidazole	0.010
3	3,4,5 Trimethacarb (0.010)	0.010	256	Furalaxyl	0.010
4	Abamectin (0.010)	0.010	257	Furathiocarb	0.010
5	Acephate (0.010)	0.010	258	Halfenprox	0.010
6	Acequinocyl (0.010)	0.010	259	Halosulfuron Methyl	0.010
7	Acetamiprid (0.010)	0.010	260	Haloxyfop-2-Ethoxy-Ethyl	0.010
8	Acetochlor (0.010)	0.010	261	Heptanafos	0.010
9	Acibenzolar-S-Methyl (0.010)	0.010	262	Hexaconazole	0.010
10	Aclonifen (0.010)	0.010	263	Hexaflumuron	0.010
11	Acrinathrin (0.010)	0.010	264	Hexazinone	0.010
12	Alachlor	0.010	265	Hexythiazox	0.010
13	Aldicarb	0.010	266	Imazalil	0.010
14	Aldicarb-Sulfone	0.010	267	Imazamox	0.010
15	Aldicarb-Sulfoxide	0.010	268	Imazapic	0.010
16	Allethrin	0.010	269	Imazapyr	0.010
17	Ametoctradin	0.010	270	Imazaquin	0.010
18	Ametryn	0.010	271	Imazethapyr	0.010
19	Amidosulfuron	0.010	272	Imazosulfuron	0.010
20	Amisulbrom	0.010	273	Imibenconazole	0.010
21	Amitraz	0.010	274	Imidachloprid	0.010
22	Amitrole	0.010	275	Indoxacarb Sum	0.010
23	Anilazine	0.010	276	Iodosulfuron methyl sodium	0.010
24	Anilofos	0.010	277	Ioxynil	0.010
25	Aramite	0.010	278	Ipconazole	0.010
26	Asulam	0.010	279	Iprobenfos	0.010
27	Atrazine	0.010	280	Iprodione	0.010
28	Azaconazole	0.010	281	Iprovalicarb	0.010
29	Azamethiphos	0.010	282	Isazofos	0.010
30	Azimsulfuron	0.010	283	Isocarbofos	0.010
31	Azinphos-Ethyl	0.010	284	Isoprocarb	0.010
32	Azinphos-Methyl	0.010	285	Isoproturon	0.010
33	Aziprotryne	0.010	286	Isoxaben	0.010
34	Azocyclotin	0.010	287	Isoxadifen Ethyl	0.010
35	Azoxystrobin	0.010	288	Isoxaflutole	0.010
36	Barban	0.010	289	Isoxathion	0.010
37	Beflubutamid	0.010	290	Kinetin	0.010
38	Benalaxyl	0.010	291	Kresoxim-methyl	0.010
39	Bendiocarb	0.010	292	Lenacil	0.010
40	Benfuracarb	0.010	293	Linuron	0.010
41	Benomyl	0.010	294	Lufenuron	0.010
42	Bensulfuron methyl	0.010	295	Malaoxon	0.010
43	Bentazone	0.010	296	Malathion	0.010
44	Benthiovalicarb Isopropyl	0.010	297	Maleic Hydrazide	0.010
45	Benzoximate	0.010	298	Mandipropamide	0.010
46	Bifenox	0.010	299	MCPA	0.010

47	Bifentrin	0.010	300	Mecarbam	0.010
48	Binapacryl	0.010	301	Mecoprop (MCPP)	0.010
49	Bioresmethrin	0.010	302	Mecoprop-P (MCPP-P)	0.010
50	Bispyribac	0.010	303	Mepanipyrim	0.010
51	Bitertanol	0.010	304	Mephosfolan	0.010
52	Boscalid	0.010	305	Mepronil	0.010
53	Bromacil	0.010	306	Meptyldinocap	0.010
54	Bromophos methyl	0.010	307	Mesosulfuron Methyl	0.010
55	Bromophos-Ethyl	0.010	308	Mesotrione	0.010
56	Bromoxynl	0.010	309	Metaflumizone	0.010
57	Bromuconazole	0.010	310	Metalaxyl	0.010
58	Bupirimate	0.010	311	Metalaxyl M	0.010
59	Buprofezine	0.010	312	Metamitron	0.010
60	Butafenacil	0.010	313	Metazachlor	0.010
61	Butocarboxim	0.010	314	Metconazole	0.010
62	Butocarboxim-sulfone	0.010	315	Methabenzthiazuron	0.010
63	Butocarboxim-sulfoxide	0.010	316	Methacrifos	0.010
64	Butoxycarboxim	0.010	317	Methamidophos	0.010
65	Butralin	0.010	318	Methidathion	0.010
66	Buturon	0.010	319	Methiocarb	0.010
67	Butylate	0.010	320	Methiocarb sulfone	0.010
68	Cadusafos	0.010	321	Methiocarb sulfoxide	0.010
69	Campheclor	0.010	322	Methiocarb Sum	0.010
70	Campheclor-methyl	0.010	323	Methomyl	0.010
71	Campheclor-oxon	0.010	324	Methomyl oxime	0.010
72	Campheclor-oxon-sulfone	0.010	325	Methomyl Sulfone	0.010
73	Campheclor-oxon-sulfoxide	0.010	326	Methoxyfenozide	0.010
74	Campheclor-sulfone	0.010	327	Metobromuron	0.010
75	Campheclor-sulfoxide	0.010	328	Metolachlor	0.010
76	Carbaryl	0.010	329	Metolcarb	0.010
77	Carbendazim	0.010	330	Metosulam	0.010
78	Carbofuran	0.010	331	Metoxuron	0.010
79	Carbosulfan	0.010	332	Metribuzin	0.010
80	Carboxin	0.010	333	Metrofenone	0.010
81	Carfentrazone-Ethyl	0.010	334	Metsulfuron-Methyl	0.010
82	Chlorantraniliprole	0.010	335	Mevinphos	0.010
83	Chlorbromuron	0.010	336	Milbemectin A3	0.010
84	Chlorbufam	0.010	337	Milbemectin A4	0.010
85	Chlorfenvinphos	0.010	338	Molinate	0.010
86	Chlorfluazuron	0.010	339	Monocrotophos	0.010
87	Chloridazon	0.010	340	Monolinuron	0.010
88	Chlormequat chloride	0.010	341	Monuron	0.010
89	Chlorotoluron	0.010	342	Myclobutanil	0.010
90	Chloroxuron	0.010	343	Naled (Dibrom)	0.010
91	Chlorpropham	0.010	344	Naphthalene Acetamide (NAD)	0.010
92	Chlorpyrifos (0.04)	0.004	345	Napropamide	0.010
93	Chlorpyrifos-Methyl	0.010	346	Napthol-1	0.010
94	Chlorsulfuron	0.010	347	Neburon	0.010
95	Chlortal-dimethyl	0.010	348	Nicosulfuron	0.010
96	Chlorthiamid	0.010	349	Nitenpyram	0.010
97	Chromafenozide	0.010	350	Norfluazuron	0.010
98	Cinidon-ethyl	0.010	351	Novaluron	0.010
99	Clethodim	0.010	352	Nuarimol	0.010
100	Clethodim Iminsulfone	0.010	353	Ofurace	0.010
101	Clethodim Iminsulfoxide	0.010	354	Omethoate	0.010
102	Clethodim Sulfoxide	0.010	355	Orthosulfamuron	0.010
103	Climbazole	0.010	356	Oxadiazon	0.010
104	Clodinafop-proparpyl ester	0.010	357	Oxadixyl	0.010
105	Clofentezine	0.010	358	Oxamyl	0.010
106	Clomazone	0.010	359	Oxasulfuron	0.010
107	Cloquintocet-methylhexyl-e	0.010	360	Oxycarboxin	0.010
108	Clothianidin	0.010	361	Oxyfluorfen	0.010
109	Coumaphos	0.010	362	Paclobutrazol	0.010
110	Crimidine	0.010	363	Paraoxon Ethyl	0.010
111	Cyanazine	0.010	364	Paraoxon Methyl	0.010

112	Cyanofenphos	0.010	365	Parathion-Ethyl	0.010
113	Cyazofamid	0.010	366	Parathion-Methyl (0.002)	0.002
114	Cyclanilide	0.010	367	Pebulate	0.010
115	Cycloloxydim	0.010	368	Penconazole(0.005)	0.005
116	Cyflufenamid	0.010	369	Pencycuron	0.010
117	Cyhalofop	0.010	370	Pendimethalin	0.010
118	Cyhalofop butyl	0.010	371	Penoxsulam	0.010
119	Cyhalofop diacid	0.010	372	Pethoxamid	0.010
120	Cyhexatin	0.010	373	Phenmedipham	0.010
121	Cymoxanil	0.010	374	Phenothrin	0.010
122	Cyproconazole	0.010	375	Phentoate	0.010
123	Cyprodinil	0.010	376	Phorate	0.010
124	Cyromazine	0.010	377	Phorate Sulfone	0.010
125	Daminozide	0.010	378	Phosalone	0.010
126	Demeton(O+S)	0.010	379	Phosmet	0.010
127	Demeton-S-Methyl	0.010	380	Phosmet oxon	0.010
128	Demeton-S-Methyl-Sulfone	0.010	381	Phosphamidon	0.010
129	Demeton-S-Methyl-Sulfoxide	0.010	382	Phoxim	0.010
130	Desmedipham	0.010	383	Picolinafen	0.010
131	Desmetryn	0.010	384	Picoxystrobin	0.010
132	Diafenthiuron	0.010	385	Pinoxaden	0.010
133	Dialifos	0.010	386	Pirimicarb	0.010
134	Di-Allate	0.010	387	Pirimicarb Desmethyl	0.010
135	Diazinon	0.010	388	Pirimicarb Desmethyl Formamido	0.010
136	Dichlofenthion	0.010	389	Pirimiphos-Ethyl	0.010
137	Dichlofluanid	0.010	390	Pirimiphos-Methyl	0.004
138	Dichlorprop	0.010	391	Prochloraz	0.010
139	Dichlorvos (DDVP)	0.010	392	Profenofos	0.010
140	Diclobutrazol	0.010	393	Profoxydim	0.010
141	Diclofop-Methyl	0.010	394	Profoxydim lithium	0.010
142	Dicloran	0.010	395	Prohexadione calcium	0.010
143	Dicrotophos	0.010	396	Promecarb	0.010
144	Diethofencarb	0.010	397	Promethryn	0.010
145	Difenoconazole	0.010	398	Propachlor	0.010
146	Diflubenzuron	0.010	399	Propanil	0.010
147	Diflufenican	0.010	400	Propaquizafop	0.010
148	Dimefox	0.010	401	Propargite	0.010
149	Dimethachlor	0.010	402	Propazine	0.010
150	Dimethenamid	0.010	403	Propetamphos	0.010
151	Dimethoate	0.010	404	Propham	0.010
152	Dimethomorph	0.010	405	Propiconazole	0.010
153	Dimetilan	0.010	406	Propisochlor	0.010
154	Dimoxystrobin	0.010	407	Propoxur	0.010
155	Diniconazole	0.010	408	Propoxycarbazone sodium	0.010
156	Dinitramine	0.010	409	Propyzamide	0.010
157	Dinocap	0.010	410	Proquinazid	0.010
158	Dinoseb	0.010	411	Prosulfocarb	0.010
159	Dinoterb	0.010	412	Prosulfuron	0.010
160	Dioxacarb	0.010	413	Prothioconazole	0.010
161	Diphenamid	0.010	414	Prothiophos	0.010
162	Dipropetryn	0.010	415	Pymetrozine	0.010
163	Disulfoton	0.010	416	Pyraclostrobin	0.010
164	Disulfoton Sulfone	0.010	417	Pyraflufen	0.010
165	Disulfoton Sulfoxide	0.010	418	Pyraflufen ethyl	0.010
166	Ditalimfos	0.010	419	Pyrasulfotole	0.010
167	Dithianon	0.010	420	Pyrazophos	0.010
168	Diuron	0.010	421	Pyrethrins	0.010
169	DNOC	0.010	422	Pyridaben	0.010
170	Dodine	0.010	423	Pyridaly	0.010
171	E-Fenpyroxymate	0.010	424	Pyridaphenthion	0.010
172	Emamectin Benzoate	0.010	425	Pyridate	0.010
173	Epichlorohydrin	0.010	426	Pyrifenox	0.010
174	EPN	0.010	427	Pyrimethanil	0.010
175	Epoxiconazole	0.010	428	Pyriproxyfen	0.010
176	EPTC	0.010	429	Quaizalofop_P_Ethyl	0.010

177	Etaconazole	0.010	430	Quinalphos	0.010
178	Ethametsulfuron Methyl	0.010	431	Quinclorac	0.010
179	Ethiofencarb	0.010	432	Quinmerac	0.010
180	Ethiofencarb-sulfone	0.010	433	Quinoxyfen	0.010
181	Ethiofencarb-sulfoxide	0.010	434	Resmethrin	0.010
182	Ethion	0.010	435	Rimsulfuron	0.010
183	Ethiprole	0.010	436	Rotenone	0.010
184	Ethirimol	0.010	437	Sethoxydim	0.010
185	Ethofenprox	0.010	438	Silthiofam	0.010
186	Ethofumesate	0.010	439	Simazine	0.010
187	Ethoprophos	0.010	440	Spinetoram	0.010
188	Ethoxyquin	0.010	441	Spinosad	0.010
189	Ethoxysulfuron	0.010	442	Spirodiclofen	0.010
190	Ethylene thiourea	0.010	443	Spiromesifen	0.010
191	Etoxazole	0.010	444	Spirotetramat	0.010
192	Etridiazole	0.010	445	Spirotetramat-Enol	0.010
193	Etrimfos	0.010	446	Spirotetramat-Enol-Glucoside	0.010
194	Famoxadone	0.010	447	Spirotetramat-Ketohydroxy	0.010
195	Famphur	0.010	448	Spirotetramat-Monohydroxy	0.010
196	Fenamidone	0.010	449	Spiroxamine	0.010
197	Fenamiphos	0.010	450	Sulcotrione	0.010
198	Fenarimol	0.010	451	Sulfosulfuron	0.010
199	Fenazaquin	0.010	452	Sulfotep	0.010
200	Fenbuconazole	0.010	453	Sulprofos	0.010
201	Fenbutatin oxide	0.010	454	Tebuconazole	0.010
202	Fenhexamid	0.010	455	Tebufenozide	0.010
203	Fenitrothion	0.010	456	Tebufenpyrad	0.010
204	Fenobucarb	0.010	457	Tebupirimfos	0.010
205	Fenoxyaprop-P-ethyl	0.010	458	Teflubenzuron	0.010
206	Fenoxycarb	0.010	459	Tembotrione	0.010
207	Fenpiclonil	0.010	460	Temephos	0.010
208	Fenpropathrin	0.010	461	TEPP(O.O-TEPP)	0.010
209	Fenpropidin	0.010	462	Tepraloxydim	0.010
210	Fenpropimorph	0.010	463	Terbufos	0.010
211	Fensulfothion	0.010	464	Terbumeton	0.010
212	Fenthion	0.010	465	Terbuthylazine	0.010
213	Fenthion Oxon	0.010	466	Terbutryn	0.010
214	Fenthion Oxon Sulfone	0.010	467	Tetramethrin	0.010
215	Fenthion Oxon Sulfoxide	0.010	468	Tetraconazole	0.010
216	Fenthion-Sulfone	0.010	469	Thiabendazole	0.010
217	Fenthion-Sulfoxide	0.010	470	Thiacloprid	0.010
218	Fentin acetate	0.010	471	Thiamethoxam	0.010
219	Fentin Hydroxide	0.010	472	Thidiazuron	0.010
220	Fipronil	0.010	473	Thifensulfuron-methyl	0.010
221	Flamprop-M-Isopropyl	0.010	474	Thiobencarb	0.010
222	Flazasulfuron	0.010	475	Thiodicarb	0.010
223	Flonicamid	0.010	476	Thiofanox	0.010
224	Florasulam	0.010	477	Thiofanox Sulfone	0.010
225	Fluazifop-p-butyl	0.010	478	Thiofanox Sulfoxide	0.010
226	Fluazinam	0.010	479	Thiophanate-methyl	0.010
227	Flubendiamide	0.010	480	Tolclofos-Methyl	0.010
228	Flubenzimine	0.010	481	Tolfenpyrad	0.010
229	Flucycloxuron	0.010	482	Topramezone	0.010
230	Flucythrinate	0.010	483	Tralkoxydim	0.010
231	Fludioxonil	0.010	484	Triadimefon	0.010
232	Flufenacet	0.010	485	Triadimenol	0.010
233	Flufenoxuron	0.010	486	Tri-allate	0.010
234	Flumioxazine	0.010	487	Triasulfuron	0.010
235	Fluometuron	0.010	488	Triazophos	0.010
236	Fluopicolide	0.010	489	Tribenuron-Methyl	0.010
237	Fluopyram	0.010	490	Trichlorfon	0.010
238	Fluorochloridone	0.010	491	Trichloronat	0.010
239	Fluoroglycofen Ethyl	0.010	492	Triclopyr	0.010
240	Fluoxastrobin	0.010	493	Tricyclazole	0.010
241	Flupyrsulfuron Methyl	0.010	494	Tridemorph	0.010

242	Fluquinconazole	0.010	495	Triethyl Phosphate	0.010
243	Fluroxypyr	0.010	496	Trifloxystrobin	0.010
244	Flurtamone	0.010	497	Triflumizole	0.010
245	Flusilazole	0.010	498	Triflumuron	0.010
246	Flutolanil	0.010	499	Triflusulfuron Methyl	0.010
247	Fluxapyroxad	0.010	500	Triforine	0.010
248	Fomesafen	0.010	501	Trinexapac Ethyl	0.010
249	Fonofos	0.010	502	Triticonazole	0.010
250	Foramsulfuron	0.010	503	Tritosulfuron	0.010
251	Forchlorfenuron	0.010	504	Uniconazole	0.010
252	Formetanate	0.010	505	Vamidothion	0.010
253	Formetanate hydrochloride	0.010	506	Zoxamide	0.010

Table 2. Active substances examined in fig fruit examples on GC-MSD device.

No	Analit	Detection Limit µg/kg	No	Analit	Detection Limit µg/kg
1	2,4-5T	0.020	58	Endosulfan, Beta	0.002
2	2-Chloranilline	0.015	59	Endrin	0.015
3	2-Phenyl phenol	0.015	60	Ethalfluralin	0.015
4	3-Chloranilline	0.015	61	Fenchlorphos	0.015
5	4.4 Dichlorobenzophenone	0.020	62	Fenson	0.015
6	4-Chloranilline	0.015	63	Fenvelarate & Esfenvelarate	0.010
7	Aldrin (HHDN)	0.015	64	Fluchloralin	0.015
8	Alpha cypermethrin	0.005	65	Fluotrimazole	0.015
9	Aminocarp	0.015	66	Flurprimidol	0.015
10	Benfluralin	0.015	67	Flutriafol	0.015
11	BHC	0.015	68	Fluvalnate, tau	0.010
12	Bifenazate	0.015	69	Folpet	0.015
13	Biphenyl	0.015	70	Formothion	0.015
14	Bromocyclen	0.015	71	Haloxyfop R Methyl	0.015
15	Bromopropylate	0.010	72	HCL Alpha	0.020
16	Captafol	0.015	73	HCL Beta	0.020
17	Captan	0.010	74	HCL Delta	0.020
18	Carbofuran-3 hydroxy	0.010	75	HCL Gamma	0.020
19	Carbophenothion	0.015	76	Heptachlor	0.015
20	Chlorbenside	0.015	77	Heptachlor Endo ECI	0.015
21	Chlordane-Cis Alpha	0.015	78	Heptachlor Endo ETI	0.015
22	Chlordane Trans Gamma	0.015	79	Hexachlorobenzene	0.020
23	Chlordecone	0.015	80	Iodofenphos	0.015
24	Chlorfenapyr	0.015	81	Isodrin	0.015
25	Chlorfenson	0.020	82	Isofenphos	0.015
26	Chlorobenzilate	0.020	83	Lactofen	0.015
27	Chloroneb	0.015	84	Leptophos	0.015
28	Chlorothalonil	0.020	85	Mefenpyr Diethyl	0.015
29	Chlorthion	0.015	86	Methoprene	0.015
30	Chlozolinate	0.015	87	Methoxychlor	0.020
31	Cyanaphos	0.015	88	Mirex	0.015
32	Cycloate	0.020	89	Nitrothal-isopropyl	0.020
33	Cyfluthrin	0.015	90	Nitrapyrin	0.015
34	Cyflutrin-beta	0.015	91	Nitrofen	0.020
35	Cyhalothrin, Lambda	0.010	92	Oxadargyl	0.015
36	Cypermethrin	0.010	93	Pentachloroaniline	0.015
37	Dazomet	0.020	94	Permethrin	0.010
38	DDD-2.4'	0.020	95	Perhane	0.015
39	DDD-4.4'	0.020	96	Procymidone	0.020
40	DDE-2.4'	0.020	97	Profuralin	0.015
41	DDE-4.4'	0.020	98	Propamocarb	0.015
42	DDT-2.4'	0.020	99	Qunomethionate	0.005
43	DDT-4.4'	0.020	100	Quintozene	0.015
44	Deltamethrin	0.010	101	S-Metolachlor	0.015
45	Dicamba	0.015	102	Tecnazene	0.020
46	Dichlobenil	0.015	103	Tefluthrin	0.015
47	Dicofol	0.010	104	Terbacil	0.015

48	Dieldrin	0.015	105	Tetrachlovinphos	0.015
49	Diethatyl Ethyl	0.015	106	Tetradifon	0.015
50	Dimethypin	0.015	107	Tetrasul	0.020
51	Dinobuton	0.015	108	Thiometon	0.015
52	Dinoseb Asetate	0.015	109	Tolyfuanid	0.020
53	Dioxathion	0.015	110	Transfuthrin	0.015
54	Diphenylamine	0.020	111	Tributtyl Phosphate	0.015
55	Dihenylmercury	0.015	112	Trifuralin	0.010
56	Endosulfan-sulfate	0.002	113	Vinclozolin	0.020
57	Endosulfan, Alpha	0.002			

Methods

Examples' Preparation for Analysis

15 g's examples were homogenized in a mechanical shredders. Other similars of the same example were put into same processes separately. Example amounts that put into extraction were taken from these homogenised examples after weighing.

Extraction of Examples

Whole examples were homogenised with steel blenders by shredding and 5g's of analyse examples from the main example were weighed and mixed with 10ml's of water and 15ml's of acetonitrile with 1% acetic acid and strongly shaked for 1 minute. Afterwards, 6 g's of waterless magnesium sulfate ($MgSO_4$) and 1.5 g's of Sodium Acetate ($C_2H_3NaO_2.3H_2O$) is added into falcon tubes and after being shaked for 1 minute, centrifugated for 5 minutes at 4000 rpm rate. As the next step, 8 ml's of examples from the previous examples' high phases were collected for the cleaning process and transported into 15 ml's falcon tubes and mixed with 1.2 g's of waterless $MgSO_4$ and 0.4 g's of PSA and centrifuged for 5 minutes at 4000 rpm rate, once again. Later, the high phase was transported into viales and kept in a freezer until the device evaluations. As the last injections into LC-MS/MS and GC-MS/MS devices were conducted and residue rates were determined. Chromatographical conditions of LC-MS/MS and GC-MS/MS devices are explained on Table 3 and Table 4.

Table 3. Chromatographic Working Conditions of LC-MS/MS

LC-MS/MS	Agilent 6420			
Mobile Phase A	5 mM Amonium Formate&Water + Acetonitrile			
Mobile Phase A	Pure methanol			
Column	Poroshell 120 SB-C18 (3.0 x 100 mm 2.7 Micron)			
Injection Volume	10 µl			
Flow Rate	0.6 ml/min			
MS Gas Temperature	300°C			
Sheat Gas Temperature	350°C			
The Column Oven	35°C			
Pump Gradient Program	Time	Mobile phase A %	Mobile phase B %	Flow rate ml/min
	0:00	80	20	0.6
	0:00	80	20	0.6
	0:20	80	20	0.6
	1:50	30	70	0.6
	6:00	5	95	0.6
	7:50	5	95	0.6
	7:60	80	20	0.6
	10:00	80	20	0.6

Table 4. Chromatographic Working Conditions of GC/MS

GC-MS		Agilent 5975	
Carrier gases		Helium	
Column		HP-5MS 30 m × 250 µm × 250 µm × 0.25 µm	
Injection Volume		5 µl	
Flow Rate		2.4 ml/min	
Duration of Injection		18.5 min	
MS Gas Temperature		300°C	
Sheat Gas Temperature		350°C	
The Column Oven		35°C	
Inlet temperature program			
Start	Rate of increase (°C/min)	Temperature (°C)	Retention Time (RT) (min)
1	0	55	0.21

2	600	325	18.5
The Column Oven temperature program			
Start	Rate of increase (°C/min)	Temperature (°C)	Retention Time (RT) (min)
1	0	50	0
2	50	150	0
3	20	230	1
4	8	290	3
5	0	290	18.5

Results and Discussion

The findings amount in the study are considered on an average of 3 repetitions of each example in accordance with the " Turkish Food Codex (TGK) Rescript of Maximum Residue Limits of Pesticides Permitted to be Found in Livestock (Official Newspaper: 21.01.2011-27822; Rescript No: 2011/2). Each residue limits of TGK for each pesticide example are given in the tables, separately. In the residue limits of fig fruit examples' examinations, where high-precisioned devices such as GC-MS/MS and LC-MS/MS were used, 506 active substances of pesticides in LC-MS/MS device and 113 active substances of pesticides at GC-MS/MS device were analysed. In this study conducted during the years of 2017 and 2018, any analyzable residues were not observed in the examples of both years. There are no pesticide residues in the fruits of this garden, which has been certified and produced by organic methods. This shows how important it is with organic farming methods, one of the sustainable agricultural techniques, where the traceability of the product is ensured, with the increasing sensitivity to food safety recently. There are also studies that fig has many good properties grown with organic farming methods. Erbay et al. (2011) determined that organic grown figs have higher sugar content and much more hardness than conventionals in the beginning and also the end of the storage. At the same time, Akbaba et al. (2011) observed that the concentration and peak intensity values of Ca, Fe, P, Zn, Cl, K, Na, Mg and Br elements were higher in the fig samples grown under organic farming regime. Likewise, Al, Cu and S levels were found in higher levels in the samples grown under conventional farming regime. Au and Ba were detected only in organic samples. They reported that organic figs are likely to have higher nutritional mineral content. And the fig samples grown under conventional farming regime could contain harmful metals like Al and Cu that might damage the various systems and/or organs of humans and animals. Organic farming techniques not only increase the quality of the product, but also make it more valuable in terms of health.

In addition to this, in some studies, there are pesticide residues in many products including fig fruit in the literature. Namely, Liu et al.(2020) used the gas chromatography-flame photometric detector (GC-FPD) to detect malathion residues content in vegetables (cherry tomatoes and broccoli) and fruits (mulberries, cranberries, and figs). They found that maximum residual limits (MRLs) of malathion was 1 mg/kg for cherry tomatoes, broccoli, mulberries, cranberries, and 0.2 mg/kg for figs, respectively. These results would be considered as important references for monitoring and assessing the quality safety of agricultural products and protecting consumer health. An other research, Ji et al. (2017) researched on one of the most important mycotoxins, patulin which is produced by a variety of molds (*Aspergillus*, *Penicillium* and *Byssochlamys*), and it has been found in rotting apples, grains, fruits, and vegetables. And researchers investigated 137 fruit products (97 dried fruits, 20 fruit juice and 20 jams) collected from markets in China. They found that dried figs, dried longans (seedless) and dried hawthorn products showed an average of patulin contamination of 87.6mg/kg, 68.4mg/kg and 5.1mg/kg, respectively. At the same time Ciscato et al. (2009), evaluated 140 pesticides residues in tropical fruit species by a multi-residue method using GC and HPLC methodologies. They found on samples of figs and persimmons had the highest violation rates. They suggested that cooperation of producers, to reduce pesticide residues. And Engebretson et al. (2001) found that residues greater than the limit of quantitation for pendimethalin in apple pomace, fresh and dry fig, grass screenings, mint oil, almond hulls, green onion, and tomato pomace (wet and dry).

Conclusion

In this research, pesticide residues on fig fruit that grown in İsafakılar village of İncirliova district of Aydın city are analysed. And no peticides residues found in fig fruit. That is important that studies should be conducted to support and disseminate agricultural techniques such as organic agriculture, which have traceability in consuming healthier products. Considering crop production in organic agriculture, the most obtained product is subjected to residue analysis involving many pesticides in accredited laboratories and certified to be free from any pollution. The product's certificate is a guarantee certificate.

References

Anonymous (2019). https://www.nutfruit.org/consumers/news/detail/statistical-yearbook-2016-17.

Akbaba U., Şahin Y., Turkez H. (2011). Comparison of Element Contents in Figs Grown Under Organic and Conventional Farming Regimes for Human

Nutrition and Health. Fresenius Environmental Bulletin, 20(10):2594-2600

Altındişli A., Ertem A. (1998). First International Symposium on Fig. Acta Horticulturae 480:227-232.

Ciscato C. H. P., Gebara A. B., Monteiro S. H., 2009. Pesticide residue monitoring of Brazilian fruit for export 2006-2007. Food Additives & Contaminants Part B-Surveillance, 2(2):140-145, DOI: 10.1080/19440040903330326

Engebretson J., Hall G., Hengel M., Shibamoto T. (2001). Analysis of pendimethalin residues in fruit, nuts, vegetables, grass, and mint by gas chromatography. Journal of Agricultural And Food Chemistry, 49(5):2198-2206, DOI: 10.1021/jf010048b

Erbay B., Dolgun O., Ertan B. (2011). Sensorial and chemical differences between organic and conventional grown figs (*Ficus carica* L. cv. Sarılop). African Journal Of Agricultural Research, 6(16):3911-3918

İrget M.E., Aksoy U., Okur B., Ongun A.Z., Tepecik M. (2008). Effect of calcium based fertilization on dried fig (*Ficus carica* L. cv. Sarılop) yield and quality. Scientia Horticulturae, 118(4):308-313

Ji X.F., Li R., Yang H., Qi P.P., Xiao Y.P., Qian M.R. (2017). Occurrence of patulin in various fruit products and dietary exposure assessment for consumers in China, Food Control, 78:100-107, DOI: 10.1016/j.foodcont.2017.02.044

Lehotay S.J. (2007). Determination of pesticide residues in foods by acetonitrile extraction and partitioning with magnesium sulfate: collaborative study. Journal of AOAC International, 2007 Mar-Apr; 90(2):485-520.

Liu Y., Liu S., Zhang Y., Qin D., Zheng Z., Zhu G., Lv Y., Liu Z., Dong Z., Liao X., Li X. (2020). The degradation behaviour, residue distribution, and dietary risk assessment of malathion on vegetables and fruits in China by GC-FPD, Food Control, 107, 106754, 10.1016/j.foodcont.2019.106754

Mordoğan N., Hakerlerler H., Ceylan S., Aydın S., Yağmur B., Aksoy U. (2013). Effect of Organic Fertilization on Fig Leaf Nutrients and Fruit Quality. Journal of Plant Nutrition, 36(7):1128-1137, DOI: 10.1080/01904167.2013.780611

TÜİK, (2019). https://biruni.tuik.gov.tr/medas/?kn=92&locale=tr (Access Date: 13.11.2019)

Yılmaz S., Gözlekçi S., Ersoy N. (2017). A review of fig sector in Turkey. Acta Hortic. 1173, 409-414, DOI: 10.17660/ActaHortic.2017.1173.70