

Index

| | |
|--|-----------|
| INDEX..... | V |
| 1 INTRODUCTION AND OBJECTIVES | 1 |
| 1.1 Weeds in agriculture | 1 |
| 1.1.1 Weed management practices | 1 |
| 1.1.2 Impact of herbicide use | 3 |
| 1.1.3 European legislation on plant protection products | 7 |
| 1.2 Microbial community role in soil fertility | 9 |
| 1.2.1 Soil organic matter | 10 |
| 1.2.2 Microbial biomass | 11 |
| 1.2.3 Soil microbial community | 13 |
| 1.3 Weed control methods studied in this work..... | 15 |
| 1.3.1 Natural herbicides: essential oils (EOs), aqueous extracts (AEs) and carvacrol (CAR) | 15 |
| 1.3.3 Synthetic herbicide: Oxyfluorfen (OXY) | 20 |
| 1.3.4 Physical management techniques: tillage and mulching | 23 |
| 1.4 Objectives | 24 |
| 2 MATERIALS AND METHODS..... | 26 |
| 2.1 Soil analysis | 26 |
| 2.1.1 Physical and chemical analyses | 26 |
| 2.1.2 Biological activity | 26 |
| 2.1.3 Microbial community structure | 27 |
| 2.2 Materials and methods used in testing natural and synthetic herbicides | 29 |
| 2.2.1 Plants used as natural herbicides sources | 29 |
| 2.2.2 Natural herbicides production and analyses | 37 |
| 2.2.3 Preliminary soil tests and experimental conditions | 42 |
| 2.2.4 Experiment one: short and medium-term response of soil microorganisms to essential oils with phytotoxic potential extracted from mediterranean plants | 45 |
| 2.2.5 Experiment two: medium term response of soil microorganisms to aqueous extracts with phytotoxic potential extracted from mediterranean plants..... | 48 |
| 2.2.6 Experiment three: short, medium and long-term response of soil microorganisms to natural and synthetic herbicides..... | 50 |
| 2.3 Materials and methods used in study of physical practices..... | 55 |
| 2.3.1 Experiment four: long-term comparison between tillage and mulching effects on soil biological properties | 55 |
| 3 RESULTS AND DISCUSSION..... | 58 |
| 3.1 Essential oils composition and main chemical components properties | 58 |
| 3.1.1 Eriocephalus africanus L. | 58 |
| 3.1.2 Eucalyptus camaldulensis Dehnh. | 63 |
| 3.1.3 Citrus reticulata Blanco | 69 |
| 3.1.4 Thymbra capitata (L.) Cav. | 72 |
| 3.2 Experiment one: short and medium-term response of soil microorganisms to essential oils with phytotoxic potential extracted from mediterranean plants | 74 |
| 3.2.1 Water and Fitoil | 74 |
| 3.2.3 Essential oils treatments | 78 |

| | |
|---|------------|
| 3.3 Experiment two: medium-term response of soil microorganisms to aqueous extracts with phytotoxic potential extracted from mediterranean plants..... | 108 |
| 3.4 Experiment three: short, medium and long-term response of soil microorganisms to natural and synthetic herbicides | 112 |
| 3.4.1 Water and Fitoil..... | 112 |
| 3.4.2 Water and Oxyfluorfen..... | 116 |
| 3.4.3 Essential Oils and Pure Compound | 121 |
| 3.5 Experiment four: long-term comparison between tillage and mulching effects on soil biological properties | 140 |
| 4 CONCLUSIONS..... | 144 |
| 4.1 Experiment one..... | 144 |
| 4.2 Experiment two | 145 |
| 4.3 Experiment three..... | 145 |
| 4.4 Experiment four | 145 |
| 4.5 Final remarks..... | 146 |
| 5 BIBLIOGRAPHY | 147 |