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Sour Fig - An invasive species on Guernsey

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Introduction

Carpobrotus edulis, commonly known as sour fig, is a succulent plant native to South Africa which has invaded the coastal areas around Guernsey. *C. edulis* was introduced as an ornamental plant in the 19th century when it (Varnham, 2006). Published research looking specifically at the response of the species to cold temperature is limited but it has been observed as being susceptible to freezing injury (MacDonald et al., 1984). and Evidence suggests the rate of spread has increased on the island since 1987 due to milder winters and lack of prolonged frost (Varnham, 2006). Hayward and Scopes (2019) habitat survey of Guernsey found areas invaded by *C. edulis* increased by 123% since it was first mapped in 2010 and this corresponds to milder frost free winters. Local volunteer groups are regularly manually removing the plant from coastal areas around the island.

The coastal invasion of C. *edulis* around Guernsey has been observed to have a negative impact on local biodiversity, and this may be due to its effect on the acidity on the soil and it outcompetes native plants due to the fact it has not eaten by any native animals. Observations also suggest that the diversity of pollinators in areas of *C. edulis* is low. This description of the environment change leads *C. edulis* to be considered as a negative ecosystem engineer on the native flora and fauna.

Coule E, (2020) **The residual effect of carpobrotus edualison,** Jersey International Centre of Advanced Studies, MSc thesis
Conser. C, Conor. E, (2009) **Assessing the residual effects of Carpobrotus edulis invasion, implications for restoration**. Bio Invasions (1) 349-358

Research Aims

- To identify the nutrients and pH in the different layers of sour fig
- To compare nutrients and pH of soil that has never had sour fig growth with recently removed sour fig.
- To investigate a biodegradable way of killing off new sour fig invasive growth

Experimental Method

Collection of soil

Advice was taken on areas for collection of soil. This included areas of recent sour fig removal, areas recovering from sour fig removal over the years and areas where no sour fig has been found. In areas of recent sour fig removal sampling was taken from top, middle and bottom layers. These layers were distinguishable by the difference in texture.

Figure 1. *Areas of soil s*

pH

5g of soil was mixed with 20ml of distilled water and stirred for 5 minutes. The suspension was filtered, and the pH of the filtrate was found using a calibrated pH probe.

Phosphates

5ml of filtrate from the pH test was added to ammonium heptamolybdate reagent. Add 5ml of dilute tin chloride reagent. The absorbance of the resulting blue solution can be measured with a colorimeter to measure concentration.

% organic matter

Dried samples in a crucible were burnt for one hour in a strong Bunsen Flame, temperature 400°C. Measurements were taken to find the mass of the ash that was left. Organic matter is mass of the original sample- mass of the remaining ash.

Use as soil

The top, middle and bottom layers of recently removed sour fig were crushed and seeded with cress and compared to standard loam soil and bought fertiliser. They were grown outside.

Reducing growth

New sour fig was sprayed with 5% ethanoic acid. The effect on this new growth was noted after a week.

Potassium

A soil sample was burnt in a hot flame using a nichrome wire washed in concentrated HCl. The colour was noted.

Texture

A small sample of each soil was looked at under a microscope at x100 and photos taken. The type of soil was identifying using a key.

Nitrates

5ml of 0.1M iron(II) sulfate solution was added to 5ml of the filtrate from soil prepared for the pH test. Concentrated sulfuric acid was added dropwise until a brown ring will form at the junction of the two layers.

Soil Type

A soil sample was added to a boiling tube to a depth of 2cm. 20cm³ of water was added and the tube was shaken for 5 minutes then left to settle. The width of the different layers was measured and the type of soil identified. Sand at the bottom, then silt layer and finally a clay layer.

Source: https://hgic.clemson.edu/factsheet/soil-texture-analysis-the-jar-test/

IRIS The Institute for Research in Schools

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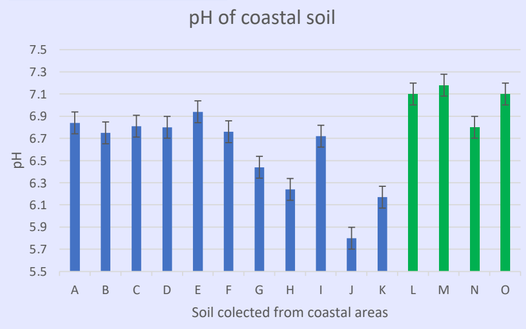
Results



Key
Blue- sour fig
Green – no sour fig
A L M Sour fig removed 2021
B C D E F G H Sour fig removed 2022
G H I Sour fig removed 2012
J K Les Sour fig removed 2020

pH

pH was also confirmed using a soil testing kit from a local garden centre using universal indicator. These results in general agreed with the results above

Texture of the soil

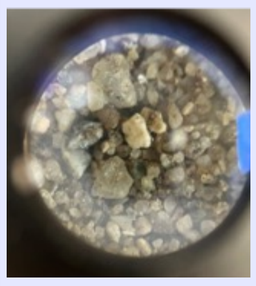


Figure 2 Soil from Area G

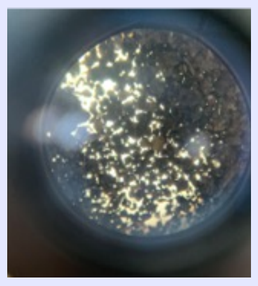


Figure 3 Soil from Area C

As all the sample were taken from coastal areas, quartz and mineral grains of sand were visible in all the samples except those from recently removed sour fig which were full of organic matter. Areas that had sour fig removed many years ago were similar to the surrounding sandy soil.

Soil composition

Figure 4 Soil from Area G

Figure 5 Soil from Area C

The composition of the majority of the soils indicated a sandy loam. The most recent area that sour fig was removed from was just organic matter. There was only a very small clay layer if any.

Potassium

Figure 5 Soil from Area G Speckled potassium test using bought kit. This shows adequate potassium.

Figure 6 Soil from Area G The flame test did not work because the flame colour was yellow which is sodium and masked the faint lilac of the potassium.

Phosphorous

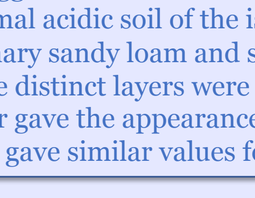
We were unable to get any results using either the bought soil test kit or the ammonium heptamolybdate reagent

Nitrates

We were unable to get any results using the iron sulphate test but with a dip stick test using a bought kit, we established that there was no difference in the nitrate in the soils tested and it was all low.

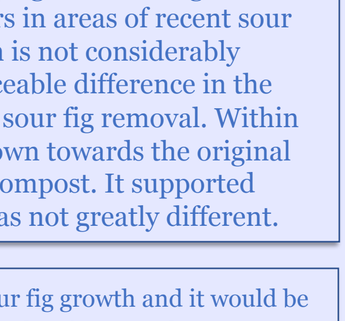
Percentage organic mass

The sandy loam soils had a low organic mass percentage, with most of them very similar at around 30%. The recent sour fig areas consisted of 70% organic mass. This agrees with the soil composition test and the soil texture results.



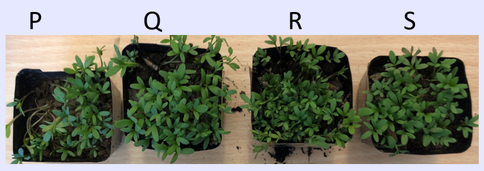
Reducing Growth

Sour fig growth was unaffected after a week by pouring 1 litre of 5% ethanoic acid on it. The appearance of the leaves was a little mottled.



Use as soil

Figure 7. Cress grown in different media. Key: P – top layer of sour fig, Q = bought compost, R = bottom layer of sour fig, S – soil from near the school car park



Analysis & conclusions

Previous studies of areas where sour fig has grown and been removed suggested the soil was very acidic (pH =4) and there were concerns that the dead sour fig was stopping new native growth. Volunteers have therefore been removing both the top and middle layers in areas of recent sour fig removal. These results suggest that the soil where sour fig has grown is not considerably different in pH than the normal acidic soil of the island. There is a noticeable difference in the appearance of both the ordinary sandy loam and soil around the recent sour fig removal. Within the recent sour fig area, three distinct layers were noticed as you dug down towards the original ground soil. The middle layer gave the appearance of deep brown rich compost. It supported lush growth of cress and was gave similar values for N and P and pH was not greatly different.

Further Work. More work needs to be done on ways of killing new sour fig growth and it would be useful to look at more detail at the soil from Fort George as described in Emily Coulson's research..