Culinary oils as herbicides

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Citation Guide

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1. Summary

Incidental observations in previous research at the BHU hinted that off-the-shelf culinary (cooking) oils may have a herbicidal effect. The FFC has studied the effect of a range of culinary oils for their herbicidal effects on a range of weed and crop species. It showed that some oils could kill some plants, and rapeseed oil was the best overall performer. It is hoped that this preliminary look will be a springboard for future research, and due to culinary oils being edible, and therefore very safe to use, farmers will also be able to experiment to see if they are both effective and economic for their farming systems.

2. Introduction

One of the issues with herbicides is they are synthetic (xenobiotic) so biology often lacks the chemistry to decompose them, meaning they can persist in the environment and cause harmful non-target effects, e.g., polluting rivers. Many farmers and scientists have looked for natural (eobiotic) herbicides, as, being naturally occurring they should have a much lower risk to the environment (though not necessarily safer for people). Among the many materials tested over the years have been essential oils, such as clove, coriander and thyme, on the basis they are chemically and biologically active, which is considered a prerequisite for herbicidal ability. However, while scientifically interesting, from a practical viewpoint, they are complete non-starters due to the very high cost of the oils, making them completely uneconomic, even for the highest value crops, as all alternative weed control methods are much cheaper.

Alongside research into the combining of steam with fish fertiliser as a systemic herbicide, conducted in the mid 2000s at the Biological Husbandry Unit (Merfield, 2007), it was noted that some of the oils being tested, when applied without steam (i.e., by themselves) to mixed pasture, had a herbicidal effect, especially the RBD (refined, bleached and deodorised) rape seed oil. The RBD refining process removes the reactive chemicals, such as omega fatty acids, from the raw oil leaving only chemically stable / inactive compounds, to give it a long shelf life and safe to use for deep frying / at high temperatures. The RBD canola oil appeared to translocate within the plant and then cause it to completely die, i.e., it had a systemic action, similar to glyphosate (aka Roundup). In comparison, more chemically active oils, such as unrefined linseed (*Linum usitatissimum*) oil, caused the contacted foliage to die-off, but otherwise leave the plant unharmed. Culinary oils, especially mass produced ones such as rapeseed oil, are vastly less expensive than essential oils, and therefore, may be economically viable to use as herbicides, especially for higher value crops. The Future Farming Centre, therefore undertook preliminary experiments test a range of culinary oils for their herbicidal activity (Hodge *et al.*, 2018).

3. Methods

Four oils were compared, olive, sunflower, rapeseed and linseed, with both a raw and refined form, e.g., organic extra virgin olive vs. extra light olive oil, to see if the more chemically reactive raw forms and the chemically more inert, refined / processed, forms achieved the same herbicidal activity. They were tested on a range of plants, dicots and monocots, both crop plants and weeds.

4. Results and discussion

Overall, the results were mixed. Most plants had their dry matter reduced by most oils, but not all. RBD rapeseed proved the most effective overall, achieving a 90% reduction in oat (*Avena sativa*) dry matter compared to untreated controls, while buckwheat (*Fagopyrum esculentum*) was much more tolerant of rapeseed oil with only a 19% reduction in dry matter.

Generally there was no difference between the raw and processed oils, though in some specific cases there was an interaction between plant species and oil type, for example, organic linseed oil completely eradicated alyssum (*Lobularia maritima*). This undermines the hypothesis formed after the steam and fish trial that it was the lack of chemical reactivity of the RBC rapeseed oil that killed the pasture. However, the alyssum and olive oil example indicates there may be some selective effects, i.e., a particular oil may kill or inhibit some plant species but not others.

However, overall the research clearly shows that it is not only essential oils that have herbicidal properties, but, common culinary oils such as rapeseed and refined oils, can also have herbicidal effects.

This study also used dry matter as its measurement, and this often fails to differentiate between live and dead plants, as dead plants often do not have time to decompose before weights are taken. Visual inspection of the trial plants indicated there were such differences with some plants being entirely killed while others were only inhibited. However, for some crops, inhibiting weeds compared to the crop plants may allow the crop to gain a competitive advantage, and therefore still provide a benefit even though the weeds are not killed.

5. Conclusions

Overall, the research provides a preliminary examination of the use of culinary oils as herbicides and shows that while they are no panacea, herbicidal effects have been achieved, some completely killing the plants. The experiment was also unsuited to economic analysis, so cost-benefit also needs to be established. However, there are also off-the record reports of farmers and growers in South America already using culinary oils as herbicides, indicating that in some situations, the are both effective and economic. By definition, being foodstuffs, culinary oils are very safe, unlike some existing organic herbicides such as concentrated vinegar (acetic acid) and plant oil derived fatty acids, that are corrosive and/or toxic to humans and soil biology, and also essential oils which can be harmful in concentrated forms or larger volumes.

It is therefore hoped that this preliminary work, acts as a springboard for more detailed studies looking at a wider range of oils and weeds in more realistic situations than a glasshouse. In addition, plant physiology and biochemistry studies are required to elucidate how the oils are achieving their effects and therefore be able to identify more effective materials to improve on the mixed results achieved here. As culinary oils are very safe / non-toxic, it is also perfectly possible for farmers and growers to experiment with such oils on their own farms, to see if they are effective for their particular crop-weed combinations, and to work out if they would be economically viable.

The full paper can be accessed from the Journal Organic Agriculture https://doi.org/10.1007/s13165-018-0208-z If you do not have institutional access, please email ffc@bhu.org.nz for an ePrint.

6. Acknowledgements

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7. References

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