



Production of oil in vegetative tissues to increase the nutritive value of herbaceous legume forages.

IMPROVING THE ENERGY CONTENT OF LEGUMES - NEXT STEPS

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Background: Many producers recognize the value of a high proportion of legumes in pasture stands. In addition to fixing nitrogen and reducing reliance on fertilizer, legumes tend to have high yields and quality. Some legume species, such as sainfoin, can be mixed with alfalfa to also reduce bloat.

Oil is twice as energy-dense as carbohydrates, which make up most of the leaves and stems of plants. Traditionally, seeds have been the main source of plant oils and primarily used for food (i.e. canola oil) or biofuel production, with few plants having a significant amount of oil in the leaves. Research groups in other parts of the world have been successful in improving the oil content in the leaves of certain plants. Increasing the oil content in vegetative tissues of forage legumes like alfalfa and sainfoin means those plants would contain more energy, and therefore be a more efficient and productive feedstuff for cattle. Adding oil to feedlot diets at levels that do not exceed 6% of total fat intake has also been shown to decrease methane production by 10-25%.

The [previous iteration of this project](#) created alfalfa and sainfoin plants that increased the leaf oil content from essentially zero to about

5% in both species, without any other visual changes to the plants, and using conventional breeding techniques (aka non-GMO). This project continues the plant breeding selection cycle process.

Objectives: The objectives of this study are to:

1. Determine the stability of increased oil content and fatty acid composition in subsequent generations of sainfoin and alfalfa
2. Examine the potential of applying CRISPR/Cas9 genome editing techniques to favourably alter lipid metabolism in these forage legumes

Implications of the Research: This project will use the new germplasm from the previous projects in further plant breeding efforts to ensure that the increases in oil content in the leaves of sainfoin and alfalfa remain stable from generation to generation and explore the potential of gene editing to supplement conventional breeding techniques.

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