

**Characterization of Seed Oil and Evaluation of Oxalate Oxidase Activity among
Kenyan Sunflower Varieties**

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ABSTRACT

The growing of sunflower (*Helianthus annuus L.*) oilseed varieties in Kenya is faced with challenges of infection by disease and infestation by insect pests, which lower yield of seeds and oil. Infection of sunflower in farms by the fungus *Sclerotinia sclerotiorum* results in heavy losses of the crop. In an effort to encourage growth of suitable sunflower oilseed varieties, this study endeavored to search for varieties with superior oil yield and expressing resistance to degradation by oxalate generated by *S. sclerotiorum* during infection. Wheat oxalate oxidase has been shown to confer some resistance to *S. sclerotiorum*. This study investigated the presence of oxalate oxidase in six sunflower varieties available in Kenya, namely: Kenya Fedha, Rekord, Issanka, H8998, H4038 and H4088. A calorimetric enzyme assay was used to screen for the enzyme activity in sunflower leaf tissue. A detached leaflet assay was conducted and lesion size measured following degradation by exogenously applied oxalic acid on leaf tissue. Sunflower oil was characterized from the six varieties. Acid Value, Saponification Value, Iodine Value, Peroxide Value, Relative Density, Refractive Index and Fatty Acid composition of the oil were determined. The oil content was also determined. The relationship between the oil quality/quantity and level of oxalate oxidase activity was also investigated.

Results revealed that the selected sunflower varieties had an oil content ranging from 40.92% to 50.55% w/w. Varieties H8998 and H4088 had 50.55% (w/w) and 49.41% (w/w) oil content, respectively. The two varieties may thus be recommended for commercial oil extraction. The oils were found to be highly unsaturated at levels of 81.93 to 89.09% of all total fatty acids, making sunflower oil superior to many edible fats and oils used commercially. Peroxide values ranged from 1.04 to 2.98 meq/kg oil while acid values ranged from 0.14 to 0.28 mg KOH/g oil. Saponification values of 162.65 to 171.78 mg KOH/g of oil were also recorded, an indication that the oils were composed of high molecular weight fatty acids. The oil was also found to be pure and light as indicated by Refractive Index and Relative Density values of 1.4709 to 1.4724 and 0.9106 to 0.9193, respectively, making it suitable for various cooking options.

All the varieties responded differently to oxalic acid degradation as characterized by differences in lesion areas per variety ($p < 0.05$) at different acid concentrations. The variety H4088 showed higher oxalate oxidase activity and hence higher resistance to degradation by oxalic acid compared to other varieties and was second highest in oil content (49.40% w/w). This study, therefore, recommends that H4088 be promoted to farmers. The variety H8998 which had relatively less oxalate oxidase activity but highest oil content (50.55% w/w) may also be recommended for transformation with the resistance gene to enhance its oxalate oxidase activity. This study formed a basis for further investigation on resistance of Kenyan sunflower to *S. sclerotiorum* infection and recommends biological studies using the natural pest to be carried out. It also recommends that molecular studies be conducted to determine the genetic potential for resistance in the six varieties.