

“Variation in Oil and Fatty Acid Composition Among Niger Accessions”



Victoria Knapp¹, Fred Allen¹, and Ming Wang²

¹Plant Science Department, University of Tennessee, Knoxville

² USDA Agricultural Research Service, Griffin, GA

vknap@utk.edu

Introduction

In the United States, Niger (*Guizotia abyssinica* L.) is primarily marketed as a seed of choice for American goldfinches (*Spinus tristis*) as well as other song and ground feeding birds because of its high oil content. In countries such as Ethiopia and India, niger is grown as an edible oilseed crop. Fourteen niger accessions of Indian, Ethiopian, and American origin were obtained from USDA/ARS germplasm collection at Pullman, WA and evaluated in summer of 2012 at the East Tennessee Research & Education Center.



Niger seed placed with dime for size comparison

Objective

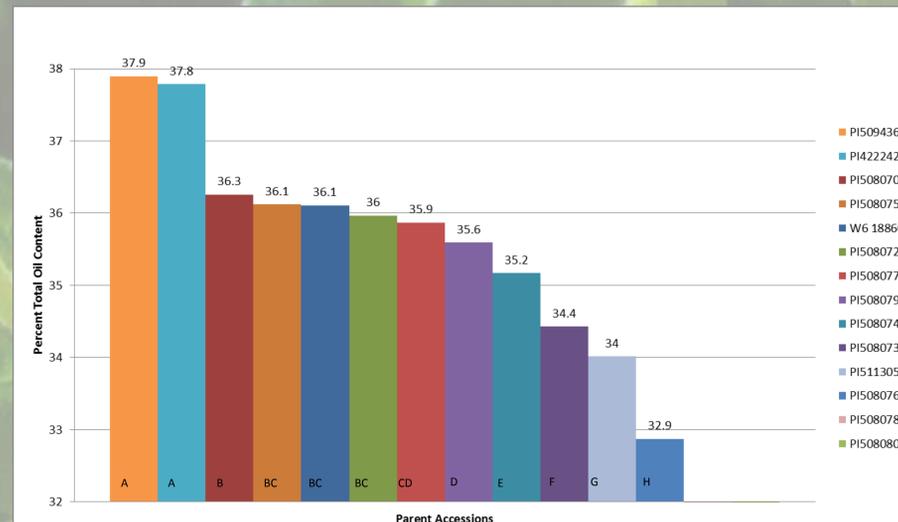
To determine the variation that exists among some of the USDA niger germplasm collection for seed oil and fatty acid composition.

Materials and Methods

A preliminary field trial was conducted in 2012 at East Tennessee Research and Education Center (ETREC) in Knoxville, TN. Sixty seeds of each accession were planted in a greenhouse on 20 July 2012. Ten seedlings were randomly selected from each accession and transplanted to the field on 21 August 2012. On 26 September 2012 the five best individuals of each accession were transplanted into a greenhouse due to seasonal frost. Selections were based on height, number of branches, and overall plant vigor. Individuals within each accession were hand pollinated with other individuals of the same accession 10-30 October 2012.

Seed harvesting of all accessions occurred between 10 December 2012 and 21 January 2013. Seed were then shipped to the USDA-ARS Plant Genetic Resources Conservation Unit in Griffin, GA for analysis of seed oil and fatty acid composition using Near Infrared Spectroscopy (NIRS).

Fig. 1. Percent Total Oil Content. Seed was combined according to accession, and analyzed using Near Infrared Spectroscopy. Data were analyzed with Fisher's Least Significant Difference Test ($P < 0.05$).



† Values significantly different ($P < 0.0001$)

‡ Similar letters indicate values do not differ significantly according to Fisher's Least Significant Difference Test ($P < 0.05$)

§ PI508078 and PI508080 not represented in figure

Results

Percent total oil content (Fig. 1), and fatty acid comparisons (Fig. 2) showed significant differences at $P < 0.0001$.

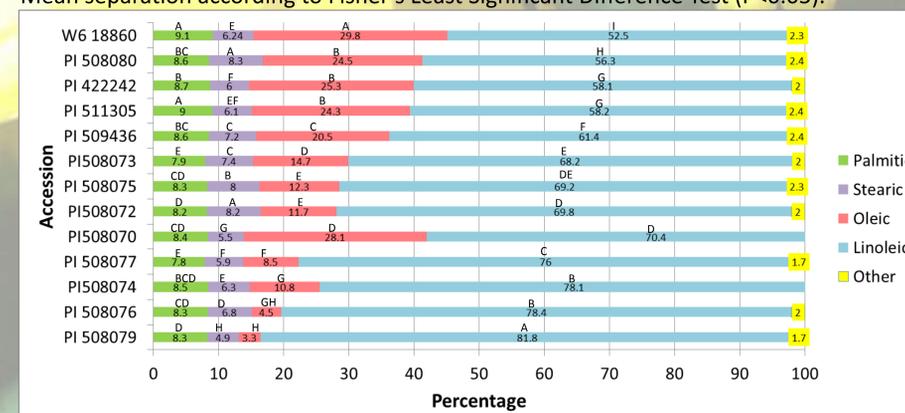
Seed oil ranged between 32.9 to 37.9% (PI508076 and PI509436, respectively). PI 509436 and PI 422242 seeds have significantly greater ($P < 0.05$) oil content than all other accessions. PI 508076 has a significantly lower ($P < 0.05$) oil content than all other accessions (Fig. 1). Major fatty acids included stearic, palmitic, oleic, and linoleic; with linoleic acid in greatest amount. Oleic acid was shown to be highest ($P < 0.05$) in W6 18860 and lowest ($P < 0.05$) in PI 508079. Linoleic acid was highest ($P < 0.05$) in PI 508079 and lowest ($P < 0.05$) in W6 18860 (Figure 2).

A strong negative correlation (-0.99) was found between oleic and linoleic fatty acid ($P < 0.0001$).



PI 508073 showing vegetative growth

Fig. 2. Comparison of four major fatty acids among niger accessions. Seed were combined according to accession, and analyzed using Near Infrared Spectroscopy. The following graph shows the proportion of palmitic, stearic, oleic, and linoleic fatty acid. Mean separation according to Fisher's Least Significant Difference Test ($P < 0.05$).



† Values significantly different ($P < 0.0001$)

‡ Similar letters indicate values do not differ significantly according to Fisher's Least Significant Difference Test ($P < 0.05$). One test was performed on each fatty acid.

Conclusion

Results from seed oil and fatty acid composition show significant variation among the USDA niger accessions. These results indicate the possibility of future breeding efforts to improve seed oil and fatty acid content for niger grown in the United States.

Future Research

Five parent lines have been chosen for crossing to evaluate:

- 1) Self-incompatibility within niger accessions
- 2) Mean yields and yield components (height, number of flowers/plant, number of seeds/flower head, and number of branches/plant) within and among niger populations
- 3) Genetic variance for yield and yield components (height, number of flowers/plant, number of seeds/flower head, and number of branches/plant) among niger accessions
- 4) Correlations between seed yield and yield component traits as well as seed yield and seed oil and fatty acid traits

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