Improvement of Canola Agronomic Practices in Piedmont Soil

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ABSTRACT

Canola "*Brassica napus*" production was evaluated for cultivation in a Piedmont soil (Sandy Clay Loam) at North Carolina A&T State University research farm located in Greensboro, Guilford County. The experiment was conducted using a Split Plot design with main plot factor variety (Virginia and DKW 46-15) and subplot factor fertilizer: NPK
140-56-168 in kg/ha with Soysoap™ (T_5), 140-56-168 (T_4), 70-28-84 with Soysoap (T_3), 70-28-84 (T_2), 0:0:0 kg/ha (T_1). Soysoap was applied through periodic foliar applications to evaluate effectiveness in nutrient absorption. The crop was planted in October and Harvested in May for all three years (2010-2012). Chlorophyll readings were taken with field scout CM-1000. The leaf samples were collected and analyzed for nitrogen. The canola seed yield was recorded and oil was extracted. The oil was then analyzed for free fatty acid composition. In 2012 DKW 46-15 proved to be the highest seed yielding cultivar,(Yield kg/ha). DKW-46 has also shown the highest Oleic acid level. Virginia cultivar has shown significant increases in both linolenic and linoleic acids Due to an increase in linolenic acid it is presumed that Virginia has the least ability to resist oxidation through prolonged periods of storage. There was a significant correlation between the cultivars seed yield (Virginia: r=0.759; DKW 46-15:r=0.658) and chlorophyll meter readings.

INTRODUCTION

It is imperative in North Carolina that we develop and utilize potential new crops that could provide a source of economic stimulus for farmers along with using production practices that enhance productivity and efficiency. Canola could provide many different resources through its production which could lower overall production cost increasing profits locally and providing a source of income and job opportunities. In 2012 an estimated 23.6% of total agricultural expenses are estimated for petroleum fuels, fertilizers, and pesticides with no sign of decreasing in the future (USDA-ERS 2012). Normal practices in agriculture leads to excess nutrients and water and therefore lead to nutrient contamination of the environment (Samborski, Tremblay, & Fallon, 2009).

New agricultural products have been developed such as Soysoap™ which could potentially augment a crops agro physical properties. A small farmer could potentially produce a higher quality and quantity crop while reducing nutrient loss helping reduce economic inputs. Potentially on farm fuel production using more sustainable production methods could not only provide a source of revenue but also produce more environmentally sound byproducts in the process.

Objective:

✓ To improve quantity and quality of Canola yield in North Carolina using various fertilizer treatments in conjunction with a surfactant.

METHODS AND MATERIALS

- Two canola cultivars DKW 46-15 and Virginia were planted in October and harvested in May from 2010-2012 in 30 m^2 plots. Canola seed was planted with a row spacing was 30cm.
- The fertilizer rates were: NPK (kg/ha) 140-56-168; 140-56-168+Soysoap; 70-28-84; 70-28-84+Soysoap and control.
- The statistical design was a split plot with 4 replications. Chlorophyll meter readings were taken 4 times with a Field Scout CM-1000 meter Along with leaf samples to obtain infield nitrogen estimates.
- At harvest the canola crop was threshed and sieved to remove excess debris.
- Canola oil was extracted using two methods (1) Oekotec seed oil press by mechanical extraction as well as using hexane solvent extraction in a soxhlet apparatus.
- Oil was analyzed for fatty acid composition using Gas Chromatograph.
- Soil samples were taken and extracted using Mehlich-3 and 2MKCL to obtain nutrient composition of the soil.

RESULTS

Seed Yield: During 2010 fertilizer treatment produced a significantly higher seed yield (p<.0001) with treatments T_5, T_4, and T_3 having a higher yield potential from T_1. In 2011 seed yields were not affected by the effect interaction or from the individual main effects. In 2012 the DKW 46-15 variety produced a significantly higher seed yield (kg/ha) than Virginia.

Oil Produced From Seed: In 2010 Treatment main effect contributed to the seed to oil yields ,(p<.0001). In 2011 there was no significant change in oil yields based on seed harvested. During 2012 there was a significant increase in oil produced from the main effect from the cultivars in which DKW 46-15 produced a higher oil per seed content than Virginia, (p=.03).

Oil Percentages: During 2010 the Virginia variety yielded significantly higher oil yields than DKW 46-15, (p<.0001). During 2011 and 2012 oil was not affected by treatment and varietal interactions.

Free Fatty Acids: Based on the results DKW-46 yielded the highest amount of Oleic acid, (p=.002) indicating a potentially more valuable oil. Virginia variety produced significantly higher amounts of Linolenic acid, (p=0.04) and Linoleic acid, (p<.0001).

Chlorophyll Meter Readings: Virginia & DKW-46 Variety both exhibited correlation between chlorophyll meter readings and seed yield (kg/ha); [r=0.759, N=15, p=0.001];[r=0.658, N=15, p=0.008]. Potentially using Chlorophyll Meter to help predict yield.

CONCLUSIONS

- The different cultivar potential in seed yield and oil production varied with more reliable trends being observed in the Virginia variety.
- The cultivars potential in the production of oil also varied statistically in 2010 for Virginia being the highest oil producer compared to 2012 in which DKW 46-15 was the highest yielder.
  * We suspect with more replications new trends might occur such as 140-56-168 +Soysoap producing the highest seed yields as in 2010 & 2011 for the Virginia variety.
- * There was a consistent trend in which 70-28-84 +Soysoap \ produced the second highest oil yield leading to the belief that potentially DKW 46-15 could utilize soysoap in a way that lower fertilizer treatments could produce higher oil yields as compared to Virginia in which high fertilizer rates produced in 2 years produced the highest yield at the maximum fertilizer rate.

Table 1. Relationship between seed and oil yields and chlorophyll meter readings

Seed Yield and Solvent Extracted Oil yield (Kg ha^{-1})														
	Virginia							DKW-46						
Fertilizer Treatment (Kg ha^{-1})	2010		2011		2012			2010		2011		2012		
	Seed	Oil	Seed	Oil	Seed	Oil	Meter	Seed	Oil	Seed	Oil	Seed	Oil	Meter
0	187	123	308	187	180	60	153	301	123	233	88	378	313	152
70-28-84	*na	*na	*na	*na	352	295	199	*na	*na	*na	*na	990	445	221
70-28-84 +Soysoap	398	316	517	255	104	188	168	551	316	492	195	462	331	170
140-56-168	453	191	750	373	490	254	200	465	191	558	217	818	281	203
140-56-168 +Soysoap	535	374	1087	567	668	214	247	536	374	492	181	608	163	201

*na=Treatment not added until 2012; *Seed=At time of Harvest; *Oil Solvent Extracted Canola oil total yield;
*Meter=Meter Readings CM-1000 Field Scout

Table 2. Free Fatty Acid Composition of oil from Mechanical Seed Press

2012 Mechanical Press Relative Fatty Acid Composition (%)									
Virginia									
Treatment	(C16:1)	(C18:1)	(18:3)	(C18:2)	(C20:1)	(22:1)	IV[1]	IV[2]	TS
0	3.7	71.31	7.34	16	0.42	0.05	112	117	5.8
70-28-84	3.59	70.46	6.75	15	0.44	0.04	108	114	5.6
70-28-84 +Soysoap	4.87	59.14	9.84	20.7	0.49	0.06	117	112	7.3
140-56-168	2.93	70.09	7.1	15.5	0.38	0.04	109	113	4.9
140-56-168 +Soysoap	3.61	69.71	6.41	15.1	0.59	0.06	107	123	5.7
DKW 46-15									
0	3.52	70.69	7.35	15.2	0.06	*	110	115	4.9
70-28-84	3.6	71.01	7.09	14.7	0.39	*	109	114	5.4
70-28-84 +Soysoap	3.54	71.7	7.06	14.2	0.36	*	108	113	5.2
140-56-168	3.51	71.14	7.22	14.8	0.22	0.03	109	114	5.1
140-56-168 +Soysoap	3.55	71.14	6.85	14.7	0.36	0.04	108	113	5.3

(16:1) palmitoleic acid, (18:1) oleic acid, (18:3) linolenic acid, (18:2) linoleic acid, (20:1) gondoic acid, (22:1) erucic acid
IV[1] =Triglycerides, iodine value
IV[2]=Free fatty acids, iodine value
TS=Total saturated fatty acids are the sum of palmitic (C16:0), stearic (C18:0), arachidic (C20:), benhenic (C:22:0)
***=Below detectable limit**

CONCLUSIONS contd:

* Potentially increased oxidization stability can be achieved in DKW 46-15 due to decreased levels of linolenic acid levels compared to the Virginia cultivar. CM-1000 Field scout chlorophyll meter shows promise in estimating seed yield.

- However, standardization will have to be achieved taking into account genetic and environmental influences.

References

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