# Environment and Herbicides Effects on Oil Content and Fatty Acids Composition in Naked Oat

N. Lanoie[1], J. Collin[1], J. Fregeau-Reid[2], D. Pageau[3], J. Lajeunesse[3], J. Durand[4], A. Vanasse[1]

[1] Department of phytology, Laval University, Quebec, QC, Canada, G1V 0A6
[2] Agriculture and Agri-Food Canada, Ottawa, ON, Canada, K1A 0C6
[3] Agriculture and Agri-Food Canada, Normandin, QC, Canada, G8M 4K3
[4] Semican inc. Princeville, QC, Canada, G6L 4K7
Email: anne.vanasse@fsaa.ulaval.ca

## Introduction

- To feed racing horses, nutritionists require grains with high oil content to obtain higher level of energy. Oat has the highest lipid content of all cereals (Welch, 1995) and naked oat has a higher lipid content than husked oat (Givens et al., 2004).
- Genotype and environment influenced the oil content and fatty acids composition of oat grains (Youngs and Püskülcü, 1976; Youngs and Forsberg, 1979; Saastamoinen et al., 1990).
- Cool temperature increased oil content and had an effect on fatty acid composition (Saastamoinen et al., 1990).
- Herbicide 2,4-D applied at 4-5-leaf stage decreased oil content (Kent and Hutchinson, 1957) but Wabersich (1963) found that MCPA and 2,4-D increased oil content.

## Objective

- Evaluate the effects of environment and herbicides on oil content and fatty acids composition in naked oat.

## Materials and methods

- Factorial experiments with randomized complete blocks design and three replications were set up during two years (2006 and 2007).
- Trial had four environments, four weeding treatments, and eight naked oat genotypes.

➢Environments were chosen because they are located in different climatic area for the cereal production in the province of Quebec, Canada: Normandin (2300 DD[1]), Princeville (2800 DD), St-Augustin (2800 DD), and St-Hyacinthe (3270 DD). [1]DD: degree-days

➢Weeding treatments were: hand weeded check, bromoxynil/MCPA, dicamba/MCPA, and thifensulfuron methyl/ tribenuron methyl. Herbicides were applied at Zadoks 12-13.

➢Genotypes selected for their oil content:
- ❖ low level: Hi Prot, Navaro, Shadow
- ❖ average level: AC Baton, AC Fregeau and VAO-2
- ❖ high level: 05ANS01 and MF2010-17.

- Oil extractions were performed on a Dionex Accelerated Solvent Extraction System 200. Solvents used were hexane:isopropanol (3:2). Fatty acids were separated with a Varian CP 8822 gas chromatograph. Peak area were calculated with Varian Star software.

## Results and discussion

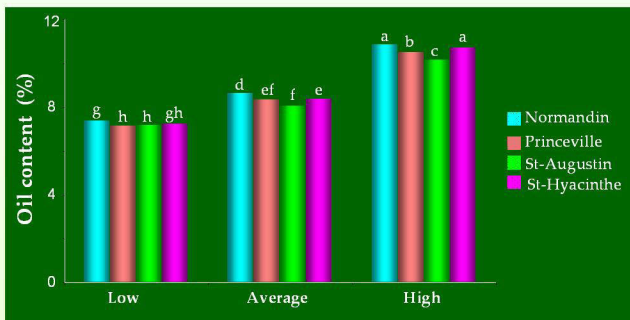



Fig. 1: Environments * Genotypes interaction for the oil content in 2006 (F-protected LSD, $p < 0.01$)

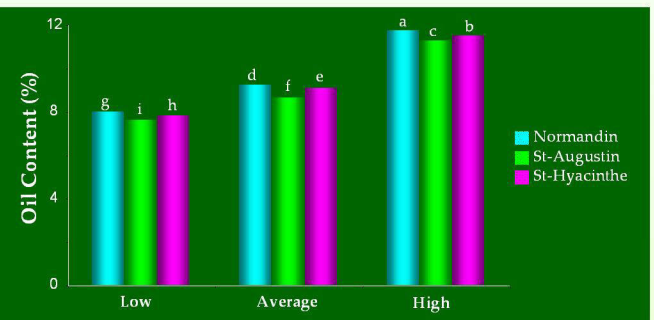



Fig. 2: Environments * Genotypes interaction for the oil content in 2007 (F-protected LSD, $p < 0.01$)

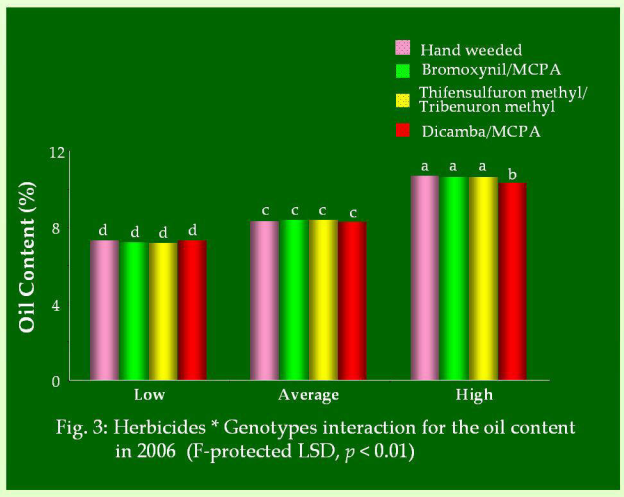



Fig. 3: Herbicides * Genotypes interaction for the oil content in 2006 (F-protected LSD, $p < 0.01$)

### Fatty Acid Composition

➔Environment changes fatty acid composition; none showed higher content in all the fatty acids. Princeville favoured a higher content of oleic acid (C18.1), and St-Augustin the higher palmitic acid (C16.0) content (Fig. 4).

➔ Herbicides influence the fatty acid composition. Thifensulfuron methyl/ tribenuron methyl increased palmitic acid (C16.0) while dicamba/MCPA gave the higher content of stearic (C18.0) and linolenic (C18.3) acids (Fig. 5).

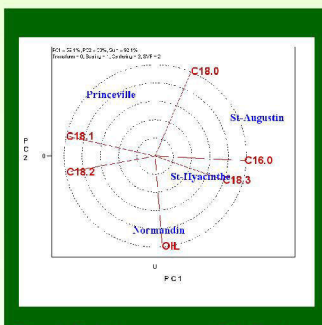



Fig. 4: Relation among Oil, Fatty Acids and Environment 2006-2007 (GGE Biplot)

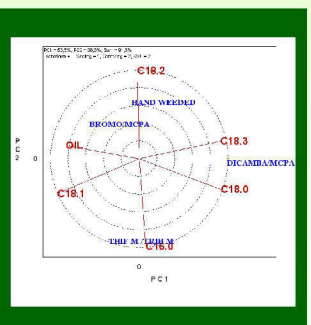
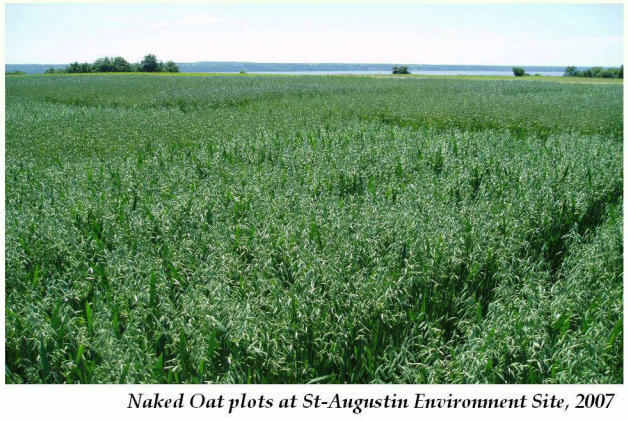



Fig. 5: Relation among Oil, Fatty Acids and Herbicides 2006-2007 (GGE Biplot)



*Naked Oat plots at St-Augustin Environment Site, 2007*

### Oil Content

➔Genotypes are very important in determining the oil content obtained. The high oil genotypes always gave always the higher oil content (Fig. 1, 2, 3).

➔Oil content changes in each environment. Normandin, the coolest environment site gave the highest oil content but St-Hyacinthe, the warmest one, gave the second highest oil content.

➔Year 2007 was colder than 2006. Genotypes with high oil content increase by 1 % their oil content while the low and average genotypes increases only by 0,5 % (Fig. 1, 2).

➔Dicamba/MCPA herbicide affected oil content only in 2006. It decreased the oil content for the high oil genotypes (Fig. 3).

➔Bromoxynil/MCPA and Thifensulfuron methyl/ tribenuron methyl had no effect on the oil content compared to the hand weeded check (Fig. 3).

## Conclusion

- Environment had an effect on both oil and fatty acids content. However, the genetic has more influence on the levels of oil and fatty acids that are expressed by each genotype.
- Only the dicamba/MCPA herbicide had an effect on oil content of high oil genotypes. The effect depended on the year.
- Herbicides also influenced fatty acids composition in naked oat.
- Choosing to seed a naked oat genotype with a high oil content is the best way to obtain grains with a high energy value for feeding racing horses.

## Acknowledgements

This project was supported by CDAQ (Conseil pour le dévelopement de l'agriculture du Québec), FPCCQ (la Fédération des producteurs de cultures commerciales du Québec), Semican inc., FQRNT (Fonds de recherche sur la nature et les technologies) and la Fondation de l'Université Laval. The authors thank Mrs E. Imbeault for their technical assistance in all the analysis.

## References

Givens et al., 2004. Anim. Feed Sci. Technol. 113:169-181.
Kent and Hutchinson, 1957. Ann. Appl. Biol. 45:481-488.
Saastamoinen et al., 1990. Acta Agric. Scand. 40:349-356.
Wabersich, 1963. Albrecht-Thaer-Archiv 7:185-192.
Welch, 1995. Oat Crop Production and Utilization p.279-320.
Youngs and Forsberg, 1979. Crop Sci. 19:798-802.
Youngs and Püskülcü, 1976. Crop Sci. 16:881-883.