Use of Genotypic Variation of Oat *(Aven sativa*. L) Cultivars to Suppress Wild Oat (*Avena fatua.* L*)* Competition

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Abstract

Wild oat (*Avena fatua* L.*)* is considered to be one of the most troublesome weed in oat cultivation due to its difficulty to control using herbicides. Genotypic variation in oat cultivars can be used as a potential strategy to suppress the wild oat competition. Seven oat lines generated from a cross of the forage oat CDC Baler and the semi-dwarf oat Ronald were evaluated for the competitive ability with wild oat. The lines were grown with and without wild oat at 250plants m^{-2} at two locations in 2008.Plant height, light interception, shoot biomass, and grain yield data were recorded. According to the preliminary data analysis the selected cop genotypes shows a significant (P =<0.05) difference in plant height among the genotypes. The grain yield, wild oat biomass and test weight was not significantly different among the oat genotypes. Therefore from these preliminary data the variation for the competitive ability was not identified among the oat genotypes used in this experiment.

Introduction

In cereal cultivation one of the main constraint faced by farmers are the yield reduction due to weeds. Weed competition has been reported to reduce grain yield by up to 29% in barley and 68% in wheat (Hucl, 1998).Wild oat (*Avena fatua* L.) considered as a troublesome weed as it one of the most widespread and harmful weeds species in most of the cereal crops such as wheat (*Triticum aestivum* L.) barley (*Hordeum vulgare* L.*),* oat (*Avena sativa* L.) and rye (*Secale cereale* L.*)* (Scrusoni,and Satorre, 2005).The negative impact in terms of economic terms is enormous, where annual yield losses only from wild oats in Western Canada estimated around 500 million dollars (Manitoba Agriculture 2002).

Wild oat very closely related to tame oat (within the same genera) therefore controlling wild oat in tamed oat cultivation is the major challenge faced by the farmers over the years. Due to phonotypical and genotypical similarities, identification at early stages is a difficult process and even though identified early, control with herbicides is difficult. Therefore alternative means of controlling wild oat must be used in oat cultivations. Enhancing crop competitive ability against weeds can be a viable option particularly for managing wild oat in oats cultivations. Crop species as well as their varieties had been identified to be different in terms of their competitive ability with weeds. Differences in competitive ability of genotypes in crops such as Rice (*Orysa sativa* L.) Barley (*Hordeum vulgare* L.) Wheat (*Triticum aestivum* L.*)* had been identified (Burnside and Wicks 1972; Challaiah et al.1986), and only very few studies are been done on oats (*Avena sativa*. L). Therefore this attempt is to identify the genotypic differences for competitive ability of oats against wild oat.

Methodology

Field experiments were conducted at Kernen Crop Research Farm (52° 9'Latitude, 106° 33' Longitude), Saskatoon, Saskatchewan for two years - 2008 and 2009. Seven oat genotypes generated from a cross of foraged oat CDC Baler and the semi-dwarf oat Ronald were used in this experiment. The genotypes considered in this study were SA050040, SA050479, SA050045, SA050498, SA050049, SA050044, SA050051 CDC Baler, and Ronald. Crop cultivars were planted with and without wild oat plants. The treatments were organized as randomized block design with four replicates. Each replicate consisted of 20 treatments with a plot size of 2x6m.Wild oat and tamed oats were seeded with targeted populations of 250 plants/m2.

When plants were at about flag leaf stage, light transmission through the crop canopy was measured using line quantum sensor (Licor). At flowering stage plant heights were measured. At late milk stage of oats (Zadoks 80) crop and wild oat shoot biomass were taken using 0.25m^2 quadrates from both front and back of each plot. The plots were direct combined and harvested grain samples were placed in a drying room for 3 to 5 days before they were weighed. Dried grains were cleaned and total weight and the test weight was taken.

Results and Discussion

The final outcome of crop weed competition is the reduction of the grain yield. Initially the competition effect can be identified by the reduction in crop biomass. Based on the preliminary analysis of the data in Sutherland 2008 there was no significant reduction in the oat biomass under the competition with wild oat (Fig.1.)

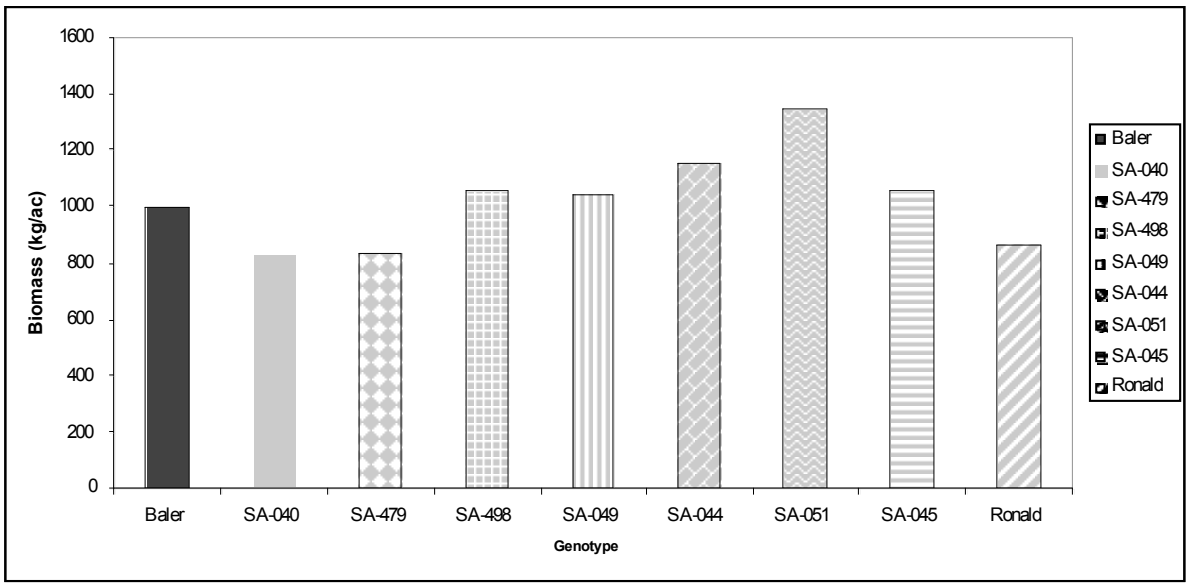

Figure. 1 Variation of oat biomass among oat genotypes under wild oat competition

The grain yields of all the oat genotypes did not gave any significant reduction with wild oat competition. The variety Ronald had given a greater yield either with or without wild oat competition in comparison to the rest of the genotypes. Although the progeny was expected to be more competitive and to give greater yields, results indicated that they are more similar to their parents (Fig.2).

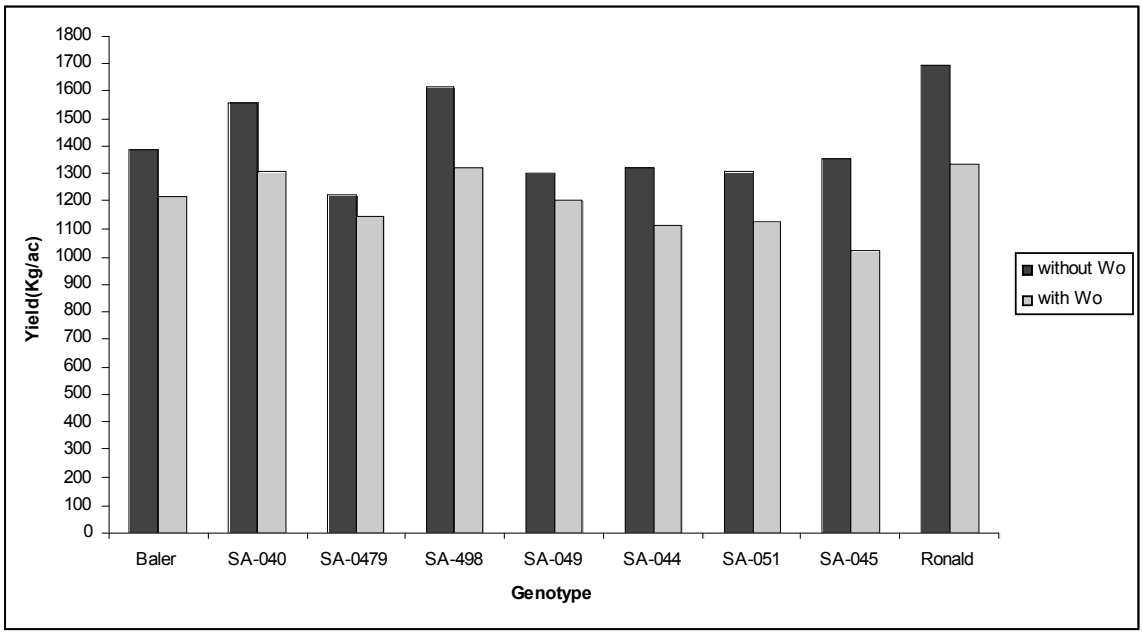

Figure.2 Mean grain yields of genotypes with and without wild oat competition

The existence of weed competition not only will affect the quantity of yields but it can also affect the quality of the yield. In this experiment the grain quality parameters tested, such as test weight was not significantly different among the genotypes (Fig.3).

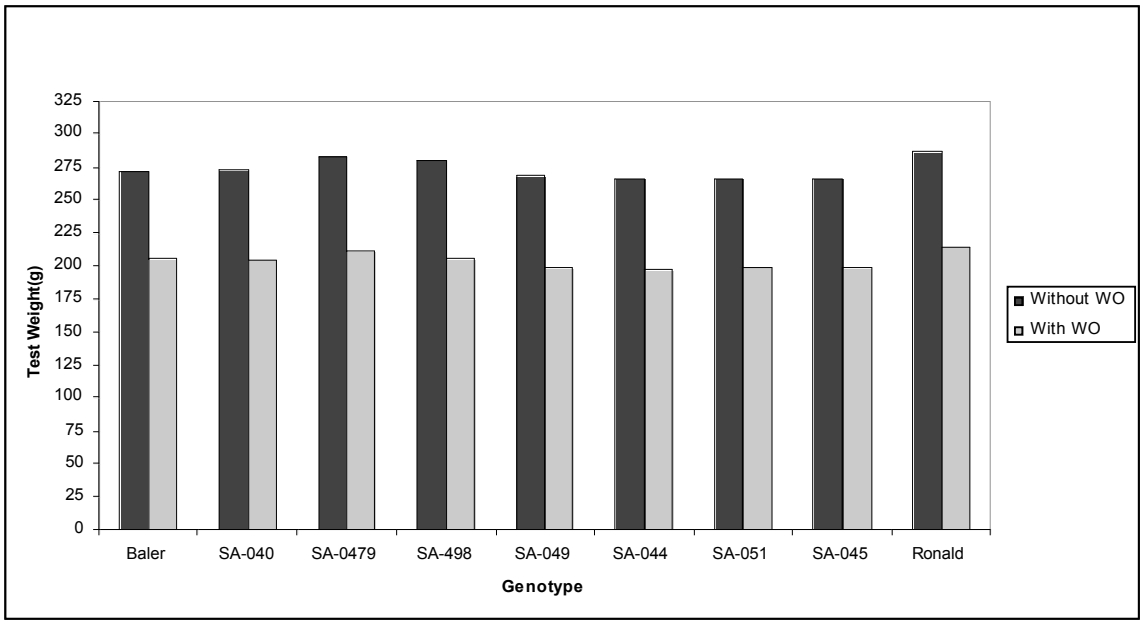

Figure.**3** Effect of wild oat competition on test weight of the genotypes

The oat genotypes used in the experiment had shown a greater variability in plant height. The genotype Ronald and SA05040 was the shortest variety and the genotypes SA050479 and SA050498 had a greatest plant height than the other genotypes (Fig.4).

The rest of the genotypes used had shown intermediate plant heights of the parental plants. In many of the early studies it was identified that plant height can be a major trait for determining the competitive ability in cereals. Richards (1992) identified that taller Australian wheat varieties have greater early vigor than short varieties. The results obtained from this experiment are not sufficient to give a conclusion on this relationship.

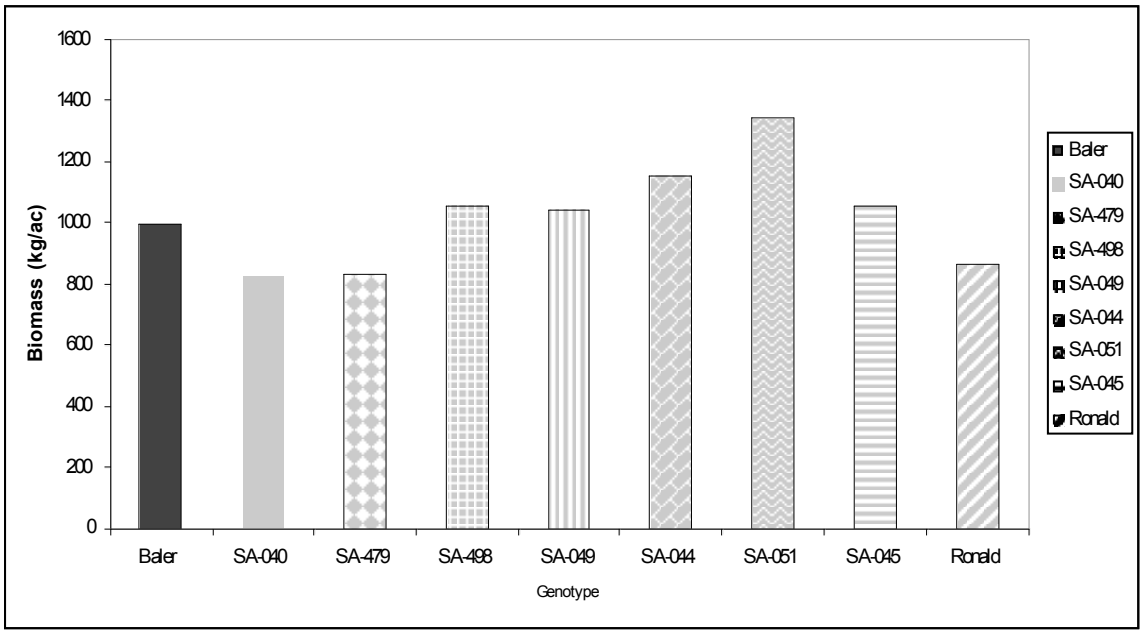

Figure.4 Plant height variation among oat genotypes

Based on these preliminary results it is not possible to build up any conclusions on the competitive ability of the genotypes tested. The competitive ability of crops can vary based on the environment, weed density and many more factors. Therefore this experiment will be carried out in multiple locations and couple of years before making any conclusions.

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