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Investigation On The Amount Of Seed On Organic Rapeseed Emergence, Density, Weed Biomass And Grain Yield

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Abstract: Rapeseed and canola are closely related members of the mustard family (Brassicaceae) that are both grown as oilseed crops. An experiment was carried to investigate the effect of seeding rate on canola emergence, red legged earth-mite (RLEM) density, weed biomass and grain yield was established at a private farm in Karaj during 2009 under a certified organic regime. Canola, cv. Ripper, was sown in acid soil (pHCa 5.2) at three seeding rates; 5, 7.5 and 10kg/ha with phosphorus (P) applied with the seed as Guano™ at 10kg/ha. Increasing seeding rate resulted in more canola plants/m^2, less weed biomass and improved yields. Seeding rate did not affect the number of ryegrass seedlings at emergence or crop biomass. Red legged earth-mite numbers were highest on the 10kg/ha seeding rate but there were no significant differences between the treatments. Increasing seeding rate had no effect on protein or oil contents. No effective management of the RLEM population was carried out during 2008 so the risk of the canola being affected by this pest was high. Despite higher RLEM densities on the 10kg/ha seeding rate earlier in the season, the increased plant density was able to survive the mite attack and significantly reduce weed biomass to provide economic yields. Increased seeding rates in canola may provide an effective tool for organic producers to reduce the impact of weeds and RLEM.

Key words: Canola, Organic farming, ryegrass, seeding rate, red legged earth mite, grain yield.

INTRODUCTION

Canola is the third most important source of plant oil in the world after soybean and palm oil (Sovero, 1997). It is also an excellent rotation crop to control cereal diseases, pests and weeds. It has a good stable yield, which requires normal farm equipment. It grows in areas that receive more than 300mm of rain, well-drained soil with a good potential for growing wheat, relatively free of broad leaf weeds, and residues of broad leaf herbicides. However, care needs to be taken not to plant in areas where it has grown consecutively for the last three seasons (Grombacher and Nelson, 1996). Production of canola is recently expanding in the Iran. It does have also the potential to grow in Karaj, because mustard, which is of the same family, grows well on the highlands. The Eritreans use the leaves at its young age as cabbage and after maturity the seeds are used for the preparation of spices.

Canola seed yield and percentage oil content by mass increases with the amount of water it receives. Water stress during the flowering stage has a severe impact both in the seed yield and percentage oil content. Therefore in seasons, with low or no rainfall at all, the crop needs to be supported by irrigation. However, the availability of water for irrigation is becoming scarce due to low rainfall as well as an increase in the demand of water for all industrial, domestic, municipal and other activities. A good irrigation water management practices are required to get promising yield with good water use efficiency. This can be facilitated by quantifying crop water requirement accurately.

Canola has been identified as having strong potential for export growth within the organic sector (McCoy *et al*., 1998). Conventional canola production is heavily reliant on inputs of herbicides and insecticides to manage weeds and insect pests such as RLEM (*Halotydeus destructor*). These inputs are not allowed in a certified organic farming system, so an integrated approach to management of pests is required. Previous research by Peltzer (Peltzer., 1999) in Western Australia has shown canola to be a poor competitor against ryegrass in comparison to cereals and yield losses of between 9 and 30% have been shown with ryegrass densities of 300 plants/m^2 (Lemerle., 1995). This experiment was established to determine whether increasing the seeding rate of canola could affect competition from ryegrass, and withstand RLEM attack under a certified organic production system.

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MATERIAL AND METHODS

The experiment was established at a private farm in Karaj. The site was a mix of Chromosol and Dermosol soils. Soil chemical properties measured in the 0-10 cm depth were pH_{Ca} 5.2, 20 mg/kg of available sulphur, and 4 mg/kg Olsen P. Available nitrogen of 121.2 kg/ha was measured in the 0-100 cm depth. Canola, cv. Ripper, was sown into a prepared seed-bed at three rates; 5, 7.5 and 10 kg/ha with phosphorus applied with the seed as Guano™ at 10 kg/ha and the experiment was replicated 4 times. Difficulty in obtaining sufficient precision between the 5 and 7.5 kg/ha seeding rate was experienced with the machinery used in sowing. This has affected the results obtained for canola emergence at the low seeding rates such that comparisons can only be made between the two lower rates and the 10 kg/ha rate. Growing season rainfall (April - November) was 318 mm compared with a long-term average of 439 mm. Previous weed management on the site involved cutting a legume hay crop in October. The canola was sown in early June, windrowed in November, and harvested in early December. At crop emergence 10 samples per plot ($28m^2$) were taken to assess RLEM population density using a suction sampler with a diameter of 125 cm in mid June 2009.

RESULTS AND DISCUSSION

Increasing seeding rate to 10 kg/ha resulted in more canola plants/m^2 at emergence (Table 1). The pre-sowing ryegrass density on this site was 1,000 plants/m^2 in early April. Cultivation prior to seeding resulted in effective ryegrass control but an average of 91 ryegrass plants/m^2 germinated with the canola (Table 1), and this had increased to a density of 108 plants/m^2 by early flowering (Table 2). RLEM density on this site in Spring 2008 was 7,890 mites/m^2 and when we measured the density in June 2009, there was an average of 76 mites/m^2. When canola and weed biomass were assessed in late October, significant differences were found in the amount of weed dry matter between the lower, and the high seeding rates (Table 2). The higher seeding rate resulted in a lower weed biomass measurement, and this trend was repeated in grain yield, with the 10 kg/ha rate resulting in the highest yield of 1.6 t/ha (Table 2). There was no effect of seeding rate on oil content or grain protein (Table 2). Ryegrass density throughout the season was consistently below 300 plants/m^2 where significant yield losses in canola can occur (Lemerle *et al*.,1995), and the density of RLEM was below control thresholds currently recommended in conventional canola production (1,000 mites/m^2) (McCoy *et al*., 1998). So, yield losses from ryegrass competition and RLEM damage were not expected to be significant. Despite the differences in canola emergence, there was no difference between the seeding rates in crop biomass production (Table 2) suggesting that the canola was able to compensate in biomass growth from initial low plant densities. Our results suggest that a higher canola seeding rate may provide sufficient competition to reduce weed biomass production, and thus have a positive effect on grain yield. Greater precision in seeding rate is required if these results are to be validated further in this environment.

Higher seeding rates can result in higher canola yields in organic production systems, but reduction of RLEM population in the previous year and prior weed management is critical to achieve this result.

Table 1: Canola and ryegrass density at emergence (18/7/05) and RLEM density (15/6/05).

Seeding rate (kg/ga)	Canola emergence (Plants/m^2)	Ryegrass density at emergence (Plants/m^2)	RLEM density (No./m^2)
5	73	85	54
7.5	68	79	66
10	97	109	109
LSD=0.05	19	ns	ns

Table 2: Ryegrass density at early flowering of canola, canola and weed biomass, grain yield, oil content and grain protein.

Seeding rate (kg/ga)	Ryegrass density at flowering (Plants/m^2)	Canola biomass (kg/ha)	Weed biomass (kg/ha)	Grain yield (kg/ha)	Oil Content (%)	Grain Protein (%)
5	107	2645	690	1.4	39.6	21.7
7.5	111	2774	860	1.3	39.2	21.9
10	106	2607	514	1.6	38.5	22.0
LSD P=0.05	ns	ns	269	0.2	ns	ns

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