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The effects of different cattle manure levels and branch management methods on organic production of *Cucurbita pepo* L.

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Abstract

To study the effects of different manure levels and two branch management methods on organic production of Schneider squash, a field experiment was conducted during 2005 and 2006. Treatments were four manure levels (10, 15, 20, 25 ton ha^{-1}) and two branch management methods (with and without a wood pole), which were allocated to main plots and subplots, respectively. Results showed that the crop performed better in branch management without a wood pole than with a wood pole. Results showed that in the first year, manure level had a significant effect on fruit and seed yields. However, these traits were not significantly affected by manure levels in the second year. For both years, there were no differences in seed numbers due to manure levels. Seed oil content was slightly increased when the manure level was increased from 10 to 25 ton ha^{-1}.

Keywords: Schneider squash, manure, seed oil, yield, organic production.

Introduction

In recent years the safety and health of food has becoming a major concern due to overuse of chemicals for food production and its negative impacts on human health and environment (Gliessman 1998; Pimentel 2005). For this reason, cultivation of medicinal plants and other food plants with medicinal properties have been expanded (Berenyi 1998). *Cucurbita pepo* is an important oilseed plant that is used in food and also in cosmetics and health items (Aruyi et al. 2000; Younis & Al-Shihry 2000; Bombardelli et al. 1997; Murkovich et al. 1996). Murkovich et al. (1996) worked on a hundred lines of this species and found 39.5-56.5 % oil and 21-67.4 % linoleic acid content. Aruyi et al. (2000) reported that the ranges of oleic and linoleic acids in the seeds were 75.98-81.84 and 12.1-16.54 %, respectively. The purpose of this experiment was to study the effects of different manure levels and branch management methods on yield, oil and protein content of *C. pepo*.

Materials and methods

This study was conducted for two growing seasons of 2005-2006 on the Research Farm of the Faculty of Agriculture, Ferdowsi University of Mashhad, Iran. The experiment was in the form of split plot based on a randomized complete block design with three replications. Cattle manure levels of 10, 15, 20, 25 ton ha^{-1} were applied in the main plots, and branch management method (with and without a wood pole) were allocated to the subplots. The nutrient content of the cattle manure used was 2.11, 0.73, and 1.88 % N, P and K, respectively. The original nutrient content of the soil was 755, 42 and 465 ppm N, P and K, respectively. No chemical fertilizers or biocides were applied and weeds were controlled by hand. In the second year no soil tillage

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was conducted and seeds were planted on the same place and the same date as the first year. However, based on the results of the first year in which the superiority of plants without a wood pole was confirmed, this treatment was not continued for the second year. Therefore, in this year only the effect of manure was investigated, and the experiment was analyzed with levels of manure only. For analysis of variance (ANOVA) Minitab software Ver. 13 was used and means were compared using Duncan's multiple range tests at 5% probability level.

Results and discussion

Results of combined analysis of the experimental data showed that the effect of manure application on fresh fruit yield was significant; however, manure application did not affect seed dry weight and seed number (not shown). With increasing application of cattle manure to 25 ton ha^{-1} an increasing trend was observed in the yield of fresh fruit (Fig. 1). However, in the second year, application of manure did not affect yield. Averaged over two years, an increasing trend in fruit yield was observed from 10 to 20 ton ha^{-1} cattle manure, but no significant difference was observed between 10 and 15 ton ha^{-1}.

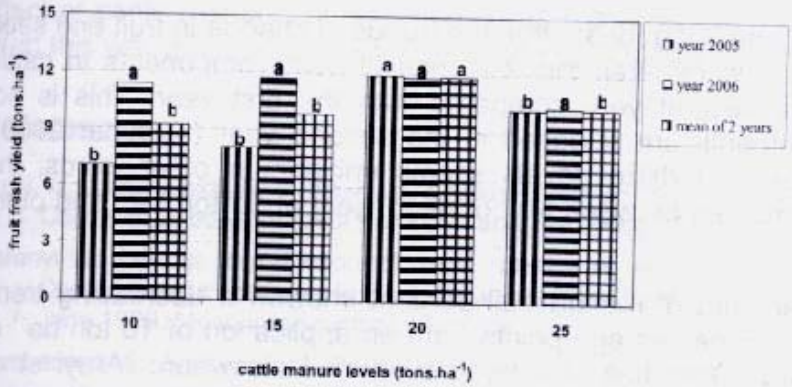

Figure 1: Effect of cattle manure levels on C. pepo fresh fruit yield. Similar letters indicate no significant differences between means within a year ($p<0.05$).

In general, the effect of cattle manure level was inconsistent, and a reduction of yield at 20 ton ha^{-1} seems to be unusual. However, it may be postulated that the effect of cattle manure on this species is achieved up to 20 ton ha^{-1}, and a further increase may have had a detrimental effect, possibly due to plants dying off. It also could be assumed that higher levels of cattle manure might have caused water to be stored in the root zone and hence leading to the spread of root pathogens. Visual investigation showed die-off of more plants at the highest manure level (25 ton ha^{-1}), which could have been associated with this effect. There is evidence (Bombardelli et al. 1997; Khorrami Vafa, 2006) that a well-drained soil is suitable for this species. This could be an indication of the sensitivity of plants to a high level of water in the root zone. On the other hand, it has also been reported (Aruyi et al. 2000) that application of high level of nitrogen fertilizers caused fresh vegetative growth and hence low yield of fruit. Therefore, the low yield at 25 ton ha^{-1} cattle manure could be associated with higher water level in the root area and also availability of more nitrogen, which changes the proportion of vegetative to generative growth.

Figure 2 shows that with increasing the cattle manure level from 10 to 20 ton ha^{-1} in the first year seed yield was increased, but there was no further increase from

increasing the level of manure to 25 ton ha^{-1}. However, in the second year there were no significant differences among the seed yields.

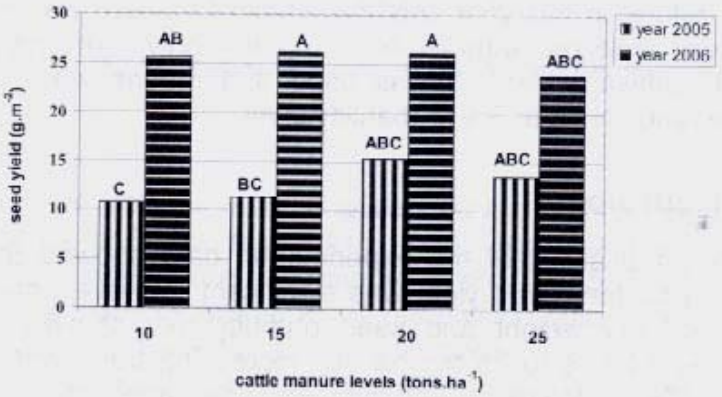

Figure 2: Interaction between cattle manure levels and year of experiment on C. pepo seed yield. Means followed by the same letters do not differ significantly ($p<0.05$).

From comparing Figures 1 and 2 it appears that the trends of change in fruit and seed yields are somehow similar. In general, the response of both components to cattle manure was higher in the second year compared with the first year. This is not unusual because more nutrients are released in the second year (Kuepper 2000). However, lack of response to fertilizer levels seems unclear. In other words, the reason there were no differences between fruit or seed yield at 10 ton ha^{-1} and other manure levels is unusual.

With an increase in the amount of manure, oil percent showed a decreasing trend (Fig. 3). This decrease was 5 percentage points from an application of 10 ton ha^{-1} of cattle manure to 25 ton ha^{-1}. This has also been confirmed elsewhere (Aruyi et al. 2000). Also, the effect of cattle manure on protein content was negligible, an increase of 1 percentage point unit was observed going from 10 to 25 ton ha^{-1} (Fig. 4). As a general trend, nitrogen fertilizer has been reported to increase protein content (Levitte 1980; Khorrami Vafa 2006).

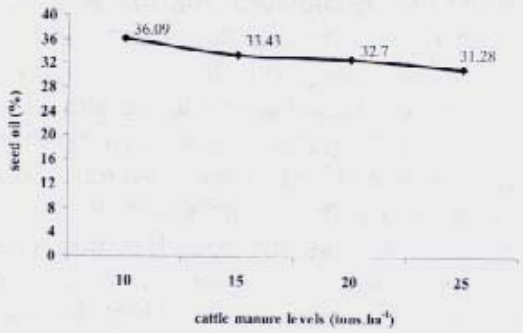

Figure 3: Effect of cattle manure levels on *C. pepo* seed oil content

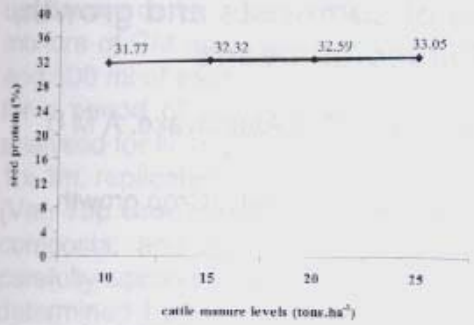

Figure 4: Effect of cattle manure levels on *C. pepo* seed protein content

Conclusion

The effect of cattle manure on fruit and seed yields are similar; when the rate of cattle manure was increased to 20 ton ha^{-1} an increasing trend was observed, but a further increase in cattle manure either did not change the yield or a slight reduction was observed. Therefore, an optimum amount of manure seems to be 20 ton ha^{-1}. The effect of cattle manure, as expected, was higher in the second year than in the first year; this was more pronounced for seed yield than for the fresh fruit yield.

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