Evaluation of nitrate leaching in drain water under canola cultivation in north of Khuzestan, Iran

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Abstract: Due to important role of Nitrogen in harvesting agricultural products in arid and semiarid regions, because the leachable of this, it is necessary to evaluating nitrogen leaching with No3 form into drain water. The purpose of this study is to determine the concentration of leached Nitrate from the drains in 30 and 60 cm soil depths of Canola plants cultivar Sor19 in three levels of nitrogen fertilizer in Dezful, Iran in 2012. The experiment design was completely randomized and has been repeated for three replicates. The design included twelve experimental plots that furrow irrigation method were applied and the water need in an I_{100} millimeter level and the experiment also had contained three fertilizer levels of N_{100}, N_{150} and N_{200} Kg per hectare. The SPSS were applied to analyze the data and in order to compare the means, Duncan test was applied. The achieved results showed that highest amount of leaching with average concentration of 78 mgr/L belonged to N_{200} level in the depth of 30 cm and lowest amount of leaching with average concentration of 7.7 mgr/L belonged to N_{100} level in the depth of 60 cm.

Key words: Canola SOR19; Dezful; Leaching nitrate; Nitrogen

1. Introduction

Canola is one of the most important farming plants for oil production all over the world (Alberk, 2006). Leaching is the exit of minerals, salt and other water solute elements from the plants' root area via water. This phenomenon is considered in the case of applying any dynamic or soluble fertilizers like nitrogen, potassium chloride, potassium nitrate, magnesium sulfate and boric acid fertilizers (Mohseni far et al., 2010). Nitrogenous fertilizers are one of the main contaminators of water resources because they leach the soils' No_3 and are also being overused (Gheisari et al., 2006). In order to prevent the nitrate leaching to groundwater, it is necessary to apply methods of determining plants' real need of nitrogen (Moez-Ardalan et al., 2002). In the condition that the amount of nitrate is more than the plants need, it will be rapidly washed away from the soil profile because nitrate louds are homologous with clays of soil. The high amount of nitrates founded in plants drainage indicates the misuse of nitrate fertilizers and low efficiency of fertilizing. Consequently, in addition to the increase of the products' prices surface and ground water will be polluted and it causes algae to be grown in ponds and lagoons. Growth of algae will result in death of aquatics (Jafari et al., 2006, Mirza et al., 2006). Not only as a chemical fertilizer, but also nitrate is considered as human and environment health threatening factor. For example overuse of nitrogen fertilizer whether artificial or organic in agriculture caused vegetables, soil and drinking water contain higher amount of nitrogen (Santamaria, 2006). The main purpose of this research is to study the effects of different levels of nitrogen fertilizers on nitrogen leaching appear in the form of canola roots' drainage.

2. Materials and methods

The present study was conducted in 2012, in Dezful. Dezful is located on the north of Khuzestan. It is placed in geographical length of 48 degree and 24 minutes from the east, the geographical width of 32 degree and 22 minutes from the north and the height level of 147 meters from the sea level. The research design was completely randomized and had been repeated for three times. The design included twelve experimental plots, furrow irrigation method were applied and the water need in an I_{100} millimeter level contained three fertilizer levels of N_{100}, N_{150} and N_{200} Kg per hectare.

Before conducting the experiment a soil sample has been extracted from the depth of 0-30 cm and 30-60 cm of the experimental terrace in order to determine soils' physical and chemical features like soils' texture, SP, EC, pH and the amount of organics exist in the soil. After that the terrace was prepared to cultivate canola cultivar sor19. The experiment was started on September. In the control treatments no nitrogen fertilizer has been used i.e. N_0. The second treatment was N_{100} Kg per hectare, the third one was N_{150} Kg per hectare and the forth one was N_{200} Kg per hectare. This amount of nitrogen

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fertilizers has been specified for each of the twelve plots and in three phases. The method of furrow irrigation was applied and all terraces have been irrigated in six phases since January 14th to May 15th. In order to gather the drainage, the vase shape bowels were dug in the depth of 30 and 60 cm. the drainage samples were gathered in six phases. The amount of the nitrate existed in drainage was also determined by spectrophotometer. The SPSS version 15 and the Duncan test were applied for analyzing the data.

3. Results and discussion

This experiment was conducted on three level of fertilization 100, 150 & 200 Kg per hectare. After determining the amount of nitrate existed in drainage, the data were input into EXCEL and were shown in a diagram. In order to determine the average amount of lost nitrate Duncan test and SPSS version 15 were applied. The results are presented in Table 1.

Table 1: Comparison mean of nitrate concentration (mgr/l) between different nitrogen levels

Nitrogen level (kg/hec)	soil depth of 30 cm	soil depth of 60 cm
100	84 ⁄44 ab	71 ⁄25 a
150	09 ⁄46 a	66 ⁄43 b
200	63 ⁄35 b	87 ⁄56 b

According to data shown in table 1, the effect of different levels of treatments on the concentration of nitrate in depth of 30cm was significant. The densest nitrate related to third treatment level i.e. 150Kg per hectare with concentration of 46.09 and the lowest concentration related to forth level of treatment i.e. 200Kg per hectare with concentration of 35.63.

The effect of different levels of treatments on the concentration of nitrate in depth of 60cm was also significant. The densest nitrate related to forth treatment level i.e. 200Kg per hectare with concentration of 56.87 and the lowest concentration related to second level of treatment i.e100Kg per hectare with concentration of 25.71.

As it is shown in figure 1 and figure 2, there is a direct relationship between the amount of used nitrogen fertilizer and the concentration of nitrate existing in drainage i.e. with enhancing the treatment levels, the drainages' nitrate concentration are enhanced. These can be happened due to plants' absorption and reduction that caused by leaching. From March 12th, the change line was first ascending and then descending. The reason is that in March 5th, the second phase of fertilizing was fulfilled. After solving nitrogen fertilizer in to water, the leaching process has been started and then again due to what has been said above the changes direction became descending again.
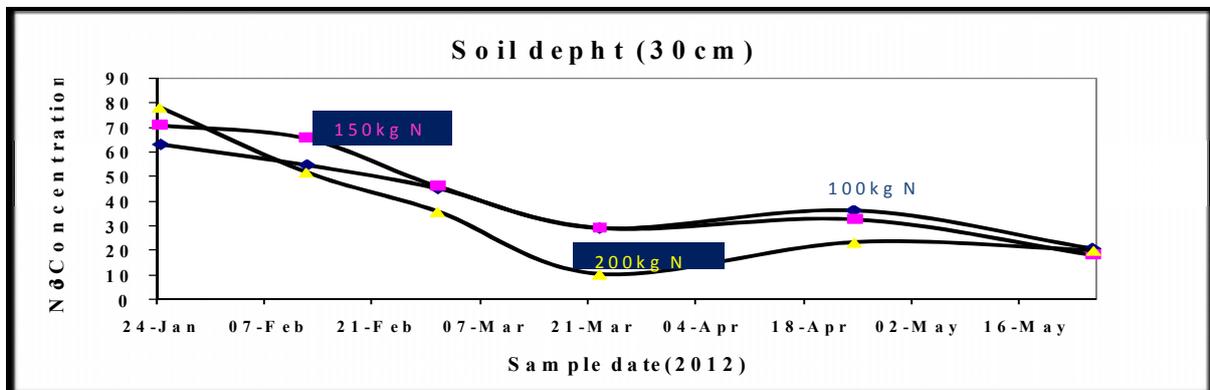

Fig. 1: Changes of nitrate concentration in soil depth 30 cm and nitrogen different level
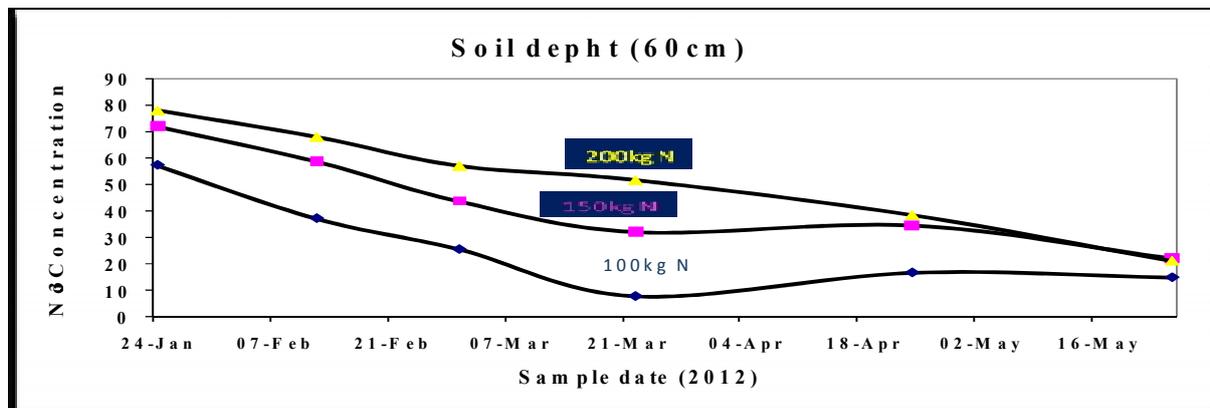

Fig. 2: Changes of nitrate concentration in soil depth 60 cm and nitrogen different levels

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