

Integrated Crop Management Effect on Carbon and Nitrogen of Soil

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Introduction: Recently, destruction of soil organic matter and its has caused by continuous utilization of soil and disregarding crop rotation, especially in arid and semiarid regions such as Iran. Considering hazards and contamination caused by the application of chemical fertilizers, reducing consumption of these inputs, finding ecological methods to provide crop nutrition supplies, increasing and maintaining soil fertility is consequential. Cultivation of the appropriate pre-sowing plants, is one of these methods which can act as green manure to maintain soil fertility by recycling carbon, organic matter and total nitrogen in the soil due to increase in microbiological activity and release nutrients for plants uptake. Therefore, this study aimed to investigate the effects of integrated crop management on soil nutrients characteristics and nitrogen mineralization during the period after adding green plant residues was conducted in Karaj.

Materials and Methods: This research is performed during growing season 2013-14 at the Agricultural Research Station of Islamic Azad University, Karaj, Iran. The experiment was conducted as a split plot based on a randomized complete block design with four replications. Main factors included pre-sowing treatments in 4 levels (Perko PVH, Buko, Cattle manure and Fallow) and sub factors also included nitrogen levels (120 and 240 and 360 kg ha⁻¹, utilized urea source). Perko PVH and Buko belong to Brassicaceae family which can increase the soil organic matter content when ploughed directly into the soil as green manure. Pre-sowing of Perko PVH and Buko were planted in the middle of March. Pre-sowing plants were removed before flowering stem emergence coincide with the end of the vegetative stage, two weeks before the corn was planted and plant residues were rotated and mixed with soil. In order to apply cattle manure treatments in intended plots the amount of 7 ton ha⁻¹ was given to the soil prior to corn. On July 6, 2014 corn planting was done by pneumatic machine. Nitrogen fertilizer split and applied in 3 rounds as topdressing in the amount of 10, 70 and 20 percentage in the five-leaf stage, Stem elongation and tassel emergence stage, Samples were randomly taken after harvesting corn silage from zero to 30 and 30 to 60 cm depths in each plot and mixed together. Soil samples separately were dehumidified by air and were passed from 2 mm sieve. Organic carbon content of soil samples was determined by oxidation in the presence of potassium dichromate and concentrated sulfuric acid (Hesse, 1971) and total nitrogen amount was determined by Kjeldahl method (Hesse, 1971) and to measure soil mineral nitrogen, samples were extracted by the 2 molar KCl solution, and ammonium nitrate samples were measured using distillation and titration with HCl. Data analyses are done using SAS (Version 9.1.3) statistic software and mean comparison was done using the LSD test at probability level of 5%.

Results and Discussion: Analysis of variance illustrated that the effect of pre-sowing on organic carbon, total nitrogen, nitrate nitrogen and soil ammonium nitrogen in 5% probability level was significant. So for all traits, Perko PVH and Buko were more effective than the fallow and animal manure treatments. The effects of nitrogen levels on all traits were significant in 1% probability level, so that elevation in nitrogen usage increased the rate of these traits. The interaction between pre-sowing treatments and nitrogen levels on soil organic carbon, total nitrogen, nitrate nitrogen and ammonium nitrogen in the soil were highly significant at 1% probability level. So Perko PVH pre-sowing treatment along with application of 360 kg ha⁻¹ nitrogen of urea source resulted to the highest values among traits. The highest percentage of soil organic carbon content was obtained by Perko PVH pre-sowing treatment and adjustment of 360 kg ha⁻¹ nitrogen in a rate of 1.08% and the lowest percentage of soil organic carbon was obtained by application of cattle manure treatment and adjustment of 120 kg ha⁻¹

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nitrogen in a rate of 0.58%. The highest percentage of total soil nitrogen gained by Perko PVH pre-sowing treatment and adjustment of 360 kg ha⁻¹ nitrogen in a rate of 0.102% and the lowest percentage of total soil nitrogen was gained by cattle manure treatment and usage of 120 and 240 kg ha⁻¹ nitrogen in rates of 0.052% and 0.047%.

Conclusions: According to the results, utilization of integrated crop management with integrated application of organic fertilizers of chemical nitrogen fertilizer, improved soil chemical properties and soil fertility. Hence applying organic fertilizers can significantly reduce the usage of nitrogen fertilizer while reducing their environmental impacts. The result of the study indicated that pre-sowings of Perko PVH and Buko plants had a positive and significant effect on soil chemical parameters, whereas soil chemical characteristics reaction on pre-sowing yield is totally diverse. In general, it can be concluded that planting the pre-sowing plants and ploughing their residues into the ground can maintain and increase soil fertility and consequently causing the increment of crop quantity and quality proportions and can be considered as a one way to achieve sustainable agriculture.

Keywords: Buko, Cattle manure, Corn, Green manure, Perko PVH

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