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ORIGINAL ARTICLE

Phosphorus Losses in Agricultural Runoff from Corn Fields (Case study, North of Khuzestan, Dezful, Iran)

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ABSTRACT
Phosphorus can carried in runoff water from agricultural fields into streams, wetlands and lakes also can dissolve into runoff water as it passes over the surface of the field or move to groundwater via drain waters. In this paper, phosphorus losses (TP) in numbers of agricultural fields with different soil textures were investigated. In this research changes of TP concentration and its losses were determined in six irrigation intervals. Results showed TP concentration were reduced in times, maximum P losses was 4.02, 3.38, 2.58 and 2.26 kg/ha that be belong to clay loam, loam, silty clay loam and sandy clay loam respectively. Results showed there was significant difference in P≤0.01.
Keywords: Phosphorus, Corn Fields

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INTRODUCTION

Manure and fertilizer have vastly higher concentrations of soluble phosphorus than soil. If a rainfall event causing runoff occurs soon after a surface application or irrigation be done, the concentration of soluble phosphorus in the runoff can be more than normal conditions. Westermann *et al* [1] evaluated Phosphorus losses in furrow irrigation runoff. In this study, Water-soluble P, Olsen P (inorganic and organic P), and iron-oxide impregnated paper-extractable P (FeO-Ps) were determined on a 0.03-m soil sample taken from the bottom of each furrow before each irrigation. Results showed that the average runoff total P concentration was 1.08 mg L (-1) at a soil Olsen P concentration of 10 mg kg (-1). Hargrave and Shaykewich [2] investigated phosphorus losses from some farms of plant such as corn, wheat and alfalfa. In this research in a growth season amounts of phosphorus losses were observed to 70 kg per hectare. The processes are effectiveness on P losses that these parameters are complex and influenced by natural factors, such as soil properties, topography and weather conditions, also different management practices in the agricultural fields. These practices include for example crops, cropping sequences, fertilizer applications [3] and soil tillage [4]. The more part of P losses may be happened to reduce from soils with macropore flow pathways. Stabilization of the macropore system seems to be a factor which enhances the risk of losses due to transport of dissolved P [5]. Low levels of phosphorus, about 0.01 mg/l, leading to euthrification in water bodies that provides growth of harmful organisms, especially algae [6]. Douglas et al. [7] studied phosphorus losses from monitored fields with conservation practices in the Lake Erie Basin, USA. In this study, the impact of Farm Bill eligible conservation practices on soluble P (SP) and total P (TP) losses from four fields that were monitored that results showed no-tillage decreased TP loading by 69 % compared to rotational tillage. Fazli et al. [8] evaluated quantities evaluation of the effect soil erosion on available phosphorus loss in Kojour watershed in Iran. Discharges resulting from storm events were sampled at one fixed point of river using the manual sampler. Results showed that minimum and maximum phosphorus loss through 7 rainfall events was 321and 6707 g respectively with an average value of 2620 g. Since in north of Khuzestan, there are how many good quality agricultural lands and consumptive use of fertilizers special phosphorus is high, therefore it is necessary to evaluating

losses of fertilizers in these lands such as phosphorus that surface irrigations with high water percolation are used.

Methods and materials

Case study of research:

Sabili region is located in Dezful city at north of khuzestan that about 6 thousand hectares of agricultural land irrigated through Dez large networks, since the lands of this region is higher than the level of the Dez river, there is no possibility of irrigation by gravity. Therefore, the main pumping station of Sabili and 4 substation station, river water distributed via channels with length of 55. This research was done in Sabili region in Dezful at 2014 season in the corn farms. Irrigation of agricultural lands in the area is traditionally (furrow irrigation) and through water pumping stations and canals to irrigate fields are transmitted.

Consumption of fertilizers and soil textures:

Shortage of fertilizers through soil sampling and analysis of soil samples in the laboratory of Soil specified. After determining the amount of the shortage of farm manure, phosphorus and potassium fertilizers in conjunction with the first irrigation and nitrogen fertilizer on the ground was added before second irrigation. Also soil textures of evaluated farms were determined that were loam, silty clay loam, sandy clay loam and clay loam.

Collect runoff samples and determines of TP and losses

Runoff samples from farms in four different types of soil and 6 irrigation periods were performed. Water samples were collected from the first to the sixth irrigation via plastic containers. Samples were transported to the laboratory and phosphorus concentrations in field's runoff were measured. Runoff water samples were analyzed for total-P after persulfate digestion [9] on an unfiltered sample and using spectrophotometer. For determine the phosphorus losses per area unit in runoff by multiplying the flow discharge out of the field at P concentrations in runoff were calculated for each event.

RESULTS

As can be seen in figure 1, the values of P concentrations in runoff of field show for 6 different types of soil texture. Maximum of phosphorus concentration in runoff was belonging to a loam soil texture in the first irrigation and the lowest amount of phosphorus concentration was belonging to silty clay loam soil for sixth irrigation.

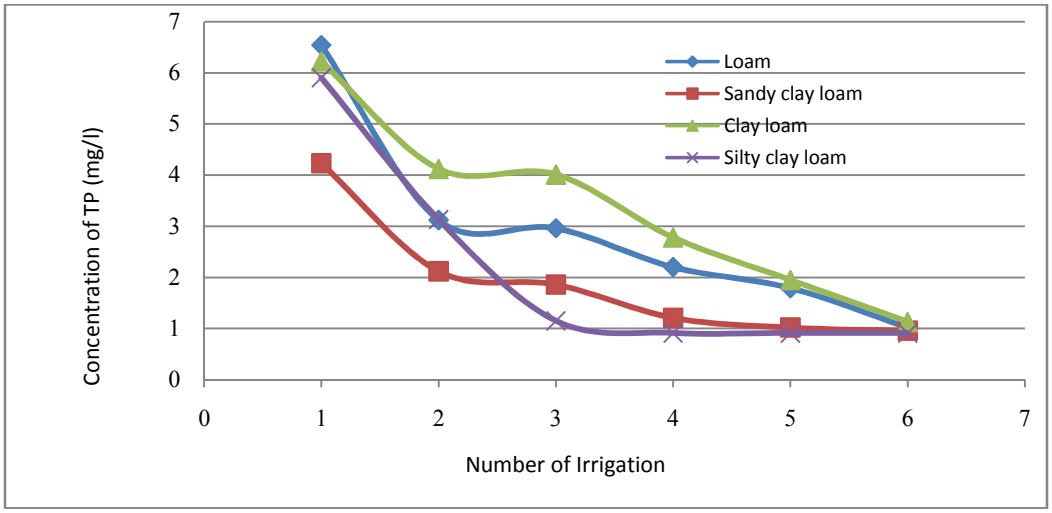

Figure 1. Changes of TP concentrations in different soil textures

Results show that maximum concentration of phosphorus in runoff was seen in first irrigation and reduced gradually in subsequent irrigations. This is because the maximum amount of phosphorus in the soil due to the low solubility of the first irrigation runoff excited from farm. The reduction in the concentration of phosphorus in runoff water from the second to the sixth primary loss through erosion and sediment in the water and on the other hand, absorbed by the plant due to its availability in the soil. Therefore Soil erosion control will be necessary to reduce P losses in surface irrigation runoff.

Phosphorus losses amounts

Figure 2 shows the total phosphorus losses in runoff for the four types of soil, in six evaluated irrigation. As can be seen from the chart, the highest phosphorus losses to the farm with clay loam texture with 4.02 and lowest amount was belong to a sandy clay loam soil with 2.26 kg/ha.

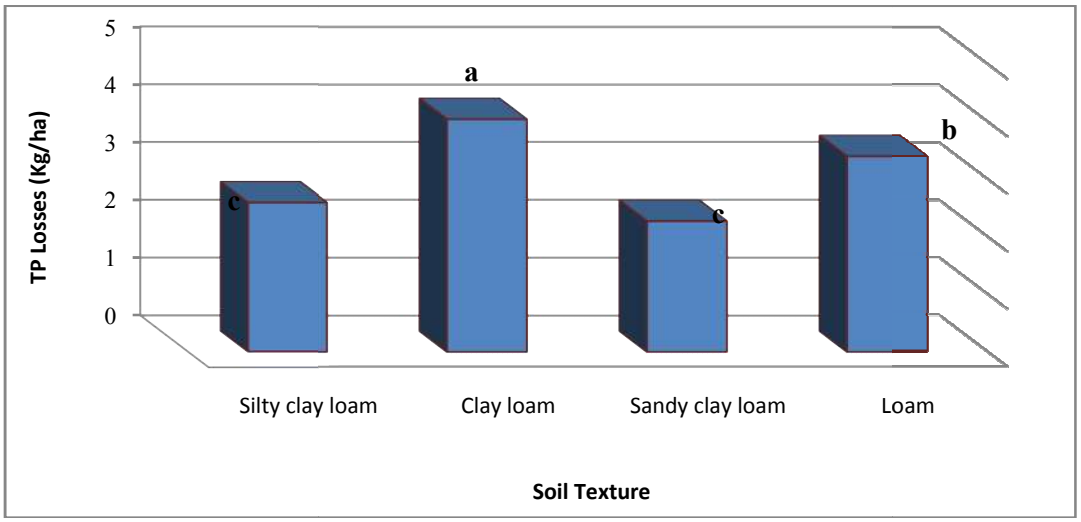

Figure 2. Amounts of P losses (kg/ha) in different soil textures

The results show a significant difference in terms of phosphorus losses not found between the sandy clay loam and silty clay loam textures. But the difference between the various textures, the loss of soil phosphorus level had significant in P≤0.01. Because of the high losses in clay loam can be separated clay colloids and particles of phosphorus absorption and high erosion of this texture. The main factors affecting the transport of P to surface waters are erosion and runoff. Therefore phosphorus losses from erosion and runoff may be reduced by increasing residue cover on the soil surface such as conservation tillage.

CONCLUSION

In this research P concentration and losses in different soil textures in corn fields were investigated. Changes of P concentration in number of irrigations reduce via leached from soil erosion and uptake by plants. In this paper soil texture of clay loam had maximum phosphorus losses.

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