Influence of heavy rainfall in 2018-2019 and submerging on some soil properties greenhouse's in Bazian plain, Sulaymaniyah Governorate

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Abstract

In rain season 2018-2019 Sulaymaniyah governorate has been precluded to rainfall precipitation with very high quantities that never has been recorded since 1985 that impact on some soil properties taking samples from 80 greenhouses in (Tainal watershed, Bazian plain, Sulaymaniyah Governorate). Since in some of these greenhouse waters flood get 1.5m high and others distorted and kinds of residues has been collected in others greenhouses as well as effects of water submerging on these greenhouses soils. Taking soil samples from greenhouses from all locations that effected hardly and making analysis for some properties' as a parameters and the results showed that the soil solution electrical conductivity (EC) decreased significantly (P<0.05) in (Location1, Location2, Location6) (1.65dsm^{-1},0.35dsm^{-1}, 0.25dsm^{-1}) respectively. the pH of soils decreased as the results showed (Location1, Location2, Location3) (8.06, 8.31, 7.8) respectively but not significantly, soil aggregate differences had effected significantly and changed in different locations because of removal of the sand part, silt decreased from (% 17.25) in control Location to (5.6 in Location2, 4.1in Location7) but didn't get to the limit that could change the soil texture. Submergence soils caused decreasing significantly (P<0.05) in phosphorus concentration in (Location1, Location7) (17ppm, 12ppm) respectively. The Concentration of nitrate in soil solution decreased significantly (P<0.05) (Location1, Location7) (2.5mg kg-1, 14mg kg-1) respectively under the submerged condition at field capacity causing an increase in the concentration of potassium (0.743 in Location3 and 4.358 in Location4) in some locations. Sodium increased in most of the locations significantly (P<0.05) (L1, L3, L5, L7) (0.378m mol^{-1}, 0.434m.mol^{-1}, 0.443m.mol^{-1}, 0.643 m.mol^{-1}) respectively otherwise, magnesium and calcium decreased in the soil solution. From the investigation some farmer record that in the study area vegetables grew better after the submerging soils.

Keywords: flooding, submerges, soil properties, nutrient concentration, ions leaching,

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Introduction

Bazian plain is one of the most important agricultural area in Sulaymaniyah Governorate because of the big numbers of greenhouses project there are as well as the forests and kinds of agricultural activates, therefore, we select an area contain 80 greenhouse for our study.

Heavy rainfalls especially with high intensity proceedings are important factors to encourage the process of soil erosion especially in lands have some slop (19). There are an interaction relationship between rainfall and the form of the earth surface effects on the visible features of an area of land especially in terms of heavy soil erosion(3)

precipitation impacts on the different levels of soil moisture and the hydrological processes like runoff in the soil surface and the infiltration of water in the deep levels and this is important for the elements cycle in the nature, precipitation especially with heavy intensity have an effect on the elements cycles process(1).

Flooding or flooding of dry soils in water causes a series of physical, chemical and biological processes that severely affect soil quality as a means of plant growth(13). The nature, pattern, and extent of the processes depend on the physical and chemical properties of the soil and on duration of submergence (13). Draining and drying a flooded soil reverse most of those changes. A unique characteristic of submerged soil, which affects shifts in nitrogen, is the depletion of oxygen (O_2) in most of the root zone (20). When the soil is submerged with water, the amount of oxygen in the soil is greatly reduced due to the propagation of oxygen. The water is about 10,000 times less than it diffuses into the air (4). Due to this dramatic reduction in gas exchange between air and soil after immersion, the source of O_2 can meet the demand of aerobic organisms. Within hours of soaking, optional microorganisms predominate. After a few hours to days, anaerobic microorganisms accumulate esoteric layers. Optional and anaerobic organisms use oxidized soil substrates as electronic receptors for respiration, thereby reducing soil components in a sequence predicted by thermo dynamics (8). The water column covering the submerged soil contains dissolved O_2 oxide, which usually moves a small distance into the soil before it runs out. Submerged soils are thus distinguished, based on the penetration of O_2, into an aerobic (oxidized) and anaerobic (reduced) surface layer (11).

The thickness of this oxidized surface layer of soil is determined by the net effect of the O_2 supply of covered water and the rate of O_2 consumption in the soil. The high CO_2 consumption in the soil results in a thin layer of oxidized soil about 1 mm thick. Low O_2 consumption results in a thicker oxidation layer.

For this purpose the present research amid to study the effect of rainfall on some greenhouses soil properties immediately after the end of rain season.

Studying the impact of submerges on some physicals and chemicals soil properties of the soil that was flooded.

Materials and Methods

Bazian plain located between longitude 35º.49'. 00" N and latitude 45º.25'. 00" E. 28km west of Sulaymaniyah city center an on elevation of approximately 950 meters above sea level, after season 2018-2019 rainfall flooding water submerged in most of Bazian plain in some places reached 150cm. select 7 locations (L1=Zeika, L2=Gawani, L3= shwankara, L4= karaitaza, L5= Warmizyar, L6= Mahmudia, L7= Latifawa), area soil samples were taking in three replicate from seven deferent locations from deep25cm during April and May of 2019. Particle size distribution was determined by dry sieving and moisture and for micro-fractions by pipette method(10).Using XLSTAT program for statically analysis. Figure 1 showed the locations that effected by raining hardly and submerging except the control location that did not hit like the other locations.

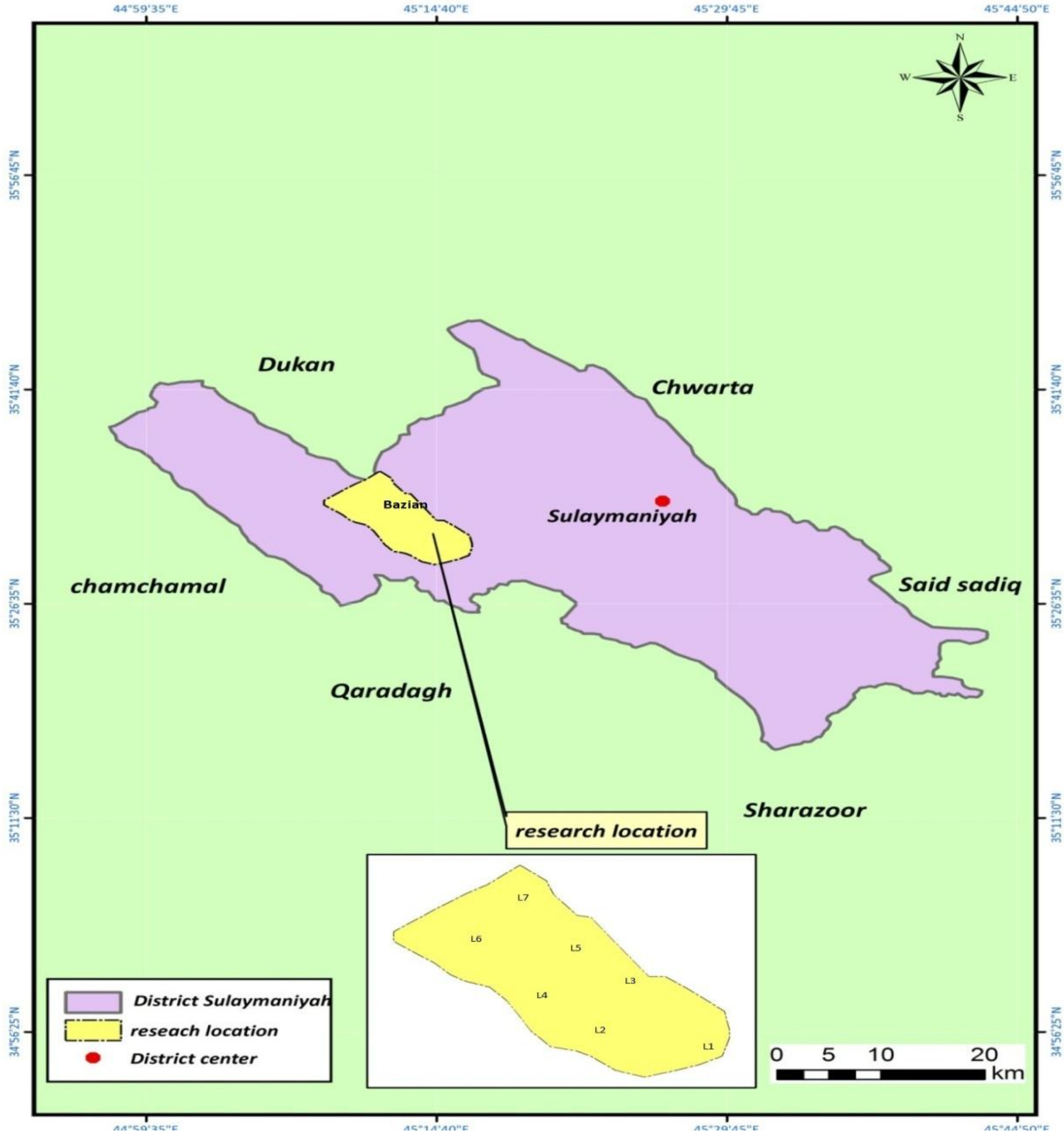

Figure 1 research locations by author using application of ArcGIS (10.2).

The Electrical conductivity for the soil was measured: water (1: 2.5) suspended after leaving the suspension settles overnight according to Richard(21).

The pH soil was determined on the suspension above after stirring. To measure pH ($CaC1_2$) the 0.01 M suspension was made with respect to $CaCl_2$ and stirred. The pH ($CaCl_2$) was measured two hours after suspension according to McLean(16).

Organic matter was determined by modifying the soil quantity method containing 30-100 mg of humus, 25 ml 0.25 MK2Cr207 and 40 ml conc. H_2SO_4 is placed in a 400 ml vial. The mixture was stored for 1.5 hours on a hot water bath, and allowed to cool for 30 minutes. 175 ml of water were added. After standing overnight, the caloric solution and measurement were measured compared to the criteria (red filter, 620-645 nm), according to Schnitzer and Khan (22).

The Total nitrogen of the soil was determined by the Kildahl method using tecator equipment. A 1-3 g sample of air-dry soil was weighed in a digestion tube containing 8 g of K_2SO_4 and 1 g of $CuSO_4$. Hit. H_2So_4 (20 ml) was added. The mixture was maintained at about 420°C (for 1-2 hours) until clear. 50 ml of water was added to the cryogenic extract, and alkaline with sodium hydroxide and distilled nitrogen was synthesized to 4% boric acid and titrated using 0.01M HC1 using bromocresol greenmethyl red as an indicator according to Chen and Dittert(7).

Phosphorus extract with 0.5 M $NaHCO_3$, pH 8.5thevolumetric soil: the extraction ratio was 1:20 and shaking time 1 hr. (27r.p.m.) Phosphorus color metrically measured with an ammonium moly ascorbic acid reagent according to Olsen *et. al*. (18)

Potassium, sodium, calcium and magnesium were extracted from the soil with 1 m CH_3COONH_4, pH 7.0 (6). The soil was volumetric: ant extract ratio 1: 10 and vibration (end on end) time 1 hour (27 noons). Hit. HC1 and La were added to the extract to make the extract 0.2 M with respect to HC1 and contains 0.25% La. Cations were determined using an atomic absorption spectrometry (Techtron AA-4 or Varian Techtron 1200) using an acetylene flame for air, magnesium and propane air for K and Na.

Extractable Ca, K, Mg, and Na were measured by atomic absorption of 1 mol/L NH^4OAC extracted of fresh soil, Total exchangeable bases were calculated as the sum of the concentration of Ca, K, Mg, and Na. exchangeable acidity was determined with the barium chloride – trie –ethanolamine method according to Thomas(24).

The effect of the flood on soil texture was detected by analyzing changes in soil molecular composition and soil texture type along the high gradient. The relationship between changes in soil texture and soil nutrients was discussed. All data were analyzed using XLSTAT software.

Results and Discussion

Description for the area after submerged waters get difference’s high starting from 30cm to 150cm left a lot of residues brings kinds of insects and worms like nematodes in some places in addition to less weed competition. Seeds of many kinds of weed species not germinate or their germination rate were decreased when they are submerged.

Saturation of soil following submergence causes kind of swelling of soil aggregates causing increasing in aggregate size and changing in many of soils properties (Table 1).

Starting from January of 2019 a heavy quantity's of rains precipitated on Sulaimaniyah that get 1235mm and this was the highest level since year1985(Figure 2).

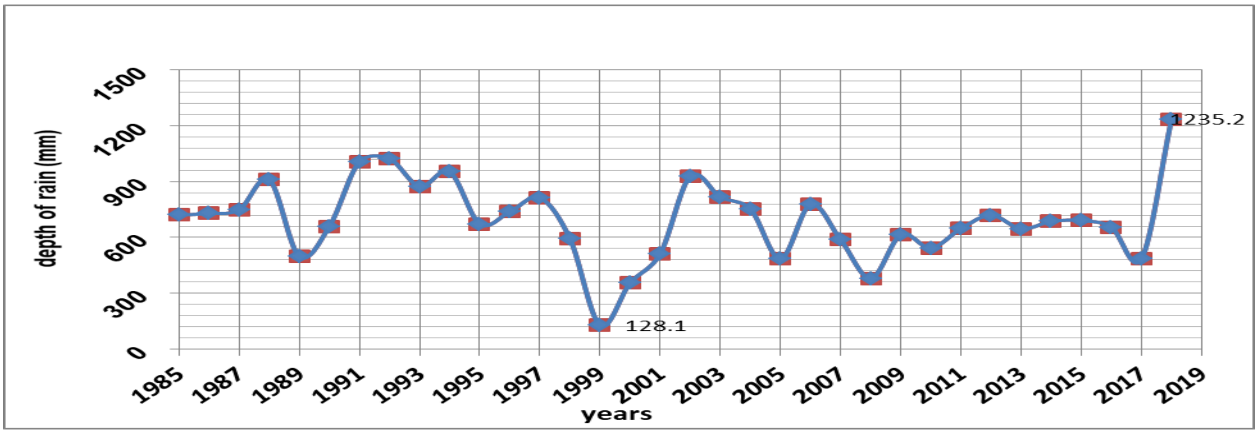

Figure 2 Annual rainfalls for 33years (1985-2019).

Source; directorate of Meteorology and earthquakes in Sulaymaniyah

Table 1 some soils properties effected after submerges in seven locations

Locations	EC $ds.m^{-1}25c$	PH	Sand	Silt	Clay	Class of Texture
L_1 (control)	1.65^a	8.06	17.25^a	39.49^b	43.26^b	Silt
L_2	0.35^d	8.31	5.68^c	50.79^d	43.53^b	Silt
L_3	0.9^b	7.8	6.75^c	32.47^a	60.78^d	Clay
L_4	0.68^c	8.08	14.71^a	44.58^c	40.71^a	Silt
L_5	0.38^d	7.8	6.08^c	50.44^e	43.48^b	Silt
L_6	0.25^d	7.87	6.34^c	50.98^d	42.68^b	Silt
L_7	0.39^d	7.89	4.15^c	47.81^d	48.04^c	Silt

Different letters in the columns indicate significant differences ($P < 0.05$).

(L1=Zeika, L2=Gawani, L3= shwankara, L4= karaitaza, L5= Warmizyar, L6= Mahmudia, L7= Latifawa)

Effects of flooding on chemical and physical properties

Comparison of locations indicated that the electrical conductivity (EC) of the soil solution changed differently in the soil of the site studied immediately after the growth of the flood. At location 5, the EC of the soil solution was significantly lower than the other soil solution (Table 1).

The specific chemical and physical properties of these soils are listed in Table 1. Important data in Table 1 indicate that the soil studied did not have a wide range in the initial pH (7.8-8.3)

The soil texture type in this area is Salty clay except in L_3 there wasn't a significant change in soil texture composition because

Of the wide range need it to make a change in soil texture, in L_3 the silt percentage Decreased to 32.47 % we suggest that return to the Flood water flow effect (14).

As well as the sand percentage decreased significantly from 17.25% to lower percentage like in locations (L_2 5.68 and L_7 4.15).

Flooding resulted a significant change in soil percentages of clay, silt, and sand (Table 1) compared with the non-flood it. When soils are submerged under water the suite of cation and anions held in the exchange complex are released in solution(10)

Nitrogen takes place in soils basically as compound organic essence, ammonia, molecular nitrogen, nitrite and nitrate. The transformations of nitrogen are micro-biological inter-conversions adjusted in the Soil by the chemically and physically environment(5).

Nitrogen mineralization was not higher in the soils studied in this survey rather than aerobic conditions, the lower Nitrogen mineralization in the submerged soil return to higher Nitrogen loss(10)

Table 2, Chemical properties effected after submerges soil in seven locations

Soil No.	Total N (mg kg^{-1})	Available P (mg kg^{-1})	Soluble ions K^+ (mmol L^{-1})	Soluble ions Na^{++} (mmol L^{-1})	Soluble ions Ca^{++} (mmol L^{-1})	Soluble ions Mg^{++} (mmol L^{-1})
L_1(control)	2.5 ^{a}	17 ^{a}	0.351 ^{b}	0.378 ^{b}	5.5^a	3.5 ^{a}
L_2	1.7 ^{c}	15 ^{a}	0.233 ^{b}	4.565 ^{b}	2.75 ^{b}	1 ^{b}
L_3	1.6 ^{c}	11 ^{b}	0.743 ^{a}	0.434 ^{b}	3.25^b	0.75 ^{b}
L_4	1.8 ^{b}	16 ^{a}	4.358 ^{b}	1.043 ^{a}	1 ^{c}	1 ^{b}
L_5	1.9 ^{b}	15 ^{a}	0.097 ^{c}	0.443 ^{b}	2.25 ^{b}	0.5 ^{b}
L_6	2.0 ^{b}	16 ^{a}	0.115 ^{c}	0.243 ^{c}	2 ^{b}	0.9 ^{b}
L_7	1.4 ^{b}	12 ^{b}	0.220 ^{b}	0.643 ^{b}	1.35 ^{c}	0.65 ^{b}

Different letters in the columns indicate significant differences ($P < 0.05$).

(L1=Zeika, L2=Gawani, L3= shwankara, L4= karaitaza, L5= Warmizyar, L6= Mahmudia, L7= Latifawa)

When soils are submerged; the main transformations are accumulation of ammonia, nitrogen fixation and leaching losses of nitrogen. The series of operations had an important possibility on the nutrition in the greenhouses (8).

In aerated soils ammonium is the in organic form and all of the nitrogen reactions that follow the composition of organic matter proceed towards the production of Nitrate Thus organic form of nitrogen undergoes mineralization to Ammonium oxidation of Ammonium to Nitrite and oxidation of Nitrite to Nitrate In aerobic soils, (23).

Nitrogen in organic form throws mineralization and ammonification result NH^{3+} throws microbial oxidation resulted NO^{2-} throws microbial oxidation NO^{3-}

In the other hand anaerobic soils the obscurity of Oxygen inhibits the activity of the Nitrosamines micro-organisms that oxidizes Ammonium and therefore, nitrogen mineralization stops at the Ammonium form (23)

In submerged soil:-

Nitrogen in organic form throws mineralization result NH^{4+} Comparison between soils studied in this survey and the control was not significantly differences the absorption of phosphorus by throwing roots led to the depletion of phosphate ions in the root system (25). This initial decreasing in available phosphorus could return to the increasing in PH or the decreased solubility of phosphorus associated with calcium(12).

Soil submergence impacts on the available phosphorus in a way that Phosphorus is notimplicated in oxidation-reduction reactions in redox potential range encountered in submerged soils, but because of its reactivity with a number of redox elements its behavior is significantly affected by flooding (11).

When an aerobic soil is submerged the concentration of available phosphorus initially decreased and thereafter declines with the period of submergence. However, the magnitude of initial increase and decrease in the later period of submergence depends on the soil properties(26)

There is an initial increasing in soluble Potassium after submergence is closely related like it is shown in Table (2) and that could return to the effect of flooding on leaching some ions like iron or manganese and It is then replaced by potassium ions.

There were evident from vegetative growth and plant production follow up support that plants in this study area can absorb the total absorbed Potassium from the non-exchangeable form under submergence than that of non-submergence soils therefor submergence soil could increase the exchangeable potassium content in these soils(15)

Calcium content was lower in locations 4, 7 and higher in control location 1. Other differences location 2, 5, and 6 was not found to be significant, Sodium ratios value was lower in the study locations 1, 3, 5, 6, and 7 and higher in location 2 Magnesium content was lower in vegetation location 2, 3, 4, 5, 6, and 7 and higher in location 1 these differences in the impact of submerge on these elements could be a result of leaching

Conclusions:

The main conclusion of this work was to study the impacts of the submerges waters that caused because of the heavy rainfall in season 2018-2019 and the results showed many change recorded in the soil physical and chemical properties such as calcium and magnesium that decreased Cleary so in these conditions farmers should be more attention to made some analysis for soils.

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