Status of Soil Fertility in Agricultural Lands under Irrigation Network of Qazvin Plain

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ABSTRACT

Awareness of nutrient elements in soil is important factors in sustainable agriculture. Chemical fertilizers are the main resources to supply plant nutrients and optimum use of them, have an important role in field of environmental sustainability and the agricultural products safety. In order to determine the status of soil fertility in land under irrigation system of Taleghan province, this study was conducted. At first using topographic maps and satellite photos was determined of the area of arable land under cultivation in the network. Places were determined with GPS device and was prepared at 200 hectares of 1 soil sample from a depth of 30-0 cm were analyzed soil samples in the laboratory. Based on the generated soil fertility maps, was assessed status of organic carbon, salinity, soil texture, TNV, available P, available K, available Fe, available Zn, available Cu available Mn and B.

Keywords: Fertility, Nutrients, Irrigation network, Qazvin province

INTRODUCTION

Chemical fertilizers are the main source of plant nutrients and proper use and efficiency from them have a key role in achieving desired result, keep the system of ecological environment and ensuring the health consumers of agricultural products. For proper fertilizer management is necessary to have full knowledge of the soil nutrients that for better performance can be placed at disposal of the plant. Lack of awareness about soil changes in different parts and uniform application of fertilizers causes that in some the soils reach more fertilizers and some of the soils reach less fertilizer than they need. Applying inputs to soil system in the form of careful management and based on dynamic behavior and spatial variability of soil characteristics spatial variability of soil properties is need to observe the principle necessity and needs of each geographic location to inputs desired. This type of management is known so special management area. This management is the basis for precision farming.

Preparation database of soils under cultivation agriculture, in order to check the status of soils fertility in arable soils, estimating requirements fertilizer based on the amount of food element, especially in agricultural products, mapping soil fertility and has particular importance. In estimating requirements fertilizer Qazvin province based on the results obtained from lands which was analyzed by laboratories in private sector, obtained results showed that from the 41 soil samples collected from depths of 0-30 and 30-60 cm. About 77% of the samples have pH=6-8 and 23% of the samples have pH=8 or higher. 89.6% from samples have electrical conductivity less than 4 ds/m, 6.3% have EC= 4-8 dS/m, 2.1% have EC=8-16 ds/m and 2.1% have EC=16-32ds/m. 4.2% of samples have less than 5%, 16.4% between 5-10%, 27.1% between 10-15%, 29.2% between 15-

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20%, 20.8% between 20-30% and 4.2% more than 30% calcium carbonate [1]. In a comprehensive study which was conducted by FAO in 1982 in more than 30 countries, found that more than 30% of the soils in these countries are suffering from the lack of one or more microelement including Fe. However, iron deficiency in Mexico, Turkey and Zambia has described severe. Numerous reports from the other parts of the world, including in plants that have grown in arid areas, limestone and calcareous non-solid soils in the East Mediterranean, Middle East, India and Bangladesh, is indicative of the occurrence of iron deficiency in these countries, in summing and average from percent deficiency elements in soils of these countries obtained number 31.1 [2]. Researchers at reviews distribution of zinc in the soils of India reported that there is lack this element in more than 50% of Punjab state and 38% from soils of Rajasthan [3,4]. Researchers in reviewing the status copper in different agricultural soils reported that mainly lack this element is more common in sandy soils and highly calcareous soils. Also, 30 percent from soils of in India faced with shortage of this element and by doing more than 25 tests in Bihar state found that in 60% of cases, plant response to copper was positive [5]. In a study of more than 35,000 soil samples collected from different parts of the world compared, the researchers found that lowest limit Mn in these soils was 0.9 milligram per kilogram. While in many world countries, deficiency this element had been made difficult growing plants, such as wheat, rice, corn and peanuts. Announcing the critical level 1 milligram per kilogram in the soil for manganese, it seems that this amount be increased to 2-3 times [2]. According to studies conducted in China, the geographical distribution of B deficiency in plants with geographical distribution of soils deficiency matches [6]. According to research conducted on 76 the soil sample, 120 samples of wheat and 16 samples of barley, the researchers concluded: 92 percent of the soils had Zinc deficiency, 86% of plant samples that were taken between May to June had zinc deficiency [7]. In examining the situation of microelements was done by FAO, with financial support of Finland, new information about the existing problems concerning micronutrients obtained. This information leads to create an overall picture of the situation micronutrients, pinpointing areas of the soils and situations in which state of one or more microelements is in trouble to lead to targeted selection of future research and field experiments, also provide solutions in order to solve practical problems [2]. There is no full report and documentary in Iran from status and distribution of iron deficiency in plants but current evidence indicate a severe shortage of iron (especially in fruit trees) in most provinces of the country, yellowing leaves caused by lime is a special form of deficiency this element in plants which covered large parts of the country. Tehran, Qazvin, Khuzestan, Khorasan, Fars, Isfahan and Azarbaijan provinces, more than other regions are suffering from this problem [8]. Taleghan river running water that provided from South Alborz areas is driven in a place called Sngban through concrete dam weighted inside the tunnel with the same name that its diameter is 3.6 and its length is 9 km and its capacity is maximum 30 cubic meters per second. Water after passing through the tunnel enters in valley Ziaran and then enters to diversion dam ziaran with capacity of 225 thousand cubic meters which is now largely filled from regional sediments by river water and then dam water be transferred into the main channel irrigation system. Qazvin plain irrigation network has a length about 1,200 km with a maximum capacity of 30 cubic meters per second, and the extent of land covered by network is about 75 to 80 thousand hectares. About 60 thousand hectares from that due to having fertile soil and prone is used for agriculture and for it, agricultural programs by calculating water requirements and water delivery to form volumetric to farmer’s representative is done. In table 1, characteristics and irrigation network channel capacity in Qazvin is provided.

MATERIALS AND METHODS

According to early studies and previous research conducted in the province, we provide files and documents existing to general attitude from nutrient status in soils under irrigation network of

Taleghan dam the province achieved. This information includes data of soil and water research department laboratory, private laboratories the province and maps classification and determining soils class. Based on the extent of under cultivation of crops in the province which were obtained by the agricultural organization and with regard to satellite images of land under cultivation irrigation network, in each 200 hectares, soil sampling locations have been recognized in extent 30,000 hectares of land under cultivation of agriculture the network and using device GPS determined coordinates of the location in terms of length, latitude and height from sea level. The number of sampling points is 148 points. Soil samples from mentioned parts prepared as composite from 0-30 cm depth that each sample consists from 5 subsidiary samples.

Soil sampling locations is possible without problems such as salinity, plaster or other limiting features in the soil that otherwise sampling is performed separately. Accordingly can be identified nutrients and soil fertility status and parts deficiency and high and or adequacy elements in land under irrigation network at Taleghan, thus in fertilization program the provincial fertilizer distribution, we can take action to estimate the amount of fertilizer needed and finally take the advice of fertilizer products under cultivation and avoid indiscriminate and irrational use of these inputs, and also their unilateral consumption and take action to create a balance of nutrients and with regard to the design of cropping pattern the ministry of agriculture in this area implemented and consider the results in this project effectively. Although in past years, soil sampling and soil analysis conducted by the laboratories of private sector, however due to failure to comply with technical notes on the preparation of samples and that samples have been prepared without supervision and self-the operator and also and also not carried out a detailed analysis on samples in different laboratories. There is not possibility of using this data in the logical distribution of nutrients and 100% of these samples have been merely a routine analysis in soil and measurement of micronutrients and microelements not carried out in them.

In implementing the project by applying the same laboratory method, there is the possibility of measuring detailed analysis of the soil and also were the measure microelements in the program and sampling was conducted at regular intervals to have more precise planning possible based on scientific standards for different uses, including Estimate the amount of chemical fertilizer needed in the province. It is worth noting in this project Geostatistical and GIS software is used.

RESULTS AND DISCUSSION

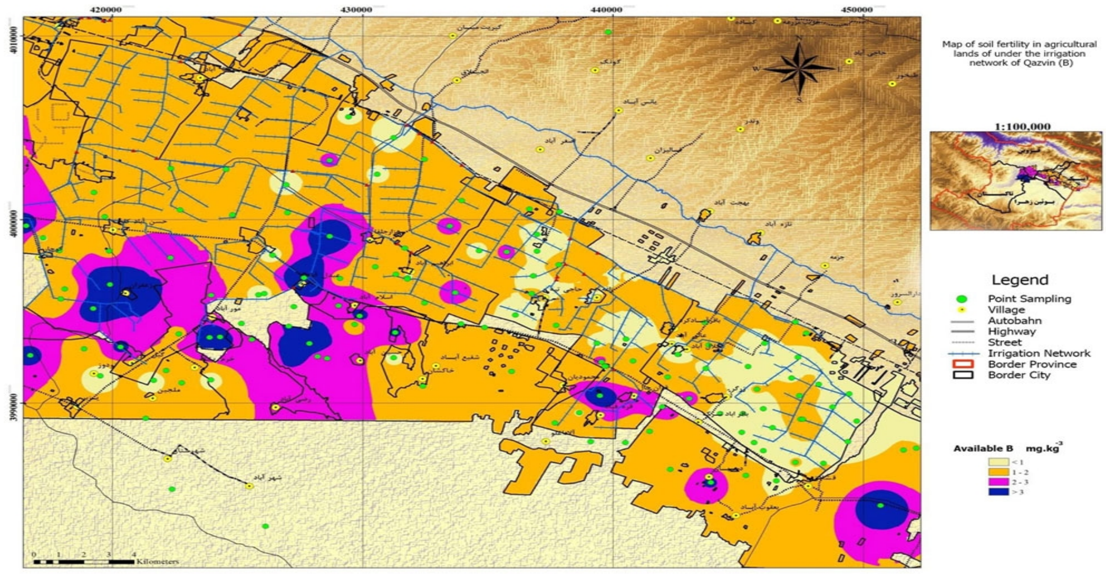
Changes in chemical and physical properties of land under irrigation network L1, L2 and L3: pH:1.35% from soil samples in land under irrigation network have pH<7, 72.3% from samples have 7≤pH<8, 26.35% from samples have pH>8. EC: 34.46% from soil samples in lands under irrigation network have EC<1 dS/m and 40.54% from samples have EC=1-2 dS/m, 18.92% from samples have EC=2-4 dS/m, 4.05% from samples have EC=4-8dS/m and 2.03% from samples have EC>8dS/m. Calcium carbonate: 0.68% from lands have $CaCO_3$<5%, 33.78% have $CaCO_3$=5-10%, 26.351 have $CaCO_3$=10-15%, 23.65% have $CaCO_3$=15-20% and 15.51% have $CaCO_3$>20%.

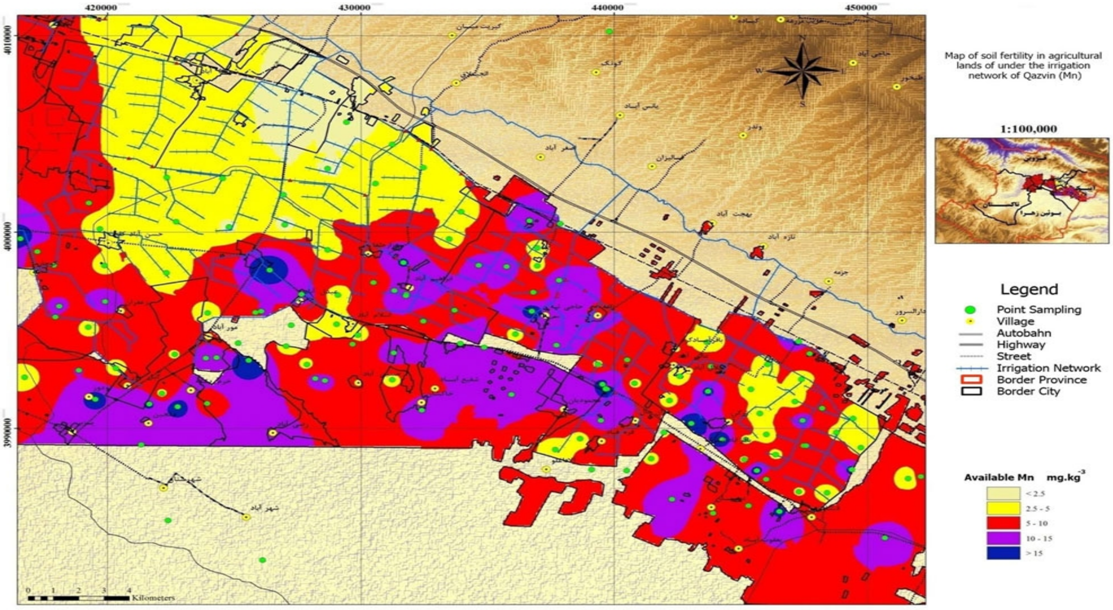
Organic carbon: 22.3% from lands have OC<0.5% and 73.65% have OC=0.5-1%, 3.38% have OC=1-1.5 and 0.67% from samples have OC>1.5. Unfortunately, organic carbon measured that is presents the amount of soil organic matter, is less than standard limit that these values should be above 1 percent. Phosphorus absorbent: 23.64% from lands have P<5%, 37.84% from lands have P=5-10%, 15.54% from lands have P=10-15% and 10.81% from lands have P=15-20%, 6.76% from lands have P=20-25% and 5.41% from lands have P>25 milligrams per kilogram. Potassium absorbent: 2.7% from lands have K<200 milligrams per kilogram, 5.4% from lands have K= 200-250, 10.81% from lands have K= 250-300, 13.51% from lands have K=300-350, 12.83% from lands have K=350-400 and 52.03% from lands have K>400 milligrams per kilogram. Iron: 35.14% from lands have Fe>2.5 milligrams per kilogram, 37.84% from lands have Fe=2.5-5, 25% from lands have Fe=5-10 and 2.03% from lands have Fe=10-15 milligrams per kilogram.

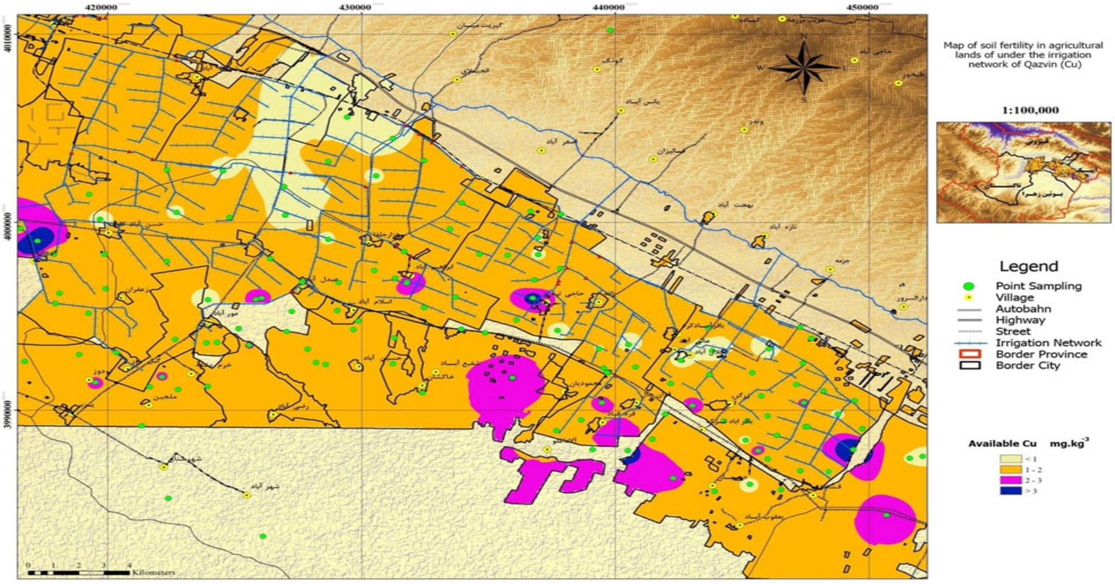
Table 1. Characteristics and irrigation network channel capacity in Qazvin.

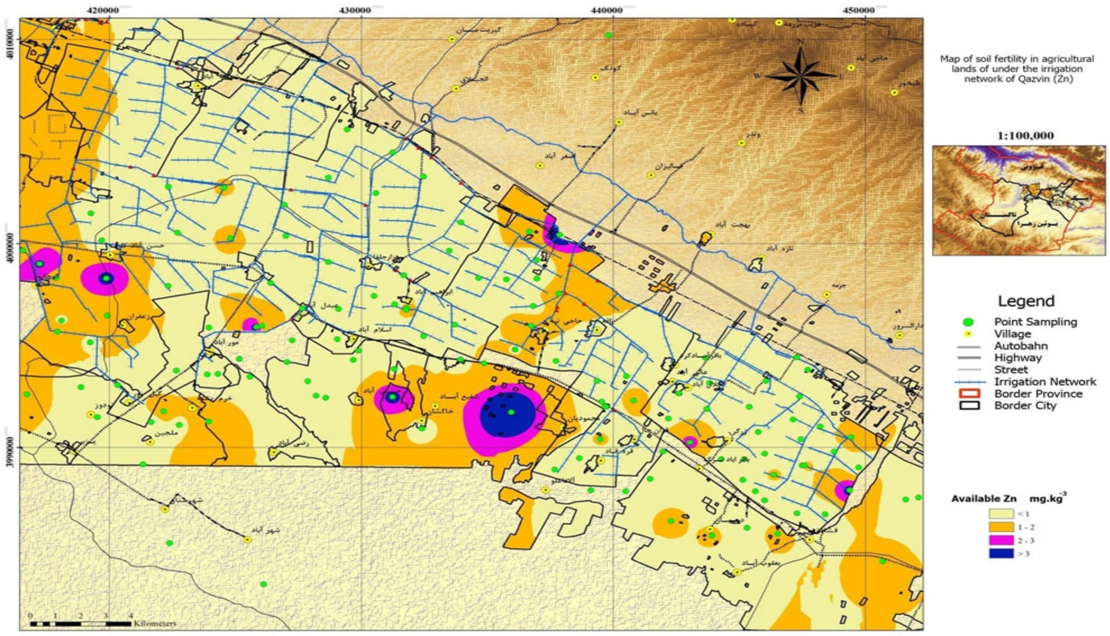
Channel type	Shape section	Type of Coverage	Design capacity (M ^3/sec)	Length channel (Km)	Properties section	
					Depth (m)	Floor width (m)
First	Rectangular	Concrete	30	3	3	4
degree	Trapezoidal	Concrete	2.9-30	91	0.9-2.5	1.2-4
Two degree	Trapezoidal	Concrete	0.6-7.4	220	0.65-1.5	0.8-2
Three degree	Trapezoidal	Concrete	0.17-1	320	0.6-0.8	0.6
Forth degree	Trapezoidal	Concrete	0.17-0.34	560	0.4-0.55	0.3-0.6

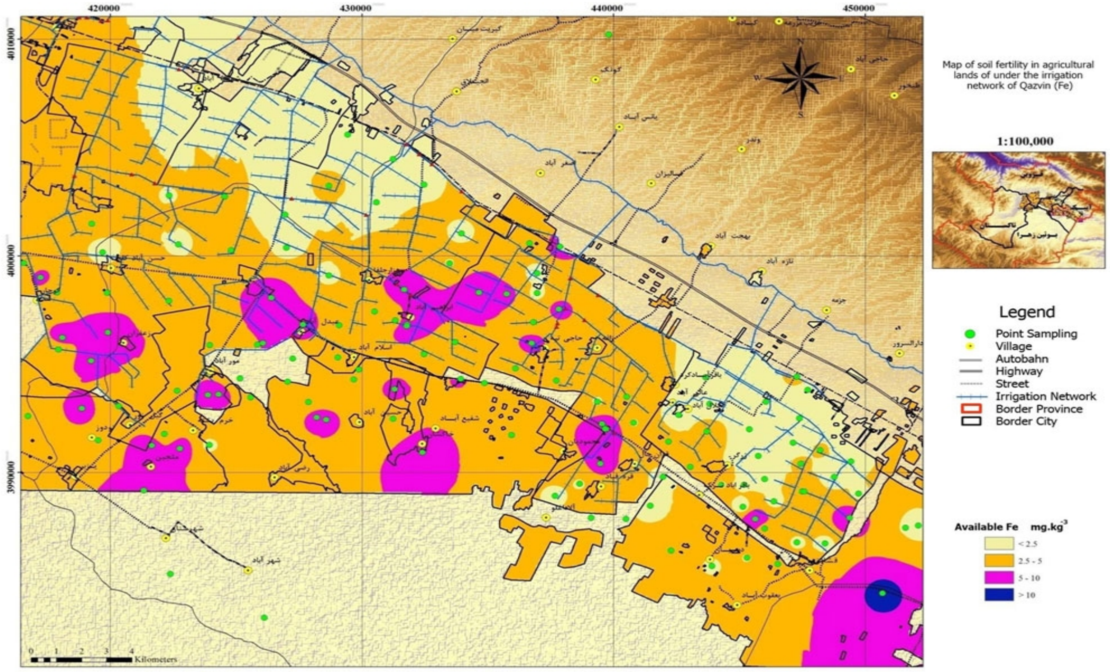
Manganese: 8.11% from lands have Mn<2.5 milligrams per kilogram, 33.11% from lands have Mn=2.5-5, 20.27% from lands have Mn=5-10 and 21.62% from lands have 10-15 and 16.89% from lands have Mn>15 milligrams per kilogram. Zinc: 71.62% from land have Zn<1, 22.29% from lands have Zn=1-2, 1.35% from lands have Zn=2-3 and 4.73% from lands have Zn>3 milligrams per kilogram. Boron: 33.10% from lands have B<1, 39.19% from lands have B=1-2, 12.84% from lands have B=2-3 and 14.86% have B>3 milligrams per kilogram. Copper: 22.3% from lands have Cu<1, 60.13% from lands have Cu=1-2, 14.18% from lands have Cu=2-3 and 3.83% have Cu>3 milligrams per kilogram. Maps of the distribution of nutrients under irrigation network are presented in figure 1.

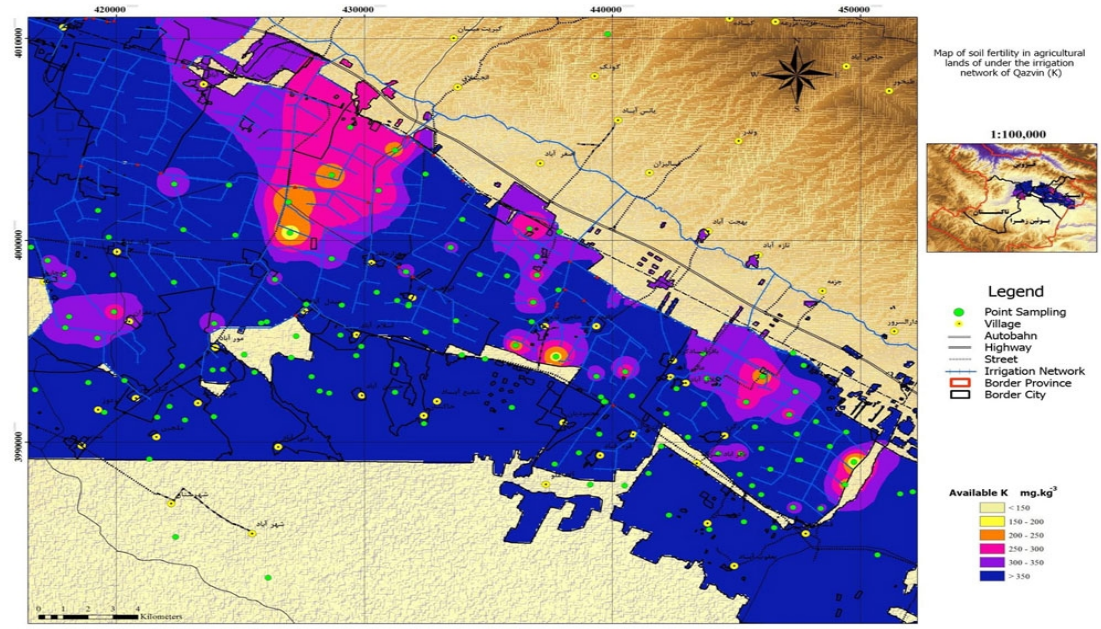


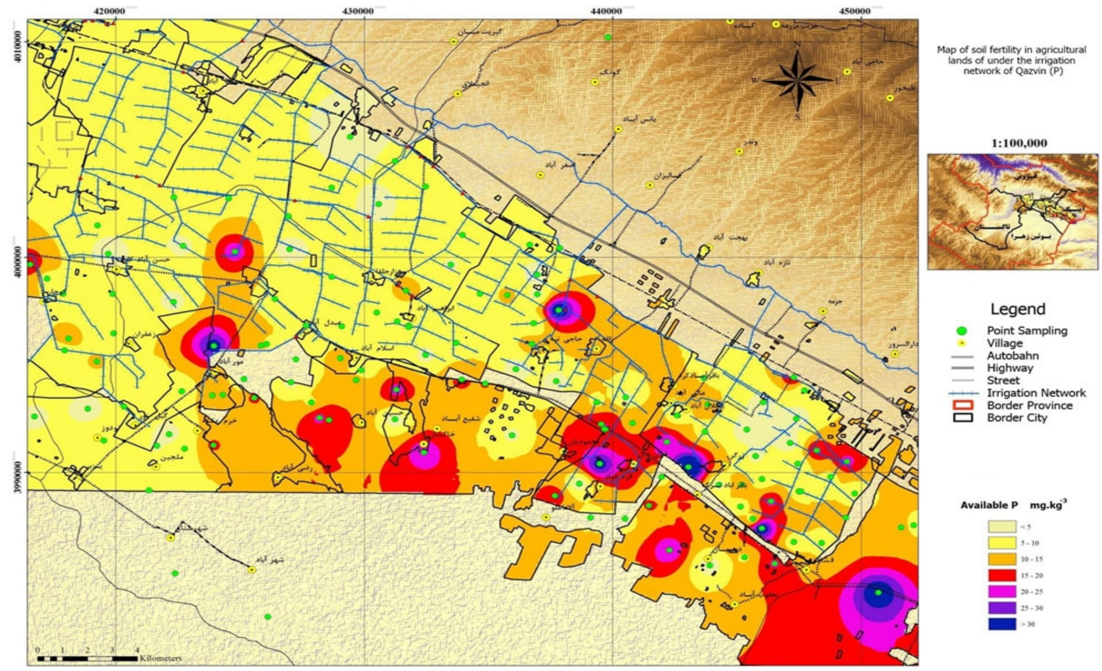

Map of soil fertility in agricultural lands of under the irrigation network of Qazvin (Mn)
1:100,000
Legend
Point Sampling
Village
Autobahn
Highway
Street
Irrigation Network
Border Province
Border City
Available Mn mg.kg-3
< 2.5
2.5 - 5
5 - 10
10 - 15
> 15
420000
430000
440000
450000
Kilometers

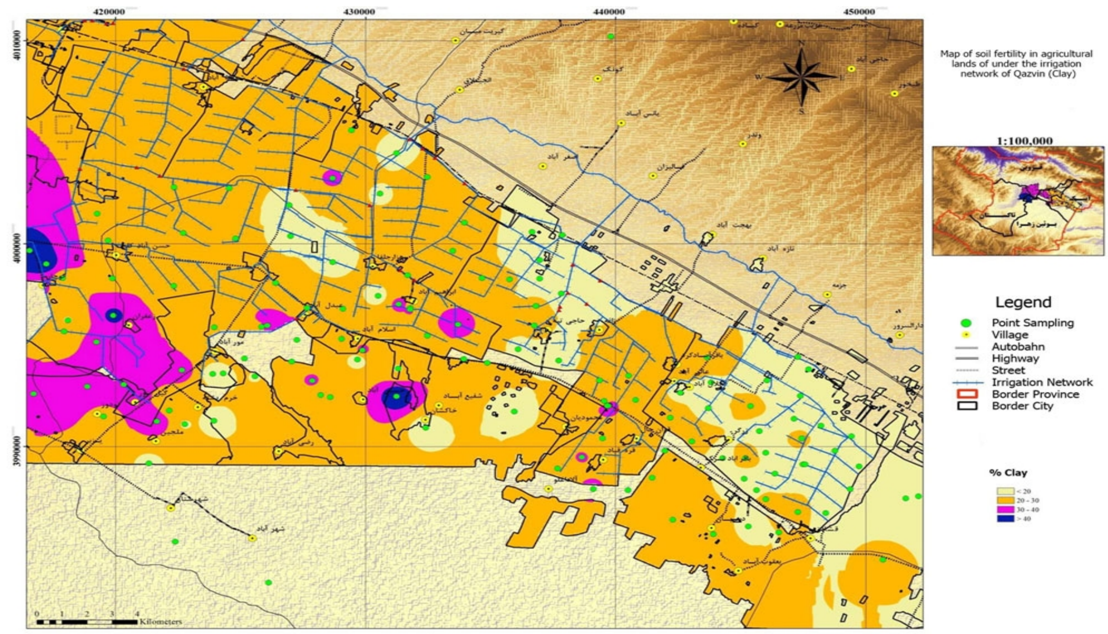

Map of soil fertility in agricultural lands of under the irrigation network of Qazvin (Cu)
1:100,000
Legend
Point Sampling
Village
Autobahn
Highway
Street
Irrigation Network
Border Province
Border City
Available Cu mg.kg-3
< 1
1 - 2
2 - 3
> 3
420000
430000
440000
450000
Kilometers

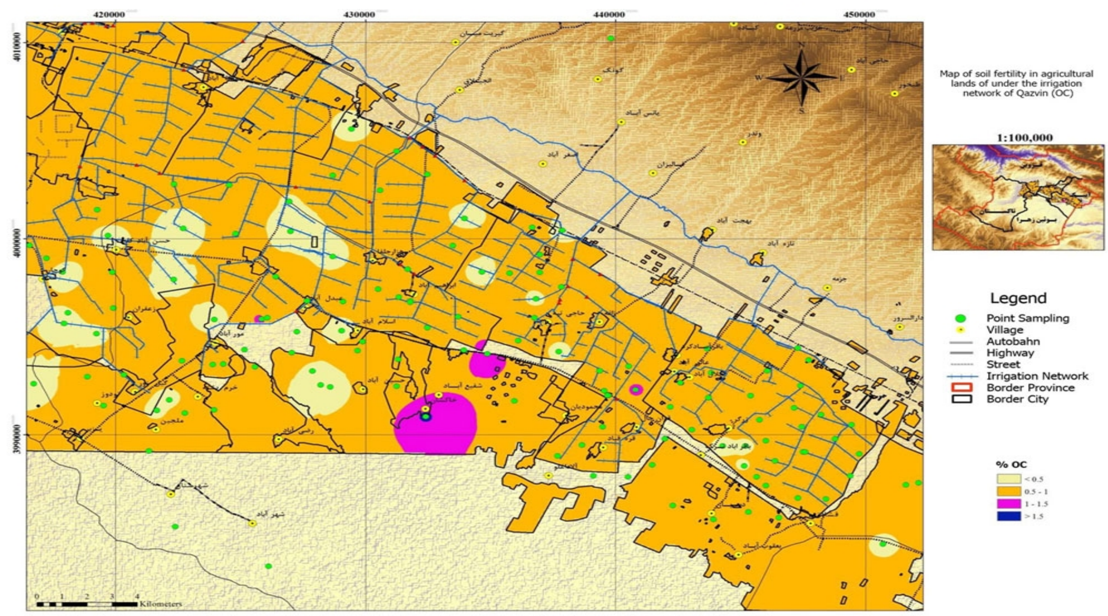

420000
430000
440000
450000
4010000
4000000
3990000
Map of soil fertility in agricultural lands of under the irrigation network of Qazvin (Zn)
1:100,000
Legend
Point Sampling
Village
Autobahn
Highway
Street
Irrigation Network
Border Province
Border City
Available Zn mg.kg-3
< 1
1 - 2
2 - 3
> 3
0 1 2 3 4
Kilometers

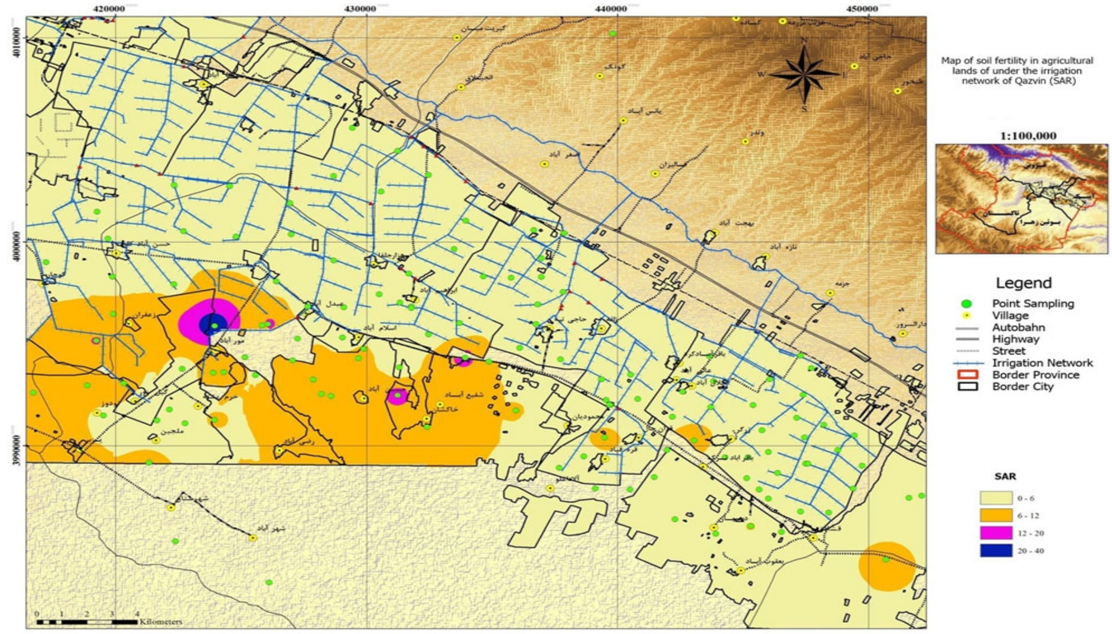

420000
430000
440000
450000
4010000
4000000
3990000
Map of soil fertility in agricultural lands of under the irrigation network of Qazvin (Fe)
1:100,000
Legend
Point Sampling
Village
Autobahn
Highway
Street
Irrigation Network
Border Province
Border City
Available Fe mg.kg-3
< 2.5
2.5 - 5
5 - 10
> 10
0 1 2 3 4
Kilometers

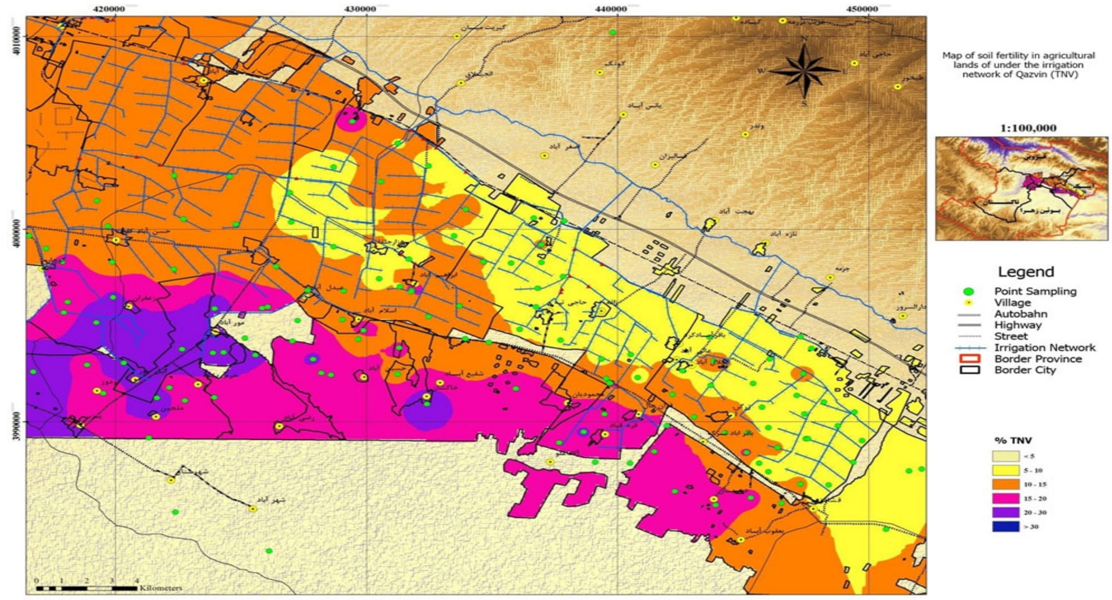

Map of soil fertility in agricultural lands of under the irrigation network of Qazvin (K)
1:100,000
Legend
Point Sampling
Village
Autobahn
Highway
Street
Irrigation Network
Border Province
Border City
Available K mg.kg-1
< 150
150 - 200
200 - 250
250 - 300
300 - 350
> 350
Kilometers


Map of soil fertility in agricultural lands of under the irrigation network of Qazvin (P)
1:100,000
Legend
Point Sampling
Village
Autobahn
Highway
Street
Irrigation Network
Border Province
Border City
Available P mg.kg-1
< 5
5 - 10
10 - 15
15 - 20
20 - 25
25 - 30
> 30
Kilometers


420000
430000
440000
450000
4010000
4000000
3990000
Map of soil fertility in agricultural lands of under the irrigation network of Qazvin (Clay)
1:100,000
Legend
Point Sampling
Village
Autobahn
Highway
Street
Irrigation Network
Border Province
Border City
% Clay
< 20
20 - 30
30 - 40
> 40
0 1 2 3 4 Kilometers


420000
430000
440000
450000
4010000
4000000
3990000
Map of soil fertility in agricultural lands of under the irrigation network of Qazvin (OC)
1:100,000
Legend
Point Sampling
Village
Autobahn
Highway
Street
Irrigation Network
Border Province
Border City
% OC
< 0.5
0.5 - 1
1 - 1.5
> 1.5
0 1 2 3 4 Kilometers


420000
430000
440000
450000
4010000
4000000
3990000
Map of soil fertility in agricultural lands of under the irrigation network of Qazvin (SAR)
1:100,000
Legend
Point Sampling
Village
Autobahn
Highway
Street
Irrigation Network
Border Province
Border City
SAR
0 - 6
6 - 12
12 - 20
20 - 40
Kilometers


420000
430000
440000
450000
4010000
4000000
3990000
Map of soil fertility in agricultural lands of under the irrigation network of Qazvin (TNV)
1:100,000
Legend
Point Sampling
Village
Autobahn
Highway
Street
Irrigation Network
Border Province
Border City
% TNV
< 5
5 - 10
10 - 15
15 - 20
20 - 30
> 30
Kilometers

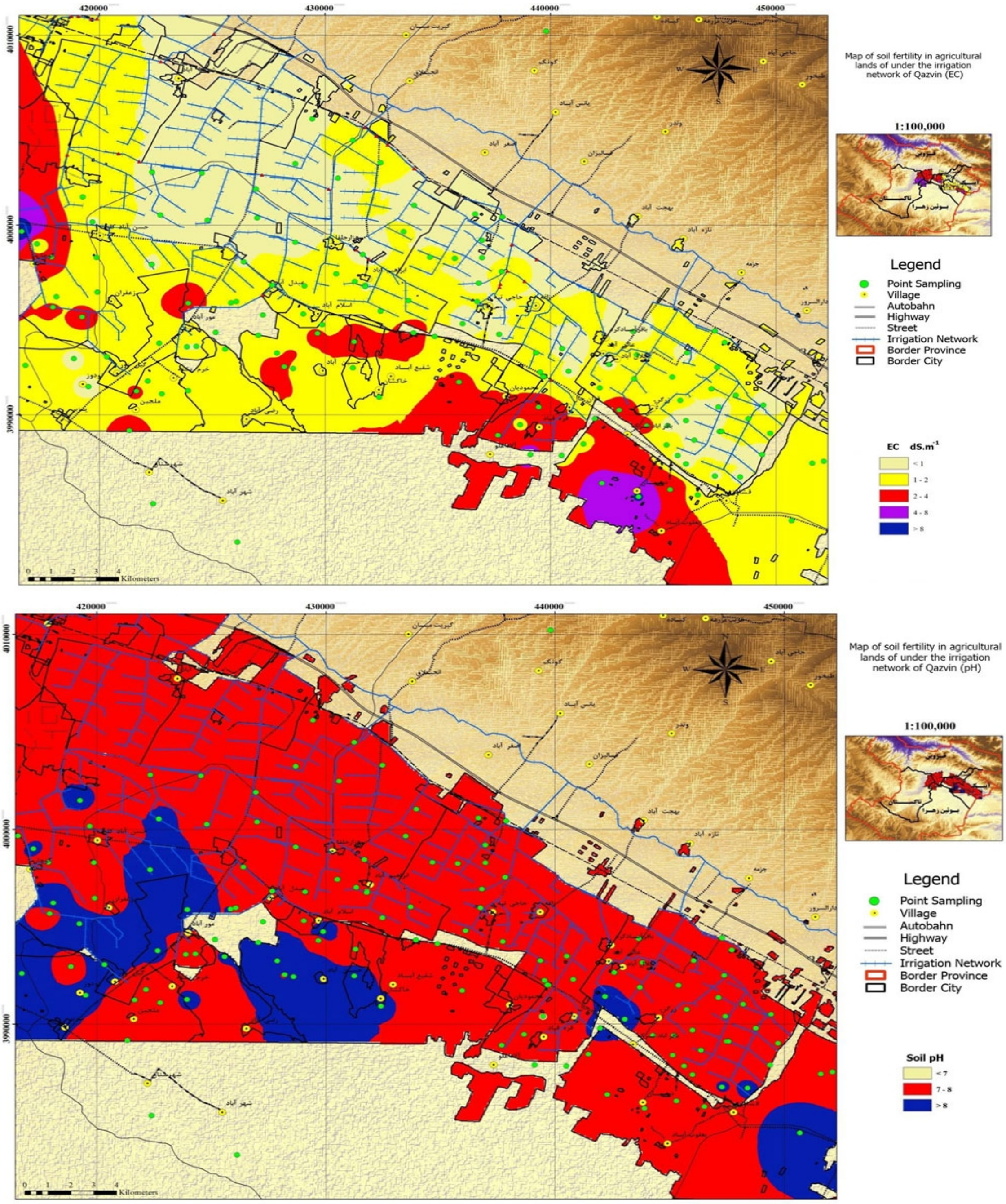


Figure 1. Maps of the distribution of nutrients under irrigation network.

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