Chemical Analysis of Available Nutrients (N, P, K) in Agricultural Soil

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ABSTRACT: Taking x County as the study object, doing experiment, calculation, comparison, this article analyzes the topsoil nutrients and PH value in field. The results showed that it has abundant organic content and teaches the standard of growing well for crops. The soil in X County has rich available content. If we take the measurement in available nitrogen of more than 120 mg/kg as high nitrogen supplying capacity, the soil of the whole county has high capacity in the short term. The phosphorus content is low. Most of the samples are in level five, accounting for 41.43%, and the content is not balanced in different villages and towns. The potassium content is low; PH value is suitable for growth. The survey result reflects the state of soil nutrients in different villages and towns in X County. It can provide important reference for ecological environment protection, farmers' scientific farming, increasing the income of farmers', reasonable fertilization, reducing soil and water pollution.
KEYWORD: X County; Field soil; available nutrients; analyze; environment

1 INTRODUCTION

At present, Due to the farmer's unreasonable fertilization, the quantity of fertilizer is too large. They attach too importance to the use of chemical fertilizers and ignore the use of organic fertilizer. The application of fertilizer is too simple, and the topdressing is not paid attention to. All of these result in imbalance of soil nutrient, serious soil compaction, productivity of field declining, agricultural production costs increasing, serious pollution of soil and water, and low quality of agricultural products (Meng Hongguang, 2008). Agricultural production has been unable to meet the demand of the international trend of agricultural market and people's living. While soil is the basis of agricultural production and the basic production material. It is the carrier of crops growing, and provides crops with most of essential elements (Pan Guoqing, 2004). Soil nutrient is an important index of soil fertility, but also the comprehensive index of measuring soil productivity. It is affected by crop production, fertilization (input), farming, and natural conditions, always in a dynamic balance.

Reasonable land use can improve soil structure, and increase the soil resistance to external environment change; however, unreasonable land use can cause a decline in soil quality. Therefore, using the agricultural land rightly is of great fundamental significance to present sustainable development strategy. Not only can it improve soil physical and chemical characteristics and biological character, improve soil fertility and increase crop yield, but also it is the bond of modern agriculture which is on the basis of technology, with high yield, high quality, high efficiency and low consumption for the object. (Pan Guoqing, 2004). But which fertilizers should be applied to different crops in different plots? How much fertilizer is applied properly and how is it applied to achieve fertilization? How can farmers get high and stable yield? These problems have plagued the majority of farmers.

So in this article part of soil effective nutrients contents in sixteen villages and towns of X County are sampled, in order to ascertain the current status of soil fertility of cultivated field, find the change rule, to help farmers put forward reasonable proposals and countermeasures, to improve the quality of agricultural products and rate of fertilizer utilization , promote the sustainable development of agriculture, provide the necessary scientific basis for agricultural crops stable yield and high quality, and provide scientific support for the rapid and healthy development of agriculture.

2 MATERIALS AND METHODS

2.1 *Samples Collection.*

Sample collection is an important link before soil testing, is the basis of testing soil for formula fertilization, and is the prerequisite that the test result can reflect the land area objectively. Only by reasonable distribution and scientific sampling ca we ensure the representative ness of the sample, the objectivity and rationality of the analysis, thus the validity of the test data About sampling time, on the basis of crop cultivation, field crop soil collecting is in spring and autumn, mainly in autumn; others are arranged according to the season fruits ripe, generally are after harvesting the crops or before sowing. Remember: don't collect samples after soil preparation and fertilization.

2.2 *Research Methods.*

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We always use the S type sampling line, and each sampling amount should be uniform. Finally, mix all the soil samples with each other fully, retain soil samples around 1 kg, by quartering, fill out the label, let it dry and clean it. We set the total of 2080 sample sites, and collect the sample of 2000. The completion rate reaches 99.1%, covering all the six towns of the county (Xiao Anshui, 2008). Then test organic matter, available phosphorus, available potassium in the soil, and analyze pH and available nitrogen content.

Basing soil organic matter content status of X Country, we divide the soil organic matter into 6 levels. See Table1and Table2.

Table 1 Soil Nutrient classification standard

Grade	pH	Organic matter (g/kg)	Available nitrogen(mg/kg)	Available phosphorus(mg/kg)	Quick acting potassium(mg/kg)
1	8.5	>20	>150	>120	>130
2	7.5-8.5	15-20	120-150	80-120	200-300
3	6.5-7.5	12-15	90-120	200-300	150-200
4	5.5-6.5	10-12	75-90	150-200	120-150
5	4.5-5.5	8-10	60-75	20-30	100-120
6	<4.5	6-8	45-60	15-20	75-100
7		<6	30-45	10-15	50-75

Table 2 Indicators of soil nutrient abundance and deficiency

Abundance and lack of grading	Very short	deficiency	commonly	high	sky-high
Organic matter (g/kg)	<5	5-10	10-15	15-20	>20
Available phosphorus(mg/kg)	<10	10-20	20-30	30-50	>60
Quick acting potassium(mg/kg)	<50	50-75	75-100	100-150	>60
Alkali-hydrolysable nitrogen(mg/kg)	<50	50-80	80-100	100-150	>150

Table 3 Data aggregation of soil nutrient detection in field crops in X County

Sampling site(town)	PH	Organic matter(g/kg)	alkali-hydrolysable nitrogen (mg /kg)	Available phosphorus(mg /kg)	Quick acting potassium(mg /kg)
Feeche	6.5	12.8	123.4	21.21	152.3
Shangye	7.5	16.3	102.3	19.66	65.23
Huyang	5.8	16.5	152.3	31.55	153.1
Liangqiu	6.3	14.4	132.6	21.12	56.03
Tai yi	6.8	10.2	73.90	32.89	96.12
Xuzhuang	6.6	20.2	151.2	33.56	56.24

2.3 *Measurement Method.*

Measuring soil organic matter is by oil bath heating potassium permanganate oxidation; soil available phosphorus is by sodium bicarbonate extraction - molybdenum antimony anti calorimetric, soil alkali hydrolysable nitrogen by alkali solution diffusion; soil available K by nitrate extraction - Flame photometric method, soil pH value by potentiometer.

3 RESULTS AND ANALYSIS

Soil nutrient is the core part of soil fertility. Comprehensive and objective evaluation of soil of the actual nutrient level is the basis for scientific fertilization. 2000 soil samples of six towns are analyzed and detected, soil types of which mainly covers all types of soil. See Table3.

3.1 *Analysis of Soil organic Matter Content in the Field in X County.*

Soil organic matter accounted for the primary position in factors of soil quality. The characteristics of soil organic matter is having full nutrients and lasting fertilizer. It can provide nitrogen, phosphorus, potassium and other nutrients and trace elements crops need, so it is one of the important signs of soil fertility. And soil organic matter content is an important index of soil fertility. The soil organic matter is not only the important source of soil nutrient elements especially N, P, but also has the function of retaining fertilizer and buffer property, so as to improve the physical properties of the soil. According to the soil nutrient classification standard and indicators of soil nutrient abundance and deficiency (Table 1 and Table 2), 12.78% of the samples are in the first class, 31.25% of the samples are in the second class. Third, fourth, fifth account for 56.25%, 10.5% and 1.64% respectively, and only 0.95% of the samples are in sixth, etc. Content more than 20 g/kg accounts for 47.23%, Between10 g/kg to 12 g/kg samples account for 49.47%, less than 10 g/kg samples account for 3.28%. Analysis results in Table 1 and Table 3 show that the soil organic matter content is abundant and suitable for field in X County, Areas that content reach the secondary standard are mainly distributed in Shangye town, Taiyi town; while Liangqiu town is in three grade standard; other towns are at the fourth level.

3.2 *Soil Available Nitrogen Analysis.*

The statistics and analysis results of 2000 soil samples show that the average content of soil available nitrogen (N) in six towns of X County is 83 mg/kg, belonging to level 4. We can see from Table 3 that Huyang has the highest average of 152.3 mg/kg. According to the classification standard of soil nutrient (Table 1) shows that the soil available nitrogen content in X County is high. 36.67% samples are at level 1, 15.63% sample sat level 2, level account for 21.49%, 16.58% and 8.46% respectively. Only 1.17% samples are at level 6. The content of more than 90 mg/kg accounts for 52.3%, in 60 mg/kg ~ 75 mg/kg accounts for 38.07% samples, less than 60 mg/kg only accounts for 9.63% sample. On the basis of soil nutrient abundance and deficiency (Table 2), the soil available nitrogen is abundant. If we take the measurement in available nitrogen of more than 120 mg/kg as high nitrogen supplying capacity, the soil of the whole county has high capacity in the short term. During the process of agricultural production, the application of nitrogen fertilizer can be reduce, which can reduce agricultural source pollution and agricultural production cost (Shen Qirong, 2001).

3.3 *Soil Available Phosphorus Analysis.*

Soil available phosphorus includes soluble phosphate in soil solution, phosphate ion adsorbing on soil colloids and sulfide, organic phosphorus easy to cure. Available phosphorus amounts for 10% of total phosphorus content. The content of soil available phosphorus is the main index of soil fertility. Therefore, soil available phosphorus is taken as the index of phosphorus supply level. (Pan Guoqing, 2004). Statistics and analysis of the experimental results shows the average content of available phosphorus (P) is 22.7 mg / kg, ranging from 2.0 mg / kg to 179 mg / kg, of which Xuezhuang reaches the highest 2.3 mg / kg.Seeing from Table 3, we know there is great difference among the six towns. On the basis of the classification standard of soil nutrient and soil nutrient abundance and deficiency. We can see that the content of available phosphorus is low, and most of the samples area level 5, accounting for 32.43%, and 12.08% and15.03% samples belong to level 3 and 4. That is to say, only 25.00% samples are abundant in phosphorus; however, 37.5% samples are lacks of it.25.00% samples are mideium. So we can see that the content of available phosphorus is low in the entire county. Active measures of applying more phosphorus should be taken in order to reach the purpose of increasing production.

3.4 *Soil Available Potassium Analysis.*

The average content of soil available potassium (K) in field in X County is 96 mg/kg, belonging to the level 6. The statistics and analysis results of 2000 soil samples show that the average content of soil available potassium in six towns of X County is 96.00 mg/kg, ranging from 2.9 mg/kg to 489.34 mg/kg. It is can be seen from Table 3 that the average content in six villages and towns is greatly different. The highest town is Tai Yi, with the content of 154.10 mg/kg. Basing the content of soil nutrient content and classification the soil phosphorus abundance index, we can see that most of the soil samples stay in the third and the fourth grade, account for 12.42% and 30.32% respectively. The field where available potassium content is more than 150 mg/kg accounts for only 25%; the field where the

content is less than 70 mg/kg accounts for 37.58%, which is called potassium deficiency.

4 SUMMARY

We can see that the soil fertility level is high and most of the organic matters are at three levels. The overall level is high and has inconsistent distribution. Nitrogen, phosphorus and potassium contents are different. The results show that the nitrogen supply is enough to meet the short-term nitrogen demand. Soil PH value (Between pH values in 6-7) is suitable for crop growth. But the phosphorus content is low, only 47.38% of the sample in a secondary level or above, and phosphorus deficiency has appeared. Potassium deficiency reaches 37.58%, and there are big differences among six villages and towns. The proportion of nitrogen, phosphorus and potassium is in the misalignment. The key reason is farmers' imbalance utilization of N, P, K fertilizers (Liu Shunguo et al, 2008). The level of nitrogen supply in X Country is strong. Phosphorus and potassium contents in soil are low. In order to maintain fertility of soil, protect ecological environment and realize the sustainable development of agriculture, Government should promote vigorously formula fertilization by soil testing, scientific farming and fertilization basing on situation of soil. Farmers should be encouraged and supported to fertilize scientifically and evenly, so as to improve the comprehensive productivity of cultivated land, increase farmers income, maintain ecological balance, reduce agricultural source pollution, improve the soil nutrient content effectively, which can ensure the sustained and stable growth of agricultural production.

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