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Evaluation of soil fertility status and constraints under vegetable cropping at Budhanilkantha, Kathmandu

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Abstract
The soil fertility evaluation is perhaps the most basic decision making tool in order to impose the nutrient management strategies. The field study was carried out from July-October, 2017 at Budhanilkantha with the objective to find out the fertility status of the soil, the constraints occurring under the vegetable cropping system and to know about the demographic features of the farmers. About 30 respondents were sampled randomly and their soil was analysed in the laboratory. The soils of the Bhudanilikantha area was found from medium to high in nutrient content; whereas the nitrogen level was ranged from 0.13-0.33, phosphorus was 7.79-624.71, potassium was 85.3-1309.90, soil organic matter was 2.61-6.70 the pH of the soil was slightly acidic as 37%. 83% of the sampled soil was in loam texture. The use of chemical fertilizer was done by almost all of the farmers and also the organic manure was used by farmer. The farmer followed cultural practices that help to increase in the production of their crops. This study confirms that the fertility status of Budhanilkantha area under vegetable farming is satisfactory and is at the increasing rate despite of the constraints faced by farmers. There is still an urge to lessen the use of chemical fertilizers in the soil that cause long term constraints or farmers. The major constraints of the farmers are price fluctuation, pest and disease infestation and lack of proper market for their product. The use of organic fertilizer must be increased to enhance the soil quality and improve soil health which helps to increase the permanent fertility of the soil that will ultimately increase in the production.

Keywords: Soil fertility, Fertility evaluation, Vegetable cropping

Introduction
The sustainability of any system has become major concern now days. The evaluation of soil fertility is perhaps the most basic decision making tool in order to impose appropriate nutrient management strategies (Brady & Weil, 2004) [1]. There are various techniques for soil fertility evaluation, among them soil testing is the most widely used in the world (Havlin *et al*., 2010) [3]. Soil testing assess the current fertility status and provides information regarding nutrient availability in soils which forms the basis for the fertilizer recommendations for maximizing crop yields and to maintain the adequate fertility in soils for longer period. The texture, structure, colour etc. are important soil physical parameters. Similarly, soil reaction (pH), organic matter, macro and micronutrients etc. are also important soil chemical parameters. The physical and chemical tests provide information about the capacity of soil to supply mineral nutrients (Ganorkar & Chinchmalatpure, 2013) [2].

Materials and Methods
Budhanilkantha is selected for the survey which is situated at the Kathmandu district that lies in the province number three. The latitude and longitude of the study area is from 27.7654° N to 85.3653° E respectively. The average annual temperature of Budhanilkantha is 17.4 °C whereas precipitation is 1848 mm.
The survey was conducted randomly among the farmers of Budhanilkantha. Randomly 30 respondents growing vegetables were selected and interviewed and their soils were collected as a sample for further analysis. Both the small as well as large growers were taken into consideration for the collecting the required information and soil sample collection. The survey was done in Bansbari, Chapali and Hattigauda of Budhanilkantha.
The survey was carried out from 17th of Bhadra to Mangsir 20. The total duration of the study was 3.5 months. The questionnaire was prepared to collect information regarding the soil type and the inputs used by the farmer to maintain their soil fertility.
The collected soil samples of different farmer's fields were first air dried and sieved through 2mm sieve. Routine analysis was done of each sample. The pH of the sample was determined by digital pH meter/ pH tester after extraction of a soil: water ratio of 1: 2. Soil organic matter content was determined by oxidation of organic carbon with potassium dichromate described by Walkley and Black (1954). Available phosphorus was determined by extraction with 0.5 M

$NaHCO_3$ according to the methods of Olsen *et al*. And available potash was determined by extraction with 1N ammonium acetate pH 7. The texture of the soil was determined by hydrometer method.
The data were tabulated in MS-Excel which was used to interpret data. Different statistical procedures were used for the data analysis like, mean, percentage (%), frequency.

Result and Discussion
Major constraints faced by farmers
The major constraints faced by the farmers of the study area were market problems, price fluctuation and insect and pest infestations. Among these constraints most of the farmers experienced the problem of the price fluctuation i.e. they did not get reasonable price for their harvested product. Insect pest and disease were also seen as the main problem of the farmers in the study site.

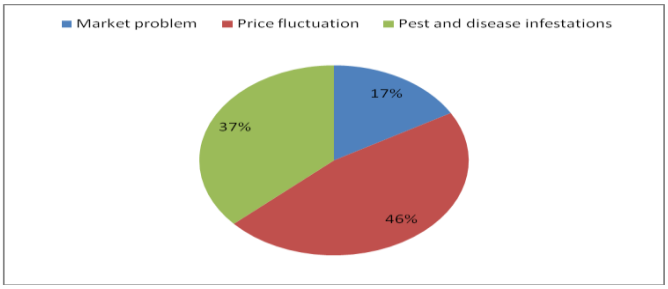

Fig 3: Major constraints of the farmers

Lab Analysis result of sampled soil

Table 1: Percentage Distribution of Sample

S.N.	Parameters	% distribution of samples					Range		NI	Remarks
		VL	L	M	H	VH	Min	Max		
1.	OM	-	-	83.33	16.667	-	2.61	6.70	2.1667	M
2.	N	-	-	33.33	66.667	-	0.13	0.33	2.667	H
3.	P_2O_5	3.33	-	3.33	6.667	86.667	7.79	624.71	2.8667	H
4.	K_2O	3.33	3.33	16.667	33.33	46.667	85.36	1309.90	2.8	H

(VL: Very Low, L: Low, M: Medium, H: High, VH: Very High, NI: Nutrient Index)

Soil Organic Matter (SOM)
The organic matter content was ranged from 2.61-6.70% (Table 1). Distribution of organic matter content in the soil from lab analysis indicates that, about 83.33% are medium and other 16.667 % samples had higher organic matter (Table 1). The nutrient index shows that the OM level comes under medium range i.e. 2.1667.The OM in the soil that was found in medium level which is an optimum amount required for the vegetation. The satisfactory condition of the OM in the soil is due to use of organic manure and farm manure that provide organic carbon in the soil.

Total nitrogen
The total nitrogen content was ranged from 0.13-0.33% (Table 1). About 33.33% of soils are medium and remaining 66.667% of soils are high in nitrogen content (Table 1).The nutrient index value for nitrogen is 2.667 which is quite high level. The high level of nitrogen in the soil may be due to the heavy application of nitrogenous fertilizer in the soil. The use of chemical fertilizer increased the nitrogen content in the soil.

Available phosphorus
The available phosphorus was ranged from 7.79-624.71kg/ha (Table 1). The analysis revealed high status of available phosphorus. The nutrient index also stated the high value of phosphorus in the soil i.e. 2.8667. The study indicates that about 3.33% of sample exhibits very low, 3.33% were medium, 6.667% were high and 86.667 percent were very high (Table 8). The different classes of available phosphorus that the farm possesses might be due to different managerial practices in their farm. The high phosphorous content is due to use of phosphorous fertilizer in heavy amount as well as occurrence of different classes of pH that affect the phosphorous availability.

Available potassium
The potassium content was varied from 85.36-1309.90kg/ha (Table 1). The value of nutrient index is 2.8 which suggest high status of potassium in soil. The data reveals that, 3.33% of soil samples were in very low level of potassium, while 3.33% were low, 16.667% were medium, 13.33% ere high and 46,.667% were very high (Table 1). There was a high level of potassium in the soil of surveyed area. The high level of potassium in the soil is due the use of the potash fertilizer in a haphazard way and more incorporation of potash fertilizer in soil than recommended dose.

PH of the soil
This indicates slightly acidic soil reaction (pH). The pH of soil samples was found to be 37% of sample showed slightly acidic, 3% samples were very acidic, while 23% samples were nearly neutral, 3% samples were alkaline in nature and 34% samples were highly acidic. The soils are acidic might be as a result of the leaching of basic Cation or due to incessant uptake by crops grown on the field (Brady and Weil, 2004) [1]. The soil acidity implied that nutrients are likely to be available or unavailable for crop uptake. Therefore, agriculture lime should be incorporate to increase soil pH of the very acidic and slightly acidic soils.

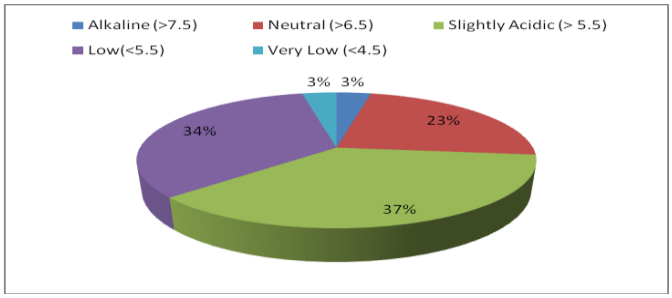

Fig 2: pH of the Soil Sample

Soil Type
The texture of the soil was found as sandy loam which covered most percentage from total i.e. 83% whereas 17% of the soils were loamy texture. Sandy loam soils are dominated by sand particles, but contain enough clay and sediment to

provide some structure and fertility. Therefore, the soils of the area are more or less fertile due to sandy loam texture.

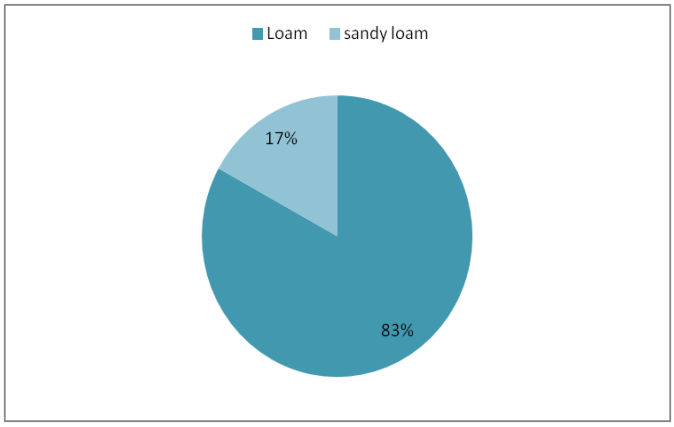

Fig 3: Texture of soil

Conclusion

The study was conducted at one of the commercial vegetable farming area of Kathmandu district. The objective of the survey was to determine the soil fertility status and constraints under vegetable cropping area which was done by interviewing farmers and by analysing of their soil sample. It was found that the farmers of the surveyed area were using chemical as well as organic fertilizer in their soil to increase the nutrient content of the soil. From this survey, it was found that the nutrient content in the soil was ranged from medium to high. The nitrogen, phosphorus and potassium level was high whereas the SOM was present in medium level in the sampled soils. The pH was slightly acidic since the majority of the soil was quite acidic in nature. The soil was found to be sandy loam in texture. The nutrient level was found to be high and this is due to imbalanced use of fertilizer; using more than recommended dose and also due to pH variation of the soil. Most of the agricultural land has high level of nutrient due to haphazard use of the chemical fertilizer. The major constraints of the farmers were market problems, price fluctuation and insect pest infestations.

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