International Journal of Chemical Studies

P-ISSN: 2349–8528
E-ISSN: 2321–4902
IJCS 2019; 7(4): 833-835

Received: 16-05-2019
Accepted: 18-06-2019

Shipa Rani Dey
Department of Agronomy,
School of Agriculture,
Lovely Professional University,
Jalandhar, Punjab, India

Prasann Kumar
(1) Division of Research and Development, Lovely Professional University,
Jalandhar, Punjab, India
(2) Department of Agronomy,
School of Agriculture
Lovely Professional University,
Jalandhar, Punjab, India

Correspondence
Shipa Rani Dey
Department of Agronomy,
School of Agriculture,
Lovely Professional University,
Jalandhar, Punjab, India

Effect on available soil phosphorus of wheat cultivated soil under different sources of organic and inorganic fertilizers

Shipa Rani Dey and Prasann Kumar

Abstract
The field experiment was conducted using wheat as a test crop at Agronomy field, to study the effect on available soil phosphorus of wheat cultivated soil under different sources of organic and inorganic fertilizers. The result indicates that T_5 with 15.71 and 15.57 kg ha^{-1} at 60 and 90 DAS. The percentage increase in T_5 was 79% for both the dates. The lowest significant soil available phosphorus was found in T_1 with 12.88 and 12.72 kg ha^{-1} at 60 and 90 DAS. The percentage of phosphorus was 47% and 46% as compare to the control.

Keywords: Agronomy, crop, economy, fertilizers, phosphorus, wheat

Introduction

Wheat (*Triticum aestivum* L.) is a popular staple cereals crop at the tropic and semi-arid region of India. Botanically, it belongs to the family Poaceae. On account, India has 30.22 mha area under wheat cultivation with production of 93.50mt (Anonymous, 2018a) [2]. In Punjab, area under wheat production is 3.46 mha with production of 17.63 mt (Anonymous, 2018b) [3]. Soil fertility is estimated by three major components such as nitrogen, phosphorus, and potassium (N, P and K). Among these there essential nutrient nitrogen plays a major role to improve soil fertility. Phosphorus is the second essential primary macro nutrient which helps in root modulation, to maintain the nourishment of soil DAP is the artificial source of providing phosphorus in soil. When phosphatic fertilizer is applied near to the root zone it become insoluble because P fertilizer is direct contact with soil colloids which may create insoluble phosphatase, so plant cannot absorb nutrient from soil. So to avoid this kind of losses if P fertilizer is applied with Organic manure it increase its efficiency and also helps in availability of other essential elements which is required for plant growth and development. Moreover, NPK deficiencies show significant effect and application of soil amendments become necessary to replenish soil fertility and hence can provide good productivity with minimum leaching of soil nutrients (Roy *et al.*, 2006) [5]. In several countries including Ethiopia reported the cultivation land are deficit of various nutrients other than the major ones *viz* N and P. Further, this condition of agricultural land can only be improved when supplemented with appropriate organic amendments such as biochar, vermicasts etc. The integrated use of organic and inorganic fertilizers is efficacious in some ways because it maintains nutrient provide, provides organic carbon to soil microbes, and mobilizes soil-bound nutrients on decomposition through the discharge of organic acids (Sharma *et al.*, 2013) [6]. Integration of inorganic fertilizers with organic manures and bio-fertilizers will not only help sustain the crop productivity but also will be effective in improving soil health and hastening the nutrient-use efficiency (Verma *et al.*, 2006) [7].

Materials and Methods

The experiment was carried out at the Agricultural research farm of Lovely Professional University, Phagwara. The experiment design was Randomized Block Design (RBD) in a field with three replications and seven treatments. A complete account of the material used and methodology adopted during the course. The observation was done at 30, 60, and 90 DAS. The observed parameter was soil available Phosphorus (P). Available phosphorous was resolved to utilize Olsen's technique found. The reagents and methodology are given below:

- Sodium hydro-carbonate ($NaHCO_3$)
- Ammonium molybdate
- Ascorbic acid
- Sulphuric acid

P% = GF*(S-B)*25/Soil*100/5
Kg/ha = %*22400
Where, GF = Graph factor
S = Reading of Soil sample
B = Blank sample
Soil = Sample weight of soil

In 150ml of conical flask take 2gm of soil sample. A pinch of charcoal was taken and added 20ml of 0.5N $NaHCO_3$. Shake the flask using an electric shaker for half an hour. After shaking the suspension was filtered through the Whatman's No.1 filter paper. Although one blank sample also prepared. In a volumetric flask of 25ml, pipette the extract of 5ml. The 0.5N H_2SO_4 was added in the amount of 5ml and shake it until CO_2 estimation was disappeared. Then ascorbic acid was added of 4ml to it. Distilled water was added to make up the volume of 25ml. To measure the concentration of blue colour spectrophotometer was used at the 420 nm wavelengths.

Results and Discussion

Soil Available Phosphorus (kg ha^{-1}) is a major macronutrient which is needed very importantly for the tillering stage of the crop and it is a component of nucleic acid structure and also helps in protein synthesis. Soil available phosphorus was estimated at 30, 60 and 90 DAS. The highest significant value was found in T_5 with 15.34 kg ha^{-1} at 30 DAS. The percentage increase in T_5 was 78%. The lowest value was found in T_1 with 12.53 kg ha^{-1} and percentage increase was 45% as compare to the control. The highest significant result was found in T_5 with 15.71 and 15.57 kg ha^{-1} at 60 and 90 DAS. The percentage increase in T_5 was 79% for both the dates. The lowest significant soil available phosphorus was found in T_1 with 12.88 and 12.72 kg ha^{-1} at 60 and 90 DAS. The percentage of phosphorus was 47% and 46% as compare to the control (Table 1, Figure 2 & 3). The phosphorus is popularly known for its role in the development of root growth and its optimal activity. Its availability depend the solublization of its forms to the plants. The phosphate soluble microbes determine its solubility in the soil solution of the rhizosphere. Vermicompost is the source for lots of nutrients in the soil. The recommended concentration of phosphorus is 0.10 to 0.30% in the vermicompost (Meenakumari, 2012) [4]. This one is digested by earthworm, so its availability is easy in the soil (Adi *et al*., 2009) [1]. Among the sources of organic fertilizers for the phosphorus, the vermicompost occupied the top place to supply the same.

Table 1: Soil available phosphorus (kg ha^{-1})

Treatments	30 DAS	60 DAS	90 DAS
T0	$8.60^{d} \pm 0.012$	$8.73^{g} \pm 0.012$	$8.67^{g} \pm 0.012$
T1	$12.53^{c} \pm 0.017$	$12.88^{f} \pm 0.017$	$12.72^{f} \pm 0.017$
T2	$14.78^{b} \pm 0.023$	$15.16^{b} \pm 0.014$	$15.06^{b} \pm 0.012$
T3	$14.62^{b} \pm 0.032$	$14.94^{d} \pm 0.012$	$14.77^{d} \pm 0.017$
T4	$14.76^{b} \pm 0.012$	$15.11^{c} \pm 0.02$	$14.93^{c} \pm 0.013$
T5	$15.34^{a} \pm 0.01$	$15.71^{a} \pm 0.008$	$15.57^{a} \pm 0.003$
T6	$14.76^{b} \pm 0.341$	$14.69^{e} \pm 0.026$	$14.63^{e} \pm 0.011$

Where, DAS: Days after sowing. Data are in the form of Mean±SEM at $p<0.05$. The mean followed by different letters was significantly different at $p<0.05$, according to DMRT for separation of Means. T_0=control; T_1=100% RDF; T_2=75% RDF+25% Neem coated urea; T_3=50% RDF+50% Neem coated urea; T_4=75% RDF+25% vermicompost; T_5=50%RDF+50% vermicompost; T_6=50% RDF+25% Neem coated urea+25% vermicompost.

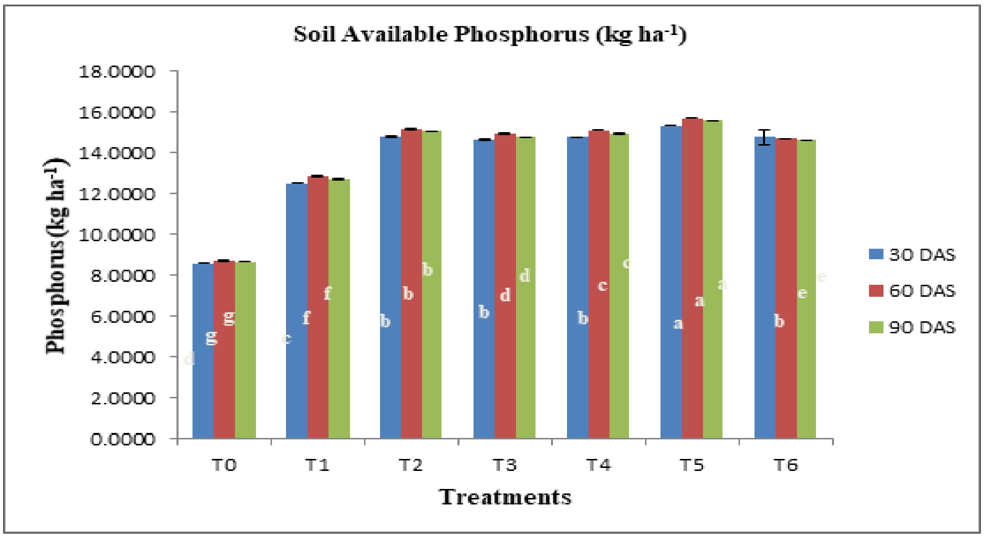

Fig 1: Soil available phosphorus (kg ha^{-1})

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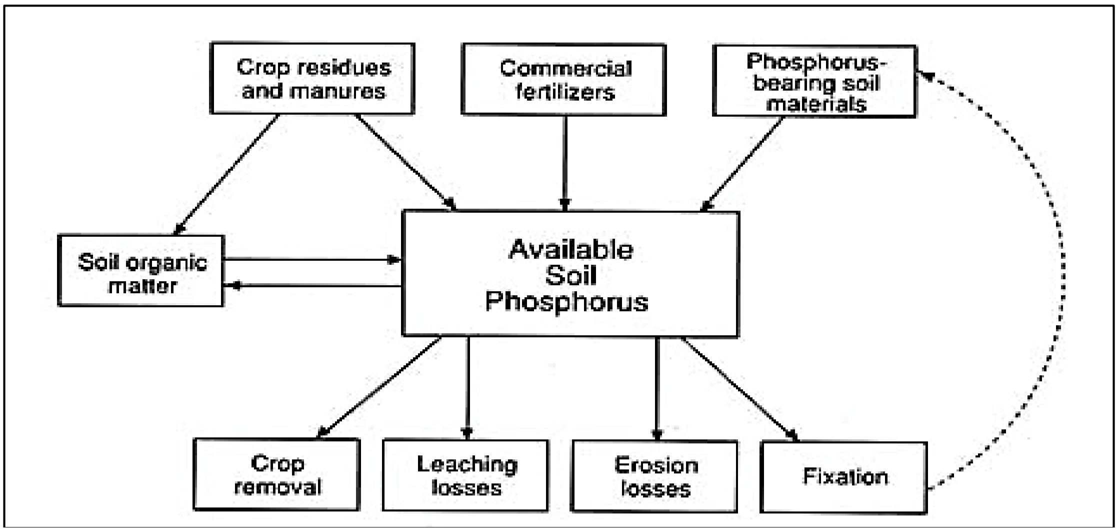

Source: Based on review of literature, 2019

Fig 2: Available phosphorus in soil crop system

Conclusion

The highest significant result was found in T_5 with 15.71 and 15.57 kg ha^{-1} at 60 and 90 DAS. The percentage increase in T_5 was 79% for both the dates. The lowest significant soil available phosphorus was found in T_1 with 12.88 and 12.72 kg ha^{-1} at 60 and 90 DAS. The percentage of phosphorus was 47% and 46% as compare to the control (T_0).

Acknowledgement

Authors are thankful to Department of Agronomy, Lovely Professional University, Punjab, for support during the research work.

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