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Effect of Nitrogen and Zinc on Physico-chemical properties of soil of Allahabad Uttar Pradesh India

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Abstract

A field experiment was conducted during *Rabi* season 2015-16 to study the Effect of Nitrogen and Zinc on Physico-chemical Properties of Soil at the research farm of department of soil science. Laid out in factorial with 3x3 randomized block design with three levels of Nitrogen [0, 60 and 120] kg ha^{-1}, three levels of Zinc [0, 15 and 30 kg ha^{-1}}, respectively. The treatment combination T_8 - [@ 120 kg Nitrogen ha^{-1} +@ 30 kg Zinc ha^{-1}] gave the best results with respect to slight increase in, soil, EC 0.56 dS m^{-1}, OC 0.474% and bulk density 1.17 g cm^{-3}, combination of resulted in significant increase in particle density 2.73g cm^{-3}, pore space 57.2 %, available N 258 kg ha^{-1}, P 23.0 kg ha^{-1}, K 278.4 kg ha^{-1} and Zinc (3.40) kg ha^{-1}, pH 7.45.

Keywords: Soil Properties, nutrients, pH, EC and OC.

Introduction

The application of N increased the Zn concentration in wheat tops and roots in unlimed soil, and decreased it limed soils. However, because of an increase in wheat yield, the uptake of zinc by wheat tops and roots also increased whit N application both in limed and unlimed soils. The audition of Zn 10 mg per kg, increased the N concentration in the absence of N, but in the presence of N, the addition of Zn to 20 mg per kg decrease the N concentration in wheat tops and roots. The applied of Zn 10 mg per kg in unlimed soil and to 20 mg per kg in limed soil increased the N uptake by wheat tops and roots, respectively. The Zn concentration was higher in absence of limed than in its presence while a reverse trend was true for N concentration Zinc (Zn) deficiency/toxicity is one of the most wide spread limiting factor to crop production. Zn is an element required by virtually all plants as it is a critical component of many enzymes and proteins Sharma (2006) [8]. Zinc is essential element to higher plants and is involved in several metabolic processes. A deficiency of Zn leads to change in fundamental processes of plants metabolism leading to poor growth, inter venial colorists, necrosis of lower leaves, and ultimately reduced seed production Zinc deficiency among crop plants is very common and a wide spread nutritional constrain for various part of the world, almost 50% of the soil used for cereal production are Zn deficient Gibbson (2006) [4]. Zinc deficiency is more common under some physico-chemical properties like, high pH, calcareous soil, light and sandy soil, high phosphorus level, wet soil. Water logging and arid climate condition attribute the deficiency of Zn in soil Abbas. A. and Dogan (2007) [1].

Zinc play an important role in completion the life cycle of plants and also a key role in nitrogen metabolism, photosynthesis and toxin synthesis and involved in diverse metabolic activities, influences the activity of hydrogenise and carbohydrates, synthesis of cytocrome and the stabilization of ribosomal function. The integrity of cellular membranes also requires Zn to preserve the structural orientation of macromolecules and keep ion transport system Jun Wang, *et al*. (2013) [6].

Materials and Methods

The experimental site was situated in university campus jurisdiction in district Allahabad, U.P. The soil of this site belongs to order Entisol having textural class sandy loam. The details of treatments and other relevant information are T_0-N_0Z_0 (control), T_1-N_0 Z_1, T_2- N_0 Z_2, T_3- N_1 Z_0, T_4- N_1 Z_1, T_5- N_1 Z_2, T_6- N_2 Z_0, T_7- N_2 Z_1, T_8- N_2 Z_2. Soil samples were obtained by auger from 0-15 depth and collected in gunny bags brought to laboratory for analyses. Samples Preparation Samples were finally taken after series of coning and quartering the soil samples were air-dried for a period of one week in a clean well – ventilated laboratory homogenized by grinding, passed through a 2mm (10 mesh) stainless sieve and stored in labeled plastic cans ready than soil samples were processed properly and were analyzed in laboratory for desire soil constituents. the various methods were used in determination of following desire soil constituents

Table 1: Physical properties at 0-15 cm depth of soil.

Ingredient	Methods (Year)
Particle density(g cm^3)	Relative density bottle method (Black,1965)
Bulk density (g cm^3)	Core method (Black,1965)
Pore – space (%)	Use of 100 ml Graduated Cylinder(Mathuwal *et al.*,1965)

Table 2: Chemical properties at 0-15 of soil depth.

Ingredient	Methods (Year)
Soil pH (1:2)w/v	Digital pH meter (Jackson,1958)
EC(dS m^{-1})	Digital Conductivity meter (Wilcox,1950)
Organic carbon (%)	Walkley and Black method (1947)
Available Nitrogen (kg ha^{-1})	Alkaline permanganate method (subbiah and Asija,1956)
Available phosphorus (kg ha^{-1})	Colorimetric method (olsen *et al*.1954)
Available Potassium (kg ha^{-1})	Flame photometric method (Tooth and Prince 1949)
Soil available Zinc (kg ha^{-1})	Shaw and Dean method (1952)

Result and Discussion: The initial and final values of physical properties and chemical properties are given below

Table 3: Physical properties of 0-15 cm depth of soil.

Property	Analyses value	Method used
Particle Density (g cm^{-3})	2.3	Black(1965)
Bulk Density (g cm^{-3})	1.15	Black(1965)
Percent total pore space (%)	50	Black(1965)
Moisture content (%)	12.33	Gravimetric Method
Manimum water holding capacity (%)	40	Muthuaval *at al.* (1992)
Soil colour	Yellowish Brown	Munsell colour chart (1971)

Table 4: Chemical properties at 0-15 of soil depth.

Particulars	Analysis value	Method followed
Soil pH (1:2)	7.57	Digital pH meter (Jackson,1958)
Soil EC (dS m^{-1})	0.56	Digital conductivity meter (Wilcox,1950)
Soil organic carbon (%)	0.65	Walkely and Black (1947)
Soil available Nitrogen (kg ha^{-1})	258	Kjeldhal Method (Jakson, M. L. 1973)
Soil available Phosphorus (kg $ha^{-1)}$	23	Olsen *et al*. (1954)
Soil available Potassium (kg ha^{-1})	278	Toth and Prince (1949)
Soil available Zinc (kg ha^{-1})	2.4	Shaw and Dean method (1952)

Soil Bulk density (g cm^{-3})

Soil Bulk density as influenced by various treatment combinations from pre to post-harvest soil analysis when subjected to statistical analysis shows non-significant difference among the treatment. The bulk density of the experimental soil ranges from 1.15 to 1.92 **(**g cm^{-3}**)** that reveals that the soil is slight alkaline in reaction. The Bulk density 1.15 (g cm^{-3}) before sowing the crop, the bulk density of soil shows a decline trend. The maximum bulk density was recorded in treatment T_8 (N_{120} Z_{30}) 1.18 (g cm^{-3}) and the minimum of bulk density was recorded in treatment combination T_0 (control) 1.12 (g cm^{-3})

Soil Particle density (g cm^{-3})

Soil particle density was influenced by various treatment combinations from pre to post-harvest soil analysis when subjected to statistical analysis significant difference among the treatment. The particle density of the experimental soil ranges from 1.78 to 2.43 that reveal that the soil is slight alkaline in reaction. The Particle density **(**g cm^{-3}**)** 2.30 before sowing the crop, the particle density of soil shows a increasing. The maximum particles density was recorded in treatment T_8 (N_{120} Z_{30}) 2.73 **(**g cm^{-3}**)** and the minimum of particles density was recorded in treatment combination T_0 (control) 2.21 **(**g cm^{-3}**)**

Soil Pore Space (%)

Soil pore space was influenced by various treatment combinations from pre to post-harvest soil analysis when subjected to statistical analysis shows significant difference among the treatments. The pore space of the experiment soil ranges from 33.39 to 47.07 that reveal mat the soil is slight alkaline in reaction, the pore space was 50.00 before sowing the crop, and the pore space of soil shows a decline trend. The maximum pore space was recorded in treatment T8 ($N_{120}Z_{30}$) 56.66% and the minimum pore space was recorded in treatment combination T_0 (control) 50.56%.

Soil pH (1:2) w/v

Soil pH was influenced by various treatment combinations from pre to post-harvest soil analysis when subjected to statistical analysis shows significant, difference among the treatment. The pH of the experimental soil ranges from 7.40 to 7.80 that reveal that the soil is slight alkaline in reaction. The pH was 7.6 before sowing the crop. The pH of soil shows a decline trend. The maximum pH was recorded in treatment T_0 (N_0 Z_0) 7.57 and minimum pH was recorded in treatment combination T_7 (N_{120} Z_{15}) 7.40.

Soil EC (dS m^{-1})

Soil EC was influenced by various treatment combinations from pre to post-harvest of Soil analysis when subjected to statistical analysis show s significant difference among the treatment. The EC of the experiment soil ranges from 0.15 to 0.30 dS m^{-1} that reveals that the soil is slight alkaline in reaction. The EC dS m^{-1} was 0.39 before sowing the crop. The EC of soil shows a increase trend. The maximum EC was recorded in treatment T_8 (N_{120} Z_{30}) 0.56 and the minimum of EC where recorded in treatment combination T_0 (N_0 Z_0) 0.52

Soil Organic carbon

Percentage organic carbon in soil was influenced by various treatment combinations from pre to post-harvest soil analysis when subjected to statistical analysis shows significance among the treatment.

The Organic carbon 0.40 % before sowing Data shows that the plot treated with the treatment combination T_8 (N_{120} Z_{30}) recorded maximum percentage of organic carbon in soil that is 0.65% in comparison of T_7 (N_{120} Z_{15}) percentage organic carbon in soil that is 0.63% and minimum percentage organic carbon in soil was observed in treatment combination T_0 (control) 0.48%.

Soil available Nitrogen (kg ha^{-1})

Available Nitrogen in soil (kg ha^{-1}) was influenced by various treatment combinations from pre to post-harvest soil analysis when subjected to statistical analysis shows significant difference among the treatment. The Nitrogen 240 (kg ha^{-1}) before sowing. Data shows that the plot treated with the treatment combination T_8 (N_{120} Z_{30}) recorded maximum available Nitrogen in soil that is 258.83 (kg ha^{-1}) in comparison to T_7 (N_{120} Z_{15}) available nitrogen in soil that is 254.63 (kgha^{-1}) and minimum available nitrogen in soil was observed in treatment combination T_0 (control) that is 222.12 (kg ha^{-1})

Soil available Phosphorus (kg ha^{-1})

Available phosphorus in soil (kg ha^{-1}) was influenced by various treatment combinations from pre to post-harvest soil analysis when subjected to statistical analysis shows significantly difference among the treatment. The phosphorus 22 (kg ha^{-1}) before sowing. Data shows that the plot treated with the treatment combination T_8 (N_{120} Z_{30}) recorded maximum available phosphorus in soil that is 23.00 kg ha^{-1} in comparison to T_7 (N_{120} Z_{15}) available phosphorus in soil that is 22.50 (kg ha^{-1}) and minimum available Phosphorus in soil was observed in treatment combination T_0 (Z_0 N_0)13.50 (kg ha^{-1}) that is (control.

Soil available Potassium (kg ha^{-1})

That available potassium in soil (kg ha^{-1}) as influenced by various treatment combinations from pre to post-harvest soil analysis when subjected to statistical analysis shows significant difference among the treatment. The Potassium 250 (kg ha^{-1}) before sowing. Data shows that the plot treated with the treatment combinations T_8 (N_{120} Z_{30}) recorded maximum Available Potassium in soil that is 301.20 kg ha^{-1} in comparison to T_7 (N_{120} Z_{15}) available potassium in soil that is 278.44 kgha^{-1} and minimum available potassium in soil was observed in treatment combination T_0 (control) that is 253.74 kg ha^{-1}.

Soil available Zinc (Kg ha^{-1})

Available zinc in soil (kg ha^{-1}) as influenced by various treatment combinations from pre to post-harvest soil analysis when subjected to statistical analysis shows significant difference among the treatment. The Zinc 2.40 (kg ha^{-1}) before sowing. Data shows that the plot treated with the treatment combinations T_8 (N_{120} Z_{30}) recorded maximum available Zinc in soil that is 3.55 kg ha^{-1} in comparison to T_7 (N_{120} Z_{15}) available Zinc in soil that is 3.30 kg ha^{-1} and minimum available Zinc in soil was observed in treatment combination T_0 (control) that is 2.89 kg ha^{-1}.

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