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Assessment of different levels of N P K and Zn on physic-chemical properties of soil in cultivation of wheat (*Triticum aestivum* L)

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Abstract
An experiment was conducted on "Assessment of different levels of N P K and Zn on Physico-chemical Properties of Soil and yield of Wheat (*Triticum aestivum* L.)" during *Rabi* season 2013-14 at the Research farm of Department Soil Science, Allahabad School of Agriculture, Sam Higginbottom Institute of Agriculture, Technology & Sciences (Deemed-to-be-University) Allahabad, trial was laid out in randomized block design (RBD) with three replications, 3 × 3 factorial RBD, on sandy loam soil in which sand 61.73.%, silt 21.12% and clay 18.15% (*Inceptisol*), consisted nine treatment it was observed that the best results were reported for post-harvest soil properties in treatment T_8-(@N P K_{100} kg ha^{-1} +@Zn_{30} Kg ha^{-1}), OC 0.62%, available nitrogen 309.37 kg ha^{-1}, phosphorus 27.94 kg ha^{-1} and potassium 206.45 kg ha^{-1} respectively, available N, OC and Zn were found to be significant. In treatment T_8 and treatment T_7 (@N P K_{75} kg ha^{-1} +@Zn_{30} kg ha^{-1}) adequate plant nutrient supply holds the key for improving the food grain production and sustaining soil fertility and food security.

Keywords: Soil Properties, Yield, Wheat

Introduction
India has witnessed a significant increase in total food grain production 259.29 Mt with a major contribution of wheat with 94.88 Mt during 2013-14 and is expected to touch 109 Mt in 2020. Wheat (*Triticum spp*.) is the second most important winter cereal in India after rice. Bread wheat contributes approximately 95% to total production while another 4% comes from durum wheat and dicoccum share in wheat production remains only 1%. Wheat crop contributes substantially to the national food security by providing more than 50% of the calories to the people who mainly depend on it. Top 10 wheat producers (2009) Exporting Quantity (tons) China 114.5, India 80.6, USA 59.4, Russia 56.5, France 39.4, Pakistan 24.0, Germany 25.1, Australia 23.0, Canada 22.5, Ukraine 20.0, Turkey 17.8, Global (Singh, 2010). To wheat the demand of increasing population, India food grain production wheat go up to about 325Mt by 2025.To achieve this largest, Production has to increase at the rate of 7Mt yr^{-1} over the next 10-12 years, without never increase in irrigated crop land. (Singh-2011) According to latest official data, wheat has been sown in a record 31.18 million hectare 2013-14 rabi season, as against 29.12 million hectare in the year-ago. So far, wheat acreage remains higher in Uttar Pradesh at 9.94 million hectares, Madhya Pradesh at 5.78 million hectares and Rajasthan at 3 million hectares. Wheat acreage remains lower so far in Punjab, Karnataka, Uttarakhand, Assam, West Bengal and Chhattisgarh. It also involves creation of a system where everyone in the supply chain is properly incentivized to maximize production and efficiency," Fertilizer is the most importance and indispensable input in crop production and response to chemical fertilizer is related to certain properties in individual nutrient source soil crop characteristics and this very true in case of Nitrogen, Phosphorus and Potash and Zinc an which play a key role among the nutrient essential for plant growth. About 40 Mt fertilizer nutrients will have to be used to produce 380-400 Mt of food grain to feed and estimated population of 1.5 billion by 2050 A.D. The Stagnation in crop Productivity has lower demand to be due to deficiency of some micro and secondary nutrients (Dhane, 2011) [6] interrogated nutrients in wheat on yield of and nutrient uptake (116,204 and 125 kg ha^{-1}) with the application of 100% N P K + 10 t FYM ha^{-1} as compared to the grain yield of4.41t ha^{-1} and total N P K uptake (95.7, 18.1 and 111kg ha^{-1} respectively) with the 100% N P K alone. The yield of and nutrient uptake by wheat were significantly lower with the suboptimal doses of N P K.

Materials and Methods

The experiment was conducted during *Rabi* season 2013-14 on crop research farm of department of Soil Science at Sam Higginbottom Institute of Agriculture, Technology and Sciences, Deemed-to-be-University Allahabad, the area is situated on the south of Allahabad on the right side of the river Yamuna on the south of rewa road at a distance of about 6 km. from Allahabad city. It is situated at 25^0 27' N latitude, 81^0 51' E longitudes and at the altitude of 98 meter above the mean sea level (MSL). The soil was neutral in reaction, soil texture sandy loam, and low in available N, medium in available P_2O_5 and high in available K_2O content. The experiment was laid out in randomized block design with three replications the data recorded during the course of investigation was subjected to statistical analysis by "Analysis of variance technique" Fisher (1960) [8]. The treatment consisted of nine combination of inorganic source of fertilizers T_0 (@NPK_0 + @Zn_0 kg ha^{-1}) Control, T_1-(@NPK_{75} + @Zn_0 kg ha^{-1}), T_2-(@NPK_{100} kg ha^{-1}+ @Zn_0 kg ha^{-1}),T_3-(@NPK_0 Kg ha^{-1} + @Zn_{15} kg ha^{-1}), T_4 -(@NPK_{75} Kg ha^{-1} + @Zn_{15} kg ha^{-1}), T_5 -(@NPK_{100} kg ha^{-1}+ @Zn_{15} kg ha^{-1}),T_6 -(@NPK_0 kg ha^{-1} +@ Zn_{30} kg ha^{-1}), T_7-(@NPK_{75} kg ha^{-1}+ @Zn_{30} kg ha^{-1}), T_8- (@NPK_{100} kg ha^{-1}+@ Zn_{30} kg ha^{-1}). The plot size having 2 x 2 m for crop seed rate is 100 kg ha^{-1} (*Triticum aestivum* L.*)* Cv. Ankur Kedar. The source of nitrogen, phosphorus, potassium, and Zn as Urea, SSP, MoP and Zinc Sulphate respectively. Basal dose of fertilizer was applied in respective plots according to treatment allocation in furrows opened by about 5 cm. All the agronomic practices were carried out uniformly to raise the crop. Soil sample were collected from the soil 0-15 cm depth, plant data were taken at 30, 60, 90 and 120 days after sowing (DAS).

Table 1: Mechanical, Physical and Chemical analysis of Soil before sowing of seeds

Particulars	Results	Method employed
Bulk density(g cm^{-3})	1.71	Graduated measuring cylinder (Black 1965) [3]
Pore space (%)	37.94	Graduated measuring cylinder (Black 1965) [3]
Soil pH (1:2) soil water suspension (w/v)	7.42	Digital pH meter
Soil EC. (dSm^{-1}) at 25^0C of 1:2 soil water suspension	0.18	Digital Conductivity meter (Wilcox 1950) [23]
Organic carbon (%)	0.22	Rapid titration method (Walkely and Black 1947) [22]
Available Nitrogen (kg ha^{-1})	260.00	Alkaline permagnate method (Subbiah and Asija 1956) [13]
Available Phosphorus (kg ha^{-1})	26.00	Colorimetric method (Olsen *et al*. 1954) [10]
Available Potassium (kg ha^{-1})	189.00	Flame photometric method (Toth and Prince, 1949) [20]
Available Zn (ppm)	0.56	Shaw and Dean method, (1952) [14]

Results and Discussion

Physical Properties

The depicted in table-2 Physical Properties on wheat crop N P K and Zn fertilizer in conjunction on particle density (g cm^{-3}), Pore space (%) of post-harvest soil was recorded 2.49, 50.99 with the treatment T_8 (@NPK_{100} kg ha^{-1}+@Zn_{30} kg ha^{-1}). Therefore bulk density (g cm^{-3}) was to be recorded non-significant increase in particle density may be due to increase in plant growth. As these indicated an enrichment of fine fractions *i.e.* silt and clay a part from the retention of dissolved O.M. leading to change in physical properties of soil**.**

Table 2: Assessment of Different Levels of N P K and Zn and their Interaction on Physical properties of post harvest Soil

Treatments	Bulk density (g cm^{-3})	Particle density (g cm^{-3})	Pore space (%)
T_0=L_0R_0	1.29	2.38	45.59
T_1=L_0R_1	1.28	2.39	46.27
T_2=L_0R_2	1.27	2.40	46.64
T_3=L_1R_0	1.24	2.40	47.23
T_4=L_1R_1	1.26	2.42	47.81
T_5=L_1R_2	1.23	2.48	50.17
T_6=L_2R_0	1.50	2.46	49.19
T_7=L_2R_1	1.24	2.47	49.59
T_8=L_2R_2	1.22	2.49	50.99
Mean	1.28	2.43	48.16
F- test	NS	NS	NS
S. Em (±)	0.01	0.09	2.24
C.D. at 5%	-	-	-

Soil Chemical Properties

As depicted in table 5 chemical properties on wheat N P K and Zn fertilizer in conjunction on organic carbon (%) available nitrogen organic carbon and Zn was to be significant. The organic carbon (%), available nitrogen (kg ha^{-1}) was recorded 0.74, 309.37 in the treatment T_8 (NPK_{100} kg ha^{-1}+ Zn_{30} kg ha^{-1}), it was significantly higher as compared to other treatment combination. But pH 1:2 (w/v), Electric conductivity (dS m^{-1}), available Phosphorus, available potassium (kg ha^{-1}) respectively were found to be non-significant. The increased in organic carbon (%) may be due to increase in plant residues, similar results have been reported by Aphale *et al.* (2005) [2].

Table 3: Assessment of Different Levels of N P K and Zn and their Interaction on Chemical properties of post harvest Soil

Treatment	pH (1:2 w/v)	EC (dS m^{-1})	N (kg ha^{-1})	P_2O_5 (kg ha^{-1})	K_2O (kg ha^{-1})	Zn(ppm)	Organic carbon (%)
$T_0=L_0R_0$	7.1	0.14	288.4	24.77	135.41	0.55	0.52
$T_1=L_0R_1$	7.3	0.15	289.1	25.28	139.36	0.87	0.52
$T_2=L_0R_2$	7.3	0.17	291.7	26.04	152.5	0.62	0.61
$T_3=L_1R_0$	7.43	0.17	297.4	27.75	166.56	0.65	0.62
$T_4=L_1R_1$	7.26	0.19	298.66	26.41	184.21	0.72	0.64
$T_5=L_1R_2$	7.5	0.23	296.70	26.81	162.76	0.85	0.62
$T_6=L_2R_0$	7.33	0.19	299	27.5	201.13	0.77	0.69
$T_7=L_2R_1$	7.53	0.21	307.5	27.56	206.37	0.82	0.71
$T_8=L_2R_2$	7.26	0.24	309.37	27.94	206.45	0.90	0.74
Mean	7.33	0.18	297.53	26.67	172.75	0.75	0.63
F- test	NS	NS	S	NS	NS	S	S
S. Em (±)	0.10	0.012	1.67	0.85	10.59	0.008	0.014
C. D. at 5%	-	-	5.02	-	-	0.02	0.042

Conclusion

It is concluded that post harvest soil properties such as Organic Carbon (%), Available Nitrogen (kg ha^{-1}) and available Zn were found to be significant with the increarse rate of application of N P K and Zn fertilizers.

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