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Iron concentration in grain and straw in rice by the incorporation of effect crop residue and residual effect of zinc in rice-wheat cropping system

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ABSTRACT

Present experiment is a part of long term experiment based on effect of crop residue and residual starter zinc. This part of investigation "Concentration of iron in grain and straw of rice in rice-wheat cropping system" indicated the synergistic effect of Zn on Fe concentration in grain and straw of rice. The interaction effects of crop residue and residual Zinc on Fe concentration in grain and straw were found non-significant.

Key words *: Rice, Grain, Straw, Iron, Concentration, Residual starter zinc, Rice-wheat cropping system*

Introduction

Now a days the wide scale adoption of rice -wheat cropping system has increased in agricultural production but this intensive system over a period of time and nature of crop has set declining yield trend as well as deterioration in soil productivity even with optimum use of fertilizers. Hence, for restoration of soil fertility, there is an urgent need to look forward another option like, crop residue incorporation in soil for better production. So the present investigation is based on concentration of iron in rice wheat cropping system as influenced by residual starter Zinc and crop residues.

Iron is a very important and essential minerals nutrient for the living organism deficit of iron is the cause of the most common we can see anemia in hole world and iron content in various plants part like root, shoot stem, leaves, flowers, fruits, seeds we can say in whole plant it is found we are consuming iron supplement if in the case of deficiency we can consume iron through the plant.

Materials and Methods

Grain and straw samples were collected from each plot of both rice and wheat crop (17^{th} and 18^{th} rotation) and washed with acidified detergent solution, rinsed with tap water followed by distilled water. The plant samples were initially dried in sun followed by dried in hot air circulation oven at 60 ^{o}C and pulverised in stainless steel blade warring blender. The powdered samples were stored in small polyethylene bags for further chemical analysis.

Nitrogen, phosphorus and potash were applied in the experimental field in the form of urea, single super phosphate and muriate of potash, respectively. Crop residues of previous crops after chopping were incorporated in the plots as per treat-

ments. A field experiment was started in *Rabi season* in light textured highly calcareous soil deficient in available Zn at Dr. Rajendra prasad central agricultural university Research farm, Pusa and the current investigation period is 2013-14. as per details given below.

Treatments

A long term field experiment is being conducted since 1994 at RAU, Pusa Farm with following details, where observations were taken.

Treatment : 16 (4 main treatment and 4 subtreatment)
Replication : 3
Design : Split Plot
Plot size : 5 x 2m
Croprotation : Rice (cv. Rajshree), Wheat (cv. HD2824)
Crop residue levels - 4 (Applied toeachcrop)
Zn - levels – 4 (Applied only to first cro
CR_1 and No crop residue (CR_0)
CR_2 and 25% of straw produced (CR_{25})
CR_3 and 50% of straw produced (CR_{50})
CR_4 and 100% of straw produced (CR_{100})
Zn_1 and no Zn (Zn_0)
Zn_2 & 2.5 kg Zn ha^{-1} ($Zn_{2.5}$) Zn_3&5. Kg Zn ha^{-1} ($Zn_{5.0}$)
Zn_4 and 10 kg Zn ha^{-1} ($Zn_{10.0}$) Recommended dose of fertilizers (NP K) for both crop are 120: 60: 40 Kg ha^{-1}. Rice and wheat crops are being grown continuously under rice-wheat system during *Kharif* and *Rabi* seasons. Chopped straw of previous crop treated as crop residues were incorporated as per treatment.

Chemical Analysis of Plant Sample: The powdered plant materials were digested in triacid mixture consisting of 10 parts of concentrated HNO_3, 1 part of concentrated H_2SO_4 and 4 parts of 60% $HClO_4$ (Jackson, 1978). First of all, 0.5 g of plant material was transferred to a neatly washed and dried 100 ml conical flask and then 15 ml triacid mixture was added to it. It was placed on a hot plate for digestion on slow heat and continued the digestion till colourless/white residue was left, dissolved in distilled water and the digested material was made up the volume 50 ml with the help of 50 ml volumetric flask. The dissolved material was filtered through Whatman filter paper No. 1. A blank was also carried out in the same way having no plant material.

Table 1. Effect of Residual Starter Zinc and Crop Residue Incorporation on Iron Concentration (mg kg^{-1}) in Grain and Straw of Rice.

Zn levels	Crop residue level (% of straw produced)									
(kg Zn ha^{-1})	0	25	50	100	Mean	0	25	50	100	Mean
	Grain (33rd crop)					Grain (35th crop)				
0	43.70	46.30	50.30	53.40	48.43	61.10	58.30	57.40	60.20	59.25
2.5	45.70	48.80	52.00	54.70	50.30	60.20	60.20	63.00	64.80	62.05
5	47.20	50.70	54.40	57.90	52.55	60.20	63.00	62.00	66.70	62.98
10	47.40	51.90	56.30	59.40	53.75	62.00	65.70	63.90	69.40	65.25
Mean	46.00	49.40	53.30	56.40	—	60.90	61.80	61.60	65.30	—
CD	CR		1.24					2.80		
(P=0.05)	Zn		1.09					1.80		
	CR x Zn		NS					NS		
	CV (%)		3.08					4.19		
	Straw (33rd crop)					Straw (35th crop)				
0	85.70	97.20	97.30	103.00	95.80	98.00	97.30	100.00	97.30	98.15
2.5	91.00	97.90	101.50	107.00	99.35	94.30	98.30	101.00	103.00	99.15
5	95.80	100.40	104.60	110.20	102.75	99.30	98.30	93.30	106.00	99.23
10	101.10	101.40	109.00	113.60	106.28	96.70	100.70	102.30	106.30	101.50
Mean	93.40	99.20	103.10	108.50	—	97.10	98.70	99.20	103.20	—
CD	CR		1.91					2.70		
(P=0.05)	Zn		1.35					2.10		
	CR x Zn		NS					NS		
	CV (%)		2.94					3.06		

Results and Discussion

Iron Concentration in Rice Grain and Straw

The results on effect of crop residue and residual Zn on Fe concentration in grain and straw of rice are presented in Table 1. Different levels of crop residue and Zn increased Fe concentration in grain of 33rd and 35th rice crops which varied from 43.70 to 59.40 and 61.10 to 69.40 mg kg^{-1} and in straw, from 85.70 to 113.60 and 98.00 to 106.30 mg kg^{-1} respectively. Crop residue significantly increased Fe concentration in grain of 33rd and 35th rice crop from 46.00 to 56.40 and 60.90 to 65.30 mg kg^{-1} and in straw from 93.40 to 108.50 and 97.10 to 103.20 mg kg^{-1}, respectively. Residual Zn significantly increased Fe concentration in grain of rice in 33rd and 35th crops from 48.43 to 53.75 and 59.25 to 65.25 mg kg^{-1}, respectively and in straw, from 95.80 to 106.28 and 98.15 to 101.50 mg kg^{-1}, respectively. These results indicated the synergistic effect of Zn on Fe concentration in grain and straw of rice (Tisdale *et al.,* 2002). The interaction effects of crop residue and residual Zinc on Fe concentration in grain and straw were found non-significant.

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