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Effect of Deep Placement of PU, USG, Sulphur and Urea + Vermi Compost Briquette on Yield and Attribute on Rice

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Abstract
An experiment was conducted in the field of instructional cum research farm Indira Gandhi krishi vishwavidalaya Raipur, during *kahrif* season (2016-2017) with a view to evaluating the effect of rice response and nutrient use efficiency to deep placement of nitrogen and sulphur under submerged condition. The soil of experimental site belong to *vertisol.* There were seven treatment combinations of sulphur and vermi compost with urea briquette. The treatments include T_1 (N_0:P_0:K_0), T_2 (N_{100}:$P6_0$:$K4_0$, N through prilled urea), T_3 (N_0:P_{60}:K_{40}:S_{10}, sulphur broadcast), T_4 (N_{80}:P_{60}:K_{40}, N through urea briquettes), T5 (N_{80}:P_{60}:K_{40}, N through VC briquettes), T_6 (N_{80}:P_{60}:K_{40}:S_{10} N and S through briquettes), T_7 (N_0:P_{60}:K_{40}) phosphorus + potassium. The experiment was laid out in a randomized block design with three replications. Prilled urea was applied in three equal splits. USG, Urea+ Sulphur briquette and Urea + Vermicompost briquettes were applied in between 7- 10 DAT and the briquettes were placed at 8-10 cm depth between four hills (USG, Urea + Sulphur briquette) and 10X20 cm (Urea + Vermicompost briquette). The yield and yield attributing characters of rice responded significantly superior with T_5 (N_{80}:P_{60}:K_{40}, N through VC briquettes) over GRD (N_{100}:P_{60}:K_{40}). The highest grain and straw yield, N content and N uptake was recorded in T_5 (N_{80}:P_{60}:K_{40} N through VC briquettes). The results revealed that the deep placement of urea briquettes accelerated regular flow of N to root may be reason for accumulation of high N in plant tissue and grain, then rice (rajeshwari) yield and yield attribute also increases in rice. Therefore, the application of 80kg N/ha as urea + VC briquettes may be recommend.

Keywords: *Vertiosol*, Grain Yield, Straw Yield, Nutrient, Rice (Rajeshwari)

Introduction
Rice (*Oryza sativa* L.) is the most important and extensively cultivated food crop that has been referred as "Global Grain" because of its use as prime staple food in about 100 countries of the world. In world, rice has occupied an area of 156.7 million tones per hectare, with a total production of 650.2 MT [Anon 2014] [1]. In India, rice occupies an area of 42 million hectare with production of 103.04 million tonnes with an average productivity of 2137 kg per hectare (Ministry of Agriculture & Farmer Welfare, 2015), which is half of the global average.
In Chhattisgarh, rice occupies an area 3.7 million ha with production of 7.65 million tonnes with an average productivity of 1322 kg ha^{-1} (Department of Agriculture, Raipur, 2015-16). Demand for rice is growing every year and it is estimated that by 2025 AD the requirement would be 140 million tonnes. To sustain present food self-sufficiency and to meet future food requirements, India has to increase its rice productivity by 3 per cent per annum. Its cultivation is of immense Importance to food security of Asia, where more than 90 % of the global rice is Produced and consumed. Rice provides 32-59% of the dietary energy and 25-44% of the dietary protein in 39 countries. In India, it accounts for more than 40% of Food grain production, providing direct employment to 70% people in rural areas. Rice is a major crop of Chhattisgarh. Near about 70% of area is under cultivation each year. The role of chemical fertilizer in increasing food production is well established. Nitrogen (N) fertilizer is a major essential plant nutrient and key input for increasing crop yield, hence the most yield - limiting nutrient in rice (*Oryza sativa* L) cropping systems worldwide.

Material Method
Experiment was conducted with three replication and and seven treatment in a randomized block design. The treatment include T_1 (N_0:P_0:K_0), T_2 (N_{100}:$P6_0$:$K4_0$, N through prilled urea),

T_3 (N_0:P_{60}:K_{40}:S_{10}, sulphur broadcast), T_4 (N_{80}:P_{60}:K_{40}, N through urea briquettes), T5 (N_{80}:P_{60}:K_{40}, N through VC briquettes), T_6 (N_{80}:P_{60}:K_{40}:S_{10} N and S through briquettes), T_7 (N_0:P_{60}:K_{40}) phosphorus + potassium. Observation related with rice attribute characteristics like, number of effective tillers, filled grain, straw yield, and test weight are recorded periodically. Rice variety (rajeshwari) was use to evaluate the effect of deep placement of nutrient. USG, Urea+ Sulphur briquette and Urea + Vermicompost briquettes were applied in between 7- 10 DAT and the briquettes were placed at 8-10 cm depth between four hills.

Result and Discussion

Effect of deep placement of PU, USG, Sulphur and urea+ vermicompost briquette on yield and attribute of rice

Effective tillers hill^{-1}

The application of PU, USG, N and S, VC briquettes on effective tiller was significantly influenced. The highest number of effective tillers hill^{-1} of 8.03 was found in T_5 (N_{80}:P_{60}:K_{40}) N through urea + VC briquettes followed by T_6 (N_{80}:P_{60}:K_{40}:S_{10})N and S through briquettes which present 7.2 effective tiller hill^{-1} and the lowest value found in control T_1 Control (N_0:P_0:K_0). The deep placement of urea + VC briquettes improved the soil physio – chemical and biological properties contributed to better crop growth root and shoot development of rice plant. Similar result was found by [Supta Das 2014] [2].

Filled grain panicle^{-1} of rice

Deep placement of urea briquette on grains panicle^{-1} of rice influenced significantly. The number of grains panicle^{-1} varied from 90-121. The highest grains panicle^{-1} 121 was measured in T_5 (N_{80}:P_{60}:K_{40}) N through urea + VC briquettes which was identical to T_6 (N_{80}:P_{60}:K_{40}:S_{10}) N and S through briquettes, followed by T_4 (N_{80}:P_{60}:K_{40}) N through urea briquettes, T_2 (N_{100}:P_{60}:K_{40}) N through prilled urea. The lowest value (90) was recorded in T_1 (Control). Similar results observed by [Islam *et al.*2011] [3].

Test weight 1000 seed of rice

Data presented on (table & fig 4.1) show the test weight non-significant variation among the different treatments. The highest test weight of grains recorded in T_5 N through urea + vc briquettes (N_{80}:P_{60}:K_{40}) 34.44g followed by T_6, T_5 N through urea + vc briquettes (N_{80}:P_{60}:K_{40}) N and S through briquettes 33.43 g and lowest value recorded in T_1 control 33.72 g. However [Islam *et al.* 2011] [3, 4]. observed that the effect on 1000 grain weight of rice was insignificant where as these results are obtain well collaborated with the findings of [Rahman *et al.* 2009] [6] who found an insignificant response of urea-N and manures on 1000 grain weight of BRRI dhan 29. [Hassan 2007] [8] showed that different levels of USG did not have any significant effect on 1000 grain weight of three rice cultivars.

Grain Yield of rice

The grain yield significantly superior in T_5 (N_{80}:P_{60}:K_{40}) through urea + VC briquettes is 58.11 q./ha when compared with GRD (100:60:40) 50.28 q/ha. Which was at par to T_6 (N_{80}:P_{60}:K_{40}:S_{10}) N and S through briquettes 52.81 q. /ha and lowest 23.89 q./ha was recorded in T_1 (N_0:P_0:K_0) control which was significantly lower than all other treatments while deep placement of urea + VC briquette T_5 (N_{80}:P_{60}:K_{40}) found 58.11 q/ha grain yield which also significantly when compare with T_2 (N_{100}:P_{60}:K_{40}) N through PU 50.25 q/ha grain yield. The grain yields obtained from different treatments may be ranked in the order of T_5>T_6>T_4>T_2>T_3>T_7>T_1. The grain yield was increased due to addition of vermicompost in treatment T5 provide better physical, chemical and biological soil condition to plant and also increase the number of effective tillers, number of grain panicle^{-1}. Broadcasting of prilled urea tends to increased various losses of nitrogen therefore lower yield compared with deep placement of briquettes slowly release of nutrient and reduce the losses and higher nutrients uptake is higher produce maximum yield. [Rahman *et al*. 2009] [6, 7] conducted an experiment and showed that the higher grain yield of NPK briquette (2.4 g ×2), USG and PU treated plots which were statistically similar to NPK briquette (3.4 g × 1) and significantly higher grain yield was observed in N treated plots over N control. [Islam *et al.* 2011] [3, 4, 5] carried out an experiment on the effectiveness of NPK briquette on rice in tidal flooded soil condition. They found that NPK briquettes, USG and PU treated plot produced statistically similar grain yield. N-treated plots (briquette, USG and PU) gave significantly higher grain yield than N control. [Kapoor *et al*. 2008] [9] observed that significantly higher grain yield was observed with deep placement of NPK briquette compared to 43 broadcast applications. [Durguda *et al*. 2008] [10] also observed that higher grain yield of in rice with DAP briquettes compared to urea.

Straw yield of rice

Data presented in table1 show that the straw yield was also influenced due to application of PU, USG, VC briquettes, N and S briquettes and sulphur broadcast. The straw yield was obtained significantly superior in T_5 Urea+VC briquettes (N_{80}:P_{60}:K_{40}) 95.39q./ha, which was at par to T_6 N and S through briquettes (N_{80}:P_{60}:K_{40}:S_{10}) 84.62q./ha. The lowest yield was recorded in T_1 (control) 33.78 q/ha which was significantly lower than all other treatments. The treatments trends recorded and fallow as T_5> T_6> T_4> T_2> T_3> T_7> T_1 in terms of straw yield as depicted in (table and fig 1.) These results support the findings of [Jahan 2014] [11] who reported that the application of PU, USG and organic manures significantly increased the paddy and straw yield of rice.

Table 1: Effect of deep placement of PU, USG, Sulphur and urea + vermi compost briquette on rice yield and attribute of rice

Treatment	Number of effective tillers/hills	Filled grain/ panicle	Test weight 1000/seed (gm)	Rice yield q. /ha	
				Grain	Straw
T_1 Control (N_0:P_0:K_0)	3.53	90	33.72	23.89	33.78
T_2 N through prilled urea (N_{100}:P_{60}:K_{40})	6.23	111	33.13	50.28	80.65
T_3 Sulphur broadcast + P + K (N_0:S_{10}:P_{60}:K_{40})	5.13	98	33.07	29.46	44.75
T_4 N through urea briquettes (N_{80}:P_{60}:K_{40})	6.93	113	32.73	51.14	81.36
T_5 N through urea + vc briquettes (N_{80}:P_{60}:K_{40})	8.03	121	33.44	58.11	95.39
T_6 N and S through briquettes (N_{80}:P_{60}:K_{40}:S_{10})	7.20	119	33.43	52.81	84.62
T_7 Phosphorus + potassium (N_0:P_{60}:K_{40})	4.21	97	32.9	28.09	38.08
SEm±	0.30	2.45		2.2	3.55
CD (P=0.05%)	0.92	7.56	NS	7.26	10.96

NS: Non significant**, N:** Nitrogen**, P:** Phosphorus, **S:** Sulphur, **K:** Potassium, **VC:**Vermicompost, **USG:** Urea super granuals

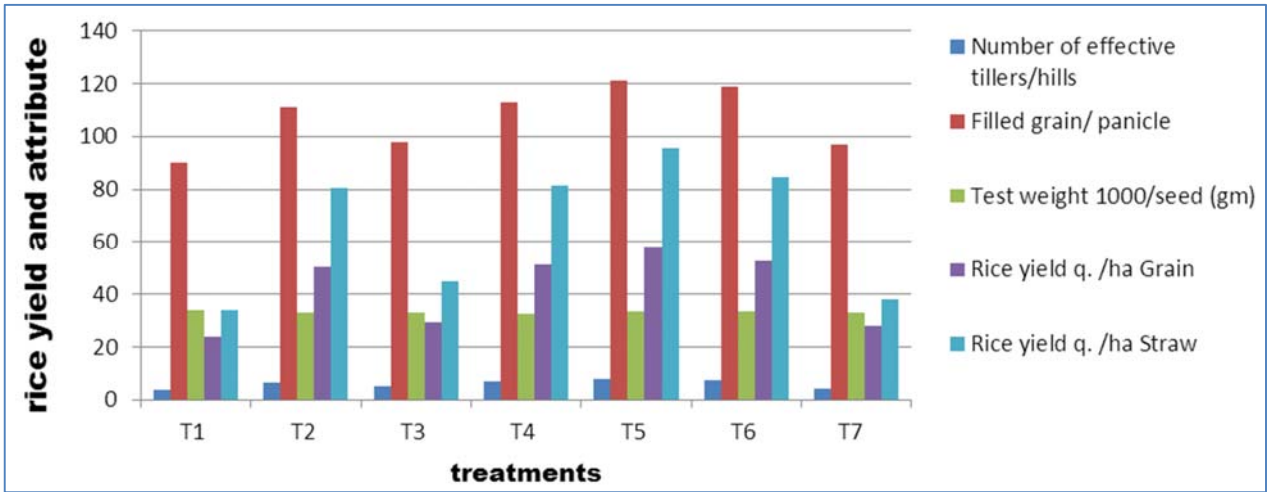

Fig 1: Effect of deep placement of PU, USG, Sulphur and urea + vermi compost briquette on rice yield and attribute of rice

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