The Pharma Innovation Journal 2022; SP-11(8): 1956-1959

www.ThePharmaJournal.com

The Pharma Innovation

ISSN (E): 2277-7695
ISSN (P): 2349-8242
NAAS Rating: 5.23
TPI 2022; SP-11(8): 1956-1959

www.thepharmajournal.com
Received: 05-06-2022
Accepted: 13-07-2022

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Rice yield, growth indices and nutrient uptake of rice as influenced by fly ash and FYM incorporation in an inceptisol

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Abstract
An investigation to study "rice yield, growth indices and nutrient uptake of rice as influenced by fly ash and FYM incorporation in an Inceptisol" was carried out during *kharif* season of 2021. The results indicated that application of 75% RDF + 45t/ha fly ash + 5t/ha FYM recorded highest rice grain (53.04 q ha^{-1}) and straw (65.98 qha^{-1}) yield as compared to 100% RDF (49.55 q ha^{-1} grain & 61.36 q ha^{-1} straw) and control (26.66 q ha^{-1} grain & 35.47 qha^{-1} straw). The plant height (138.80 cm) was found highest in T2 (100% RDF (100:60:40)), which was at par with all other treatment except control, whereas no. of grains per panicle (153.95), panicle length (23.18 cm), and no. of effective tillers (8.78) found highest in 75% RDF + 45 t/ha Fly ash + 5 t/ha FYM. The test weight, soil pH, EC and micronutrients (Fe, Mn, Zn, Cu) were not affected due to application of fly ash along with FYM, while the soil organic carbon (5.57 g/kg), N (159.60 kg/ha), P (21.09 kg/ha), and K (373.35 kg/ha) were enhanced due to incorporation of fly ash with FYM. The conjoint application of FYM, fly ash and inorganic fertilizers were found to affect the total nutrient (major and micro nutrient) uptake by rice crop. Overall result concluded that use of 75% RDF + 45 t/ha Fly ash + 5t/ha FYM can save 25% of fertilizer (NPK) and increase growth and yield attributing characters of rice.

Keywords: Rice yield, fly ash, FYM, nutrient uptake

Introduction
Being a vegetative fossil fuel fly ash consist of mineral matter which gets utilized by plants from the soil. It can act as a secondary source of fertilizer nutrients like P, K, Ca, Mg, S, Cu, Fe, Zn, Mn, Mo etc. (Totawat *et al*., 2002) [13]. Fly ash can be used for reclaiming the problematic soil and enhance the crop productivity depending upon the nature of fly ash.

Fly ash addition alters the physical properties of soil such as texture, bulk density, water holding capacity and particle size distribution, and considered as useful ameliorant which improve physical, biological, and chemical properties of problematic soils and enhance the availability of macro and micronutrients for plants (Jala and Goyal, 2006) [3]. The hydroxide and carbonate salts give fly-ash one of its principal beneficial chemical characteristics, the ability to neutralize acidity in soils. Most of the fly-ash produced in India is alkaline in nature; hence, its application to agricultural soils could increase the soil pH and thereby neutralize acidic soils.

Paddy (*Oryza sativa* L.) stands first among all food grain crops not only in world but also in our country in terms of area under the crop production and consumption. Rice is the most important and extensively cultivated food crop, which provides half of the daily food for one of every three persons on earth. It is the staple food for one third world's population and occupies almost one fifth to the total land area covered under cereals. It is grown under diverse climatic conditions and over wide geographical range. Most of the world's rice is cultivated and consumed in Asia, which constitutes more than half of the global population. Approximately 11% of the world's arable land is planted annually to rice and it ranks next to wheat (Rahman *et al*., 2010) [9].

Application of FA with FYM and inorganic fertilizers in rice may prove to be a better combination for increasing the yield and soil condition due to great potentiality of FA in agriculture and to its efficacy in modification of soil health and crop performance. The higher concentration of elements (K, Na, Zn, Ca, Mg, and Fe) in fly ash serves as a secondary source

of nutrients along with its tendency to improve the physical condition of soil when combined with an organic manure (FYM) which acts as a soil conditioner.

Material and Method

The field experiment was carried out at Collage of Agriculture and Research Station, situated in Bemetara district of Chhattisgarh which is in the center of Mahanadi basin. Geographically, it is located between 21.6104^0 N latitude and 81.2944^0'E, with an altitude of 278 meters above the mean sea level, covering an area of 2841.65 ha. The experiment was laid out in a randomized block design having 8 treatments which were randomized thrice viz. T1-Control; T2-100% RDF (100:60:40 N: P_2O_5:K_2O kg ha^{-1}); T3-75% RDF + 25 t/ha Fly ash; T4-75% RDF + 25t/ha Fly ash + 5t/ha FYM; T5-75% RDF + 30t/ha Fly ash; T6-75% RDF + 30t/ha Fly ash + 5t/ha FYM; T7- 75% RDF + 45t/ha Fly ash; and T8-75% RDF + 45t/ha Fly ash + 5t/ha FYM. The recommended dose of fertilizer (N, P_2O_5, K_2O) for rice was 100:60:40 kg/ha, resp. Urea, diammonium phosphate and muriate of potash were applied as fertilizer sources along with fly ash and FYM as an amendment. The variety used for rice was DRR DHAN 42 transplanted on 22nd July and harvest on second week of November. The yield attributes were recorded before harvest of crop. After harvest of crop, surface soil samples (0-15 cm depth) were collected from each plot separately and shade dried, samples were powdered with wooden pestle and mortar and sieved through 2 mm sieve and analyzed for pH, electrical conductivity (EC), organic carbon (OC), nutrient uptake (major and micro nutrients) by rice.

Result and Discussion

The plant height (Table. 1) was influenced with applied fly ash along with FYM treatments over control (N, P, K) and ranged from 111.73-138.80 cm. The plant height (138.80 cm) was found highest in T2 (100% RDF (100:60:40)), which was at par with all other treatment except control. The maximum no. of tillers (8.78) was recorded under T8 (75% RDF + 45 t/ha fly ash + 5 t/ha FYM) and was found at par with other treatments except control. Among the several different treatments used during the study, the maximum panicle length (23.18 cm) was observed in treatment T8 (75% RDF + 45 t/ha fly ash + 5 t/ha FYM) while minimum panicle length (16.64 cm) was observed by T1 (control). It was found that amending soil with FA and FYM registered significantly higher panicle length than sole incorporation of FA with RDF. The highest number of panicle (153.95) was observed under T8 (75% RDF +45t/ha fly ash+5 t/ha FYM) which was found at par with all other treatments except control, T3 (75% RDF+25t/ha fly ash) and T5 (75% RDF+30 t/ha fly ash) whereas, the lowest number (131.47) of grain per panicle was found in T1 (control).The different treatment showed non-significant effect on test weight. Mulla *et al.* (2000) [7] and Jeybal *et al.* (2000) [5] also supported that application of fly ash, FYM along with fertilizer improved physical environment, root activity and aeration, as well as nutrient uptake and availability providing a complimentary effect on rice grain yield and yield attributing characters.

The grain yield of rice (Table.2) significantly increased with applied fly ash with FYM treatments over control and ranged from 26.66-53.04 q ha^{-1}. The higher grain yield (53.04q ha^{-1}) was recorded under 75% RDF+ 45t /ha fly ash+5 t/ha FYM i.e in T8 which was statistically at par with yield obtained (51.47 q/ha) with the application of 75% RDF + 30 t/ha fly ash + 5t/ha FYM, however the yield obtained in 75% RDF+ 45 t/ha fly ash+5 t/ha FYM was significantly superior then the yield under RDF (T2). The lowest yield was recorded under control (26.16 q ha^{-1}). Treatment T8 (75% RDF+ 45 t/ha fly ash+5 t/ha FYM) had significantly higher straw yield (65.98 q/ha) over control and single application of fly ash. Dwivedi *et al.* (2007) [2], Jawahar and Vijyapuri *et al.* (2010) [4] also recorded that FA not just works on the actual properties of the soil yet in addition adds to better development and yield.

The total nitrogen uptake by rice was significantly influenced due to incorporation of fly ash with fertilizers and with or without FYM. Treatment T8 (75% RDF+45 t/ha fly ash+5 t/ha FYM) had significantly higher total nitrogen uptake (93.15 kg/ha) among all other treatments except T6 (75% RDF + 30 t/ha fly ash + 5 t/ha FYM) (88.90 kg/ha). The uptake of phosphorous (Table.3) was affected significantly due to the application of fly ash and FYM. The value ranged from 7.30 to 22.25 kg/ha, where the highest (22.25 kg/ha) uptake was found in T8 (75% RDF+45 t/ha fly ash+5 t/ha FYM) and the lowest (7.30 kg/ha) in T1 (control). The highest (163.58 kg/ha) K uptake was recorded in T8 (75% RDF+45 t/ha fly ash+5 t/ha FYM) whereas the lowest (67.78 kg/ha) in T1 (control).Among the total micronutrient (Fe, Mn, Zn, Cu) uptake, the highest uptake was found in T8 (75% RDF+45 t/ha fly ash+5 t/ha FYM) whereas the lowest uptake was reported in T1 (control). Prabhakar *et al*. (2018) [8], Singh *et al* (1986) [12] and Saini *et al.* (2010) [10] also supported that adding fly ash to the soil considerably boosted micronutrient (Fe, Mn, Zn, Cu) uptake, and the concentration of macro and micronutrients increased noticeably. With increasing levels of fly ash application, rice grain also absorbed more macro- and micronutrients.

Application of fly ash and FYM along with fertilizers had non-significant effect on soil pH and EC in an Inceptisol which may be due to highly buffered nature of soils. Addition of fly ash with FYM along with fertilizers in an Inceptisol significantly improved the organic carbon content in soil. The OC value ranged from 4.43 to 5.57 g/kg. The highest (5.57 g/kg) amount of OC was found under T8 (75% RDF + 45t/ha Fly ash + 5 t/ha FYM) followed by T6 (75% RDF + 30 t/ha Fly ash + 5 t/ha FYM) (5.47 g/kg), T4 (75% RDF + 25 t/ha Fly ash + 5t/ha FYM) (5.23 g/kg), while the minimum (4.43 g/kg) in T1 (control). Better soil physical conditions such as greater root growth and interception may have contributed to increase in OC of soil due to the complimentary effect of fly ash and FYM which provides better degradation of organic matter under the effect of fertilizers and microbial activity as also reported by Singh *et al.* (2011) [11], Agrawal *et al.* (2009) [1] & Krishna ku. (2020) [4].

Table 1: Effect of fly ash and FYM incorporation on growth and yield attributes of rice in an Inceptisol

Treatment	Plant height (cm)	Numbers of effective tillers/hill	Panicle length (cm)	No. of grains/ panicle	Test weight (g)
T1- Control	111.73	5.31	16.64	131.47	25.75
T2-100% RDF (100:60:40)	138.80	8.64	22.34	152.62	26.55
T3-75% RDF + 25 t/ha Fly ash	136.53	7.92	19.42	142.05	26.36
T4-75% RDF + 25 t/ha Fly ash + 5 t/ha FYM	136.33	8.62	21.14	148.35	27.61
T5-75% RDF + 30 t/ha Fly ash	135.60	8.52	20.18	144.40	26.79
T6-75% RDF + 30 t/ha Fly ash + 5 t/ha FYM	136.63	8.76	22.93	153.36	27.09
T7-75% RDF + 45 t/ha Fly ash	137.22	8.51	21.38	147.04	27.81
T8-75% RDF + 45 t/ha Fly ash + 5 t/ha FYM	138.42	8.78	23.18	153.95	28.01
SEm±	3.15	0.46	0.94	2.77	0.66
CD (p=0.05)	9.55	1.39	2.85	8.41	NS

Table 2: Effect of fly ash and FYM incorporation on Grain and Straw yield of rice in an *Inceptisol*

Treatments	Grain yield (q/ha)	Straw yield (q/ha)
T1- Control	26.66	35.47
T2-100% RDF (100:60:40)	49.55	61.37
T3-75% RDF + 25 t/ha Fly ash	41.81	53.78
T4-75% RDF + 25 t/ha Fly ash + 5t/ha FYM	46.57	58.64
T5-75% RDF + 30 t/ha Fly ash	43.79	55.23
T6-75% RDF + 30 t/ha Fly ash + 5t/ha FYM	51.47	63.23
T7-75% RDF + 45 t/ha Fly ash	43.89	57.89
T8-75% RDF + 45 t/ha Fly ash + 5 t/ha FYM	53.04	65.98
SEm±	1.01	1.45
CD (p=0.05)	3.34	4.38

Table 3: Effect of fly ash and FYM incorporation on total nutrient uptake (kg/ha) of rice in an *Inceptisol*

Treatment	Total N uptake (kg/ha)	Total P uptake (kg/ha)	Total K uptake (kg/ha)
T1-Control	39.38	7.30	67.68
T2-100% RDF (100:60:40)	78.59	18.35	146.36
T3-75% RDF + 25 t/ha Fly ash	69.82	13.62	108.83
T4-75% RDF + 25t/ha Fly ash + 5 t/ha FYM	78.19	17012	132.41
T5-75% RDF + 30 t/ha Fly ash	74.86	14.80	118.33
T6-75% RDF + 30t/ha Fly ash + 5 t/ha FYM	88.90	19.24	146.65
T7-75% RDF + 45 t/ha Fly ash	77.39	15.06	126.72
T8-75% RDF + 45t/ha Fly ash + 5 t/ha FYM	93.15	22.25	163.58
SEm±	4.06	0.90	4.11
CD (p=0.05)	12.31	2.74	12.46

Table 4: Effect of fly ash and FYM incorporation on Total Micronutrient uptake (g/ha) of rice in an *Inceptisol*

Treatment	Total Fe uptake (g/kg)	Total Mn uptake (g/kg)	Total Zn uptake (g/kg)	Total Cu uptake (g/kg)
T1-Control	1285.6	621.22	130.1	42.36
T2-100% RDF (100:60:40)	2283.1	1119.12	233.6	75.09
T3-75% RDF + 25 t/ha Fly ash	1960.2	940.95	207.6	64.02
T4-75% RDF + 25 t/ha Fly ash + 5 t/ha FYM	2159.0	1030.15	218.7	65.76
T5-75% RDF + 30 t/ha Fly ash	2052.3	996.75	208.8	63.13
T6-75% RDF + 30 t/ha Fly ash + 5 t/ha FYM	2353.9	1138.02	245.4	74.34
T7-75% RDF + 45 t/ha Fly ash	2078.8	1053.14	224.4	68.85
T8-75% RDF + 45 t/ha Fly ash + 5 t/ha FYM	2458.9	1234.95	257.3	81.29
SEm±	40.81	19.50	6.11	2.85
CD (p=0.05)	123.78	59.16	18.55	8.66

Table 5: Effect of fly ash and FYM incorporation on Soil reaction, Electrical Conductivity (dSm^{-1}) and Organic carbon (g/kg) in an *Inceptisol*

Treatment	Soil pH	EC (dSm^{-1})	OC(g/kg)
T1- Control	6.33	0.11	4.43
T2-100% RDF (100:60:40)	6.50	0.10	4.97
T3-75% RDF + 25 t/ha Fly ash	6.37	0.10	4.67
T4-75% RDF + 25 t/ha Fly ash + 5 t/ha FYM	6.41	0.11	5.23
T5-75% RDF + 30 t/ha Fly ash	6.47	0.14	4.73
T6-75% RDF + 30 t/ha Fly ash + 5 t/ha FYM	6.43	0.12	5.47
T7-75% RDF + 45 t/ha Fly ash	6.55	0.11	4.83
T8-75% RDF + 45 t/ha Fly ash + 5 t/ha FYM	6.37	0.10	5.57
SEm±	0.07	0.01	0.17
CD (p=0.05)	NS	NS	0.53

Conclusion

The application of 75% RDF along with 45t/ha fly ash and 5t/ha FYM recorded significantly higher yield over 100% RDF, and also uptake of major nutrients and micro nutrients which indicates inclusion of 75% RDF + 45t/ha fly ash + 5 t/ha FYM can save 25% of fertilizer (NPK). The application of 75% RDF + 45 t/ha fly ash and 5 t/ha FYM have been recorded non-significant effect on soil reaction, EC and a significant effect on soil organic carbon. Results of the present study therefore support the concept of fly ash incorporation along with FYM under recommended dose of fertilizers.

References

1. Agarwal S, Singh GR, Yadav BR. Utilization of Fly ash for Crop Production: Effect on the Growth of Wheat and Sorghum Crops and Soil Properties. Journal of Agricultural physics. 2009;9:20-23.
2. Dwivedi S, Tripathy RD, Srivastava S, Mishra S, Shukla MK, Tiwari KK, *et al*. Growth performance and biochemical responses of three rice (*Oryza sativa* L.) cultivars grown in fly ash amended soil. Chemosphere. 2007;67(1):140-151.
3. Jala S, Goyal D. Fly ash as a soil ameliorant for improving crop production: A review. Bioresource technology. 2006;97(9):1136-1147.
4. Jawahar S, Vaiyapuri V. Effect of sulphur and silicon fertilization on yield, Nutrient uptake and economics of rice. International Research Journal of Chemistry (IRJC); 2010, p.34-43.
5. Jeyabal A, Arivazhagan K, Thanunathan K. Utilisation of lignite fly ash as a source of plant nutrient for rice. Fertilizer News. 2000;45(7):55-58.
6. Krishn K, Jatav KG, Nayak V, Mallaiya S, Gireesh, Gyaneswar. Effect of fly ash application with FYM on soil chemical properties of rice grown area in inceptisol. The Pharma Innovation Journal. 2022;SP-11(1):31-33.
7. Mulla SR, Prakash SS, Badnur VP. Influence of fly ash and FYM on the productivity of rice, Karnataka J Agric. Sci. 2000;13(4):991-992.
8. Prabhakar R, Umadevi M, Chandrashekar R, Bhanumurthy VB. Effect of fly ash and farmyard manure application on yield and uptake of nutrients by rice grown in Inceptisols. J Agric. 2018;58:38-44.
9. Rahman, Abul Khaer, Mohammad, Rezaur, Hossain, Syed Mohammod, Akramuzzaman, Mir Md. Distribution of heavy metals in rice plant cultivated in industrial effluent receiving soil. Environment Asia, 2010;3(2):15-19.
10. Saini SP, Manchanda JS, Kansal BD, Arora CL. Effect of fly ash and FYM application on yield and macro and micronutrients availability to rice. Environment and Ecology. 2010;28(2):923-929 ref.12.
11. Singh JS, Pandey VC, Singh DP. Coal fly ash and farmyard manure amendments in dry-land paddy agriculture field: effect on N-dynamics and paddy productivity, Applied Soil-Eco. 2011;47(2):133-140.
12. Singh NB, Singh M. Effect of flyash application on saline soil and on yield components, yield and uptake of NPK of rice and wheat at varying fertility levels. Ann. Agric. Res. 1986;7(2):245-257.
13. Totawat KL, Jagar GL, Jat SL, Jangir RK. Effect of fly ash on the performance of wheat on ustochrepts of sub-humid plains of India, 17th WCSS, 14-21 Aug 2002 2002.
14. Saw G, Krishna K, Gupta N, Soong TW, Mallilankaraman K, Sajikumar S, *et al*. Epigenetic regulation of microglial phosphatidylinositol 3-kinase pathway involved in long-term potentiation and synaptic plasticity in rats. Glia. 2020 Mar;68(3):656-69.