International Journal of Advanced Scientific Research
ISSN: 2456-0421
Impact Factor: RJIF 5.32
www.allscientificjournal.com
Volume 3; Issue 3; May 2018; Page No. 53-56

Effect of inorganic and organic fertilizers with fly ash on yield attributing characters of rice crop

Kiran Patel*, RN Singh, K Tedia
Department of Soil Science & Agricultural Chemistry, College of Agriculture, Indira Gandhi Krishi Vishwavidyalaya, Raipur, Chhattisgarh, India

Abstract
The present investigation entitled "influenced by integrated effect of inorganic and organic fertilizers with fly ash on yield attributing characters of rice crop" was carried out during kharif season of 2014-15 at Ajirma village, Surajpur district (Chhattisgarh). The treatments comprised of control, 100% GRD (100:60:40), 75% GRD + 20 t fly ash ha^{-1}, 75% GRD + 40 t fly ash ha^{-1}, 75% GRD + 60 t fly ash ha^{-1}, 75% GRD + 20 t fly ash ha^{-1} + 5 t FYM ha^{-1}, 75% GRD + 40 t fly ash ha^{-1} + 5 t FYM ha^{-1} and 75% GRD + 60 t fly ash ha^{-1} + 5 t FYM ha^{-1} were laid out in Randomized Block Design (RBD) with three replications. The results showed that fly ash and FYM can be a source of plant nutrients and it could be used for enhancing the production of crops. Fly ash integrated with recommended fertilizers and FYM imprinted significant positive effect on yield attributing characters and yield of crop with improve physiochemical properties of soil. . The maximum effective tillers $hill^{-1}$ (8.96) and grain per panicle (72.19) was recorded in T_8 (75% GRD + 60 t fly ash ha^{-1} + 5 t FYM ha^{-1}) while, the minimum effective tillers $hill^{-1}$ (6.24) and grain per panicle (40.19) was recorded under T_1 (control). Application of different doses of fly ash combined with and without organic fertilizer tended significantly not increase pH, EC, particle density and test weight.

Keywords: Fly ash, FYM, physico-chemical properties and yield attributing characters

Introduction
Fly ash is a fine gray powder consisting mostly of spherical, glassy particles that are produced as a byproduct in coal-fired power stations. Fly ash has pozzolanic properties, meaning that it reacts with lime to form cementitious compounds. It is commonly known as a supplementary cementations' material. Fly ash, also known as "Pulverised fuel ash" in the United Kingdom, is a coal combustion product that is composed of the particulates (fine particles of burned fuel) that are driven out of coal-fired boilers together with the flue gases. Ash that falls to the bottom of the boiler is called bottom ash. In modern coal-fired power plants, fly ash is generally captured by electrostatic precipitators or other particle filtration equipment before the flue gases reach the chimneys. Together with bottom ash removed from the bottom of the boiler, it is known as coal ash. Depending upon the source and composition of the coal being burned, the components of fly ash vary considerably, but all fly ash includes substantial amounts of silicon dioxide (SiO_2) (both amorphous and crystalline), aluminium oxide (Al_2O_3) and calcium oxide (CaO), the main mineral compounds in coal-bearing rock strata Addition of fly ash decreased bulk density and maximum water holding capacity of soil, while no marked effects on pH, EC, cation exchange capacity and lime content was observed. The available NPK and Cu, Fe, Zn, and Mn and exchangeable Ca and Mg increased with fly ash application (Deshmukh *et al*., 2000) [3]. Effect of fly ash seed pelleting utilization on bhendi yield. The results revealed that the fly ash pelleting @ 200 g kg^{-1} registered significantly higher plant height days to 50% flowering, number of branches, number of fruits/plant, fruit length, fruit girth, fruit weight, number of seeds/fruit, seed weight/ fruit and seed yield/plant (Prakash *et al*., 2014) [5]. Fly ash amendments caused significant improvement in soil quality and germination percentage of rice seeds. Growth (shoot length, leaf area and pigment composition) and yield (panicle length, seeds per panicle, seed weight and yield per plant) of rice increased with an increase in fly ash amendments. Fly ash not only improved the physical properties of the soil but also contributed to better growth and yield (Sahu *et al.*, 2007) [9].

Materials and Methods
Soil observations
1. Soil pH
Soil pH was determined by glass electrode pH meter taking 1:2.5 soil water suspensions after stirring it for 30 minutes as described by (Jackson, 1973).

2. Electrical conductivity
Electrical conductivity was determined by taking supernatant liquid of soil water suspension prepared for pH determination by using electrical conductivity meter (Black, 1965).

3. Particle density
For the determination of particle density, pycnometer flasks were used. Particle density was calculated by recording mass of dry soil and volume of soil solids with the help of given formula.

$$\text{P.D. (Mg m}^{-3}) = \frac{\text{Mass of dry soil}}{\text{Volume of soil solid}}$$

Plant observations

1. Effective tillers

Effective tillers recorded per plants were counted from each plots and its average value was presented.

2. No. of grain per panicle

It was recorded from marked five hills of middle row of each plot.

3. Test weight

Seed samples were taken randomly from the each plot separately and dried in oven until the weight become constant. Thousand seeds were counted from the oven dried samples of each plot and then weight was recorded on electronic balance.

Results and Discussion

Chemical properties of soil

1. pH

The result of pH value presented in Table 1. The pH value varies from 4.77 to 5.15. The highest pH (5.15) was found in treatment T_8 (75% GRD + 60 t fly ash ha^{-1} + 5 t FYM ha^{-1}) while minimum (4.77) in T_1 (control). The data indicated that no significant difference was found among the treatment. The initial mean value pH value was 4.82 more over the inherent buffering capacity of the soil would also resist small changes. There was no significant change in soil pH. Similar non-significant changes on soil pH with fly ash were also observed by Sikka and Kansal (1995) [10].

2. EC

The results of electrical conductivity indicated that effect of the treatments showed non-significant. The addition of different dose of fly ash with different combination of organic and inorganic fertilizer did not increased soil electrical conductivity. The electrical conductivity no noticeable change was recorded. This might be due to fact that fly ash is free from soluble salts. Similar results were also reported by the earlier workers Matte and Kene (1994) [4] and Das *et al.* (2013) [2].

Physical properties of soil

1. Particle Density

The results of particle density indicated that the largest particle density was recorded 2.23 Mg m^{-3} and lowest particle density was noticed under T_1 (control), the effect of different treatment combinations on soil particle density was non significant (Table 1).

Table 1: Influenced by integrated effect of inorganic and organic fertilizers with fly ash on physico-chemical properties of soil after harvest of rice crop

1	pH (1:2.5)	Electrical conductivity (dS m^{-1})	Particle Density (Mg m^{-3})
T_1 Control	4.77	0.02	2.11
T_2 100% GRD(100:60:40)	4.84	0.02	2.13
T_3 75% GRD + 20 t fly ash ha^{-1}	4.93	0.02	2.14
T_4 75% GRD + 40 t fly ash ha^{-1}	4.88	0.02	2.20
T_5 75% GRD + 60 t fly ash ha^{-1}	4.97	0.02	2.20
T_6 75% GRD + 20 t fly ash ha^{-1} + 5 t FYM ha^{-1}	5.04	0.02	2.22
T_7 75% GRD + 40 t fly ash ha^{-1} + 5 t FYM ha^{-1}	5.07	0.03	2.23
T_8 75% GRD + 60 t fly ash ha^{-1} + 5 t FYM ha^{-1}	5.15	0.03	2.23
SEm±	0.18	0.003	0.07
CD (P = 0.05)	NS	NS	NS

Yield attributing characters

The performance of yield attributing characters i.e. effective tillers $hill^{-1}$, grains per panicle and test weight is presented in Table 2.

1. Effective tillers $hill^{-1}$

Result on effective tillers are presented in Table 2 revealed that overall mean of effective tillers $hill^{-1}$ was recorded 7.64. It ranges from 6.24 to 8.96 effective tillers $hill^{-1}$. The maximum effective tillers $hill^{-1}$ (8.96) was recorded in T_8 (75% GRD + 60 t fly ash ha^{-1} + 5 t FYM ha^{-1}) while, the minimum effective tillers $hill^{-1}$ (6.24) was recorded under control T_1 (control). The treatment T_8 was found significantly superior over T_2 (GRD 100:60:40), T_3 (75% GRD + 20 t fly ash ha^{-1}), T_4 (75% GRD + 40 t fly ash ha^{-1}), T_5 (75% GRD + 60 t fly ash ha^{-1}) and T_1 (control) but statistically at par with T_6 (75% GRD + 20 t fly ash ha^{-1} + 5 t FYM ha^{-1}) and T_7 (75% GRD + 40 t fly ash ha^{-1} + 5 t FYM ha^{-1}).

2. Grain per panicle

Result on grain per panicle are presented in Table 2 revealed that overall mean of grain per panicle was found 59.71. It ranges from 40.19 to 72.19 grain per panicle. The maximum grain per panicle (72.19) was recorded in T_8 (75% GRD + 60 t fly ash ha^{-1} + 5 t FYM ha^{-1}) while, the minimum grain per panicle was recorded in control T_1 (40.19). The treatment T_8 was found significantly superior over T_2 (GRD 100:60:40), T_3 (75% GRD + 20 t fly ash ha^{-1}), T_4 (75% GRD + 40 t fly ash ha^{-1}), T_5 (75% GRD + 60 t fly ash ha^{-1}) and T_1 (control) but statistically at par with T_6 (75% GRD + 20 t fly ash ha^{-1} + 5 t FYM ha^{-1}) and T_7 (75% GRD + 40 t fly ash ha^{-1} + 5 t FYM ha^{-1}). Sahu *et al.* (2007) [9] reported that fly ash amendments caused significant improvement in soil quality and germination percentage of rice seeds. Growth (shoot length, leaf area and pigment composition) and yield (panicle length, seeds per panicle, seed weight and yield per plant) of rice increased with an increase in fly ash amendments. FA not only improved the physical properties of the soil but also contributed to better growth and yield. Similar findings were also reported by Karmakar *et al.* (2010).

3. Test weight

Result on test weight indicated that effect of different treatments was non-significant (Table 2 and Fig.4.9) However; application different doses of fly ash combined with and without organic fertilizer tended significantly not increase test weight. The effect of the treatment in increasing the test weight was not consistence. Samy *et al.* (2010) [8] also reported non-significant effect of fly ash on test weight.

Table 2: Influenced by integrated effect of inorganic and organic fertilizers with fly ash on the performance of yield attributing characters of rice

Treatments	Effective tillers hill^{-1}	Grain per panicle	Test weight/ 1000 seed (g)
T_1 Control	6.24	40.19	22.70
T_2 100% GRD (100:60:40)	7.61	60.23	24.12
T_3 75% GRD + 20 t fly ash ha^{-1}	6.66	52.13	23.14
T_4 75% GRD + 40 t fly ash ha^{-1}	6.98	54.28	23.56
T_5 75% GRD + 60 t fly ash ha^{-1}	7.00	56.17	24.10
T_6 75% GRD + 20 t fly ash ha^{-1} + 5 t FYM ha^{-1}	8.76	71.00	24.37
T_7 75% GRD + 40 t fly ash ha^{-1} + 5 t FYM ha^{-1}	8.89	71.50	24.42
T_8 75% GRD + 60 t fly ash ha^{-1} + 5 t FYM ha^{-1}	8.96	72.19	24.55
SEm±	0.08	0.48	0.67
CD (P = 0.05)	0.24	1.45	NS

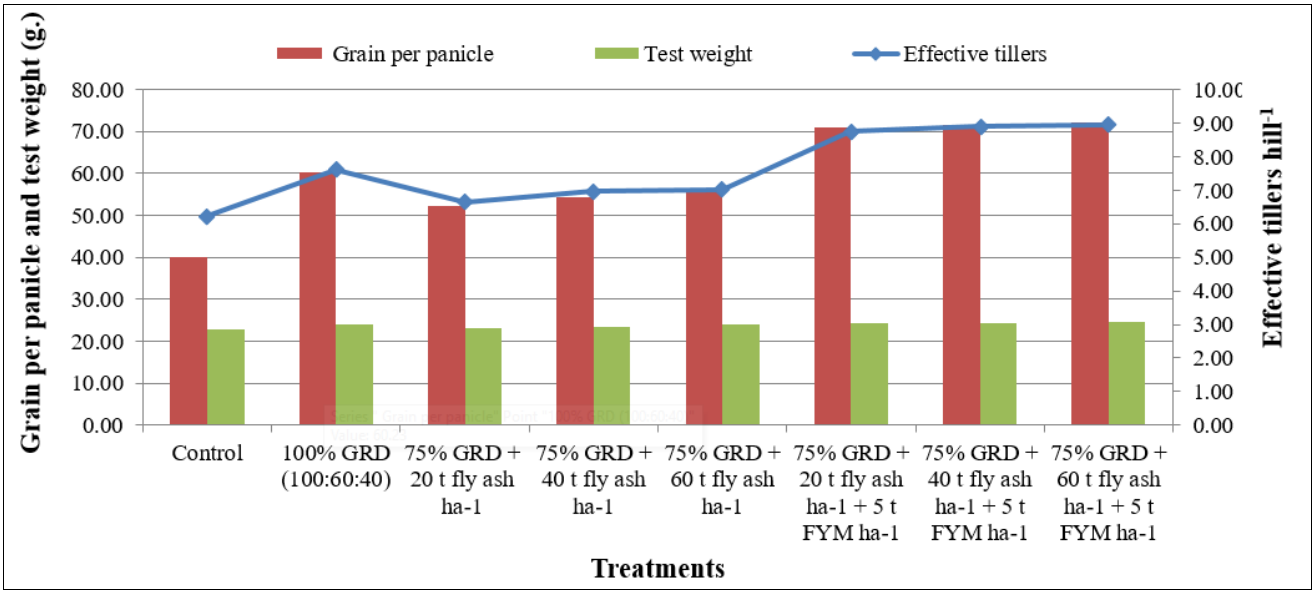

Fig 1: Influenced by integrated effect of inorganic and organic fertilizers with fly ash on the performance of yield attributing characters of rice

Fig 2: Influenced by integrated effect of inorganic and organic fertilizers with fly ash on crop growth

Acknowledgment

The financial support by Fly ash unit, Dept. of Science and Technology, New Delhi and HOD of Soil Science and Agricultural Chemistry, College of Agriculture, IGKV, Raipur for providing laboratory facilities is gratefully acknowledged.

References

1. Black CA, Evans DD. Method of soil analysis. American Society of Agronomy, Madison, Wisconsin, USA, 1965. 131-137.
2. Das BK, Choudhury BH, Das KN. Effect of Integration of Fly Ash with Fertilizers and FYM on Nutrient Availability, Yield and Nutrient Uptake of Rice in Inceptisols of Assam, India. International J. of Advancements in Research and Technology. 2013; 2(11):190-208.
3. Deshmukh Anjali, Matte DB, Kene DR, Bhaisare Bharati. Soil properties as influenced by fly ash application. J Soil Crops. 2000; 10(1):69-71.
4. Matte DB, Kene DR. Effect of fly ash application on yield performance of Kharif and Rabi crops. J Soils Crops. 1994; 5(2):133-136.
5. Prakash M, Narayanan GS, Kumar BS. Fly ash seed

pelleting enhances growth and yield in bhendi *(Abelmoschus esculentus L.*). Agric. Sci. Digest. 2014; 34(1):49-51.
6. Jackson ML. Soil chemical analysis. Prentice-Hall Inc. Englewood Cliffs N.J. USA, 1973.
7. Karmakar S, Mittra BN, Ghosh BC. Enriched coal fly ash utilization for augmenting production of rice under acid lateritic soil. Coal Combustion and Gasification Products. 2010; 2:45-50.
8. Samy Narayana Mamata T, Mishra Sahu Rajani K, Rabindra N. Growth, yield and metabolism of rice (*Oryza sativa* l.) during repeated applications of fly-ash on soil. Advance in Food Science. 2010; 32(2):110-117.
9. Sahu MM, Padhy RK. Growth, yield and elemental status of rice (*Oryza sativa*) grown in fly ash amended soils. Ecotoxicology. 2007; 16(2):271-278.
10. Sikka Kansal BD. Effect of fly ash application on yield and nutrient composition of rice, wheat and on pH and available nutrient status of soils, 1995.