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RESPONSE OF ARKEL CULTIVAR OF GARDEN PEA IN FLY ASH AMENDED SOIL

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ABSTRACT

Present study was conducted to evaluate the fly ash potential as a soil amendment for growth and yield of garden pea (Pisum sativum L.). Field experiment had been designed to study in depth the application of fly ash, organic manure like farmyard manure (FYM), bio compost (SOM) and chemical fertilizer (CF) in different combinations. Arkel a pea cultivar was used in the study. The crop was raised as per appropriate agronomical practices. Different growth and yield parameters under different treatments were observed and recorded up to 90 DAS. Combined application of FA and CF with either FYM or SOM helped in improving the measured growth parameters as compared to FA alone and control. Application of organic material in conjunction with CF helped in improving nutrient supplying capacity of the soil which was further increased when FA was added as a soil amendment. Under adequate supply of nutrients, the observed growth parameters were enhanced. The positive outcome of the results of the present investigation is expected to encourage large scale use of fly ash in agriculture with an added advantage of decreasing environmental pollution; however, the changes in soil environment caused by fly ash incorporation need to be investigated on long term basis.

Keywords: Biocompost, coal, fly ash, garden pea, growth

INTRODUCTION

Fly ash is the end residue from combustion of coal in the furnace of thermal power plants and consists of mineral constituents of coal which is not fully burnt (Basu *et al*., 2009). Globally, coal fly ash (CFA) generated in huge quantities from coal fired power plants, is a problematic solid waste. Clearly the huge quantity of CFA produced annually not only poses serious environmental concerns but also requires large areas of land for its storage and disposal. Thus, appropriate measures for its safe disposal and means of utilization are necessary for sustainable management of this waste (Singh *et al*., 2010). Fly ash is rich in several micro and macro plant nutrients (Sahu *et al*., 2017). Now a days, Fly Ash Utilization Programme (FAUP) in varying agro-climatic conditions and different soil-crop combinations supported with laboratory investigations have shown significant increase in yields of edible parts as well as biomass without any adverse impact on soil health (Kumar *et al*., 2005; Kumar and Kumar, 2017; Rajpoot *et al*., 2018). The present investigation was therefore, conducted to study the effect of different sources of fertilizers applied in an integrated manner on crop productivity, restoration on soil fertility and minimization of environmental hazards.

MATERIALS AND METHODS

Fly ash was collected from National Capital Power Station, Dadri located in Gautam Budh Nagar District of Western Uttar Pradesh (India). Field experiments were carried out at a farmer's field near Meerut with sandy loam soil. Arkel a cultivar of pea (*Pisum sativum* L.) was used as test crop. Fly ash, organic manure like farmyard manure (FYM), biocompost (Simbhaoli Organic Manure, SOM) and chemical fertilizers (CF) were used in different combinations. Fly ash @ 10 t/ ha, FYM @ 603 Kg/ ha and SOM @ 350 Kg/ ha was applied. Total eight treatment combinations used in this study were: Control (without any application), CF (recommended dose), FA (fly ash alone), CF+FA, CF+BC, CF+FYM, CF+FA+BC and CF+FA+FYM. Experimental plots (2m× 2m) were prepared using above treatment combinations and replicated thrice in randomized block design (RBD). A uniform nutrient level of 20 Kg N, 40 Kg P and 60 Kg ha^{-1} through these materials and chemical fertilizers was maintained for all the treatments except fly ash and control plots. Different growth and yield parameters viz. plant height, root length, no. of leaves/ plant, no. of branches/ plant, no. of pods/ plant, no. of seeds/ pod, pod length, biological yield, days to 50% flowering, days to maturity, seed yield/ plant, 100 seed weight, harvest index %, NPP (Net Primary Productivity), response coefficient, chlorophyll content were recorded on different intervals.

RESULTS AND DISCUSSION

It was observed that integrated use of organic materials proved advantageous for the growth and yield parameters of pea cultivar. The number of branches, number of leaves, root length, plant height, dry matter production and net primary productivity were influenced by the treatments and an increase was recorded up to 90 DAS (Table 1). Similar positive response was observed when FA in combination with organic materials was used for cultivation of pea by some earlier workers (Deepa and Poonkodi, 2004; Garg *et al*., 2005; Ram *et al*., 2006; Gupta *et al*., 2007; Aggrawal *et al*., 2009; Yunusa *et al*., 2009; Jala and Goyal,

Table 1. Effect of different fertilization sources on growth, yield attributes, yield and harvest index of Arkel cultivar of *Pisum sativum* L. at 90 DAS

Characters / Fertilization Sources	Root length (cm)	Plant height (cm)	No. of branches	No. of leaves	Days to 50 % flowering	Days to maturity	No. of pods/ plant	Pod length (cm)	No. of seeds/ pod	100 seed weight (gm)	Seed yield (gm)	Biological yield (gm)	Harvest Index	NPP (gm)
C	13.70	59.40	4.20	7.80	55.00	100.00	9.30	6.60	6.10	18.052	10.24	18.07	56.60	0.180
CF	14.20	94.50	5.10	14.50	53.00	99.00	13.40	7.00	6.50	20.416	17.78	27.23	65.20	0.275
FA	13.90	93.00	4.80	12.10	51.00	94.00	11.60	6.60	6.30	19.384	14.16	23.50	60.20	0.250
CF+FA	14.20	94.80	5.60	15.10	52.00	94.00	14.00	7.20	6.80	20.618	19.62	28.15	69.60	0.299
CF+BC	14.30	97.50	5.50	15.40	53.00	99.00	14.20	7.20	6.70	20.740	19.73	28.46	69.30	0.287
CF+FYM	14.20	97.10	5.40	14.70	55.00	98.00	14.00	7.20	6.70	20.655	19.37	28.05	69.00	0.286
CF+FA+BC	14.40	103.00	5.90	18.60	53.00	93.00	15.30	7.50	7.00	22.246	23.82	32.42	73.40	0.348
CF+FA+FYM	14.30	102.60	6.00	19.30	51.00	94.00	15.10	7.50	7.00	22.154	23.41	32.28	7.50	0.343
CD at 5 %	N.S.	3.805	0.433	1.154	2.100	2.663	0.972	0.371	N.S.	0.595	0.295	1.999	0.694	0.019

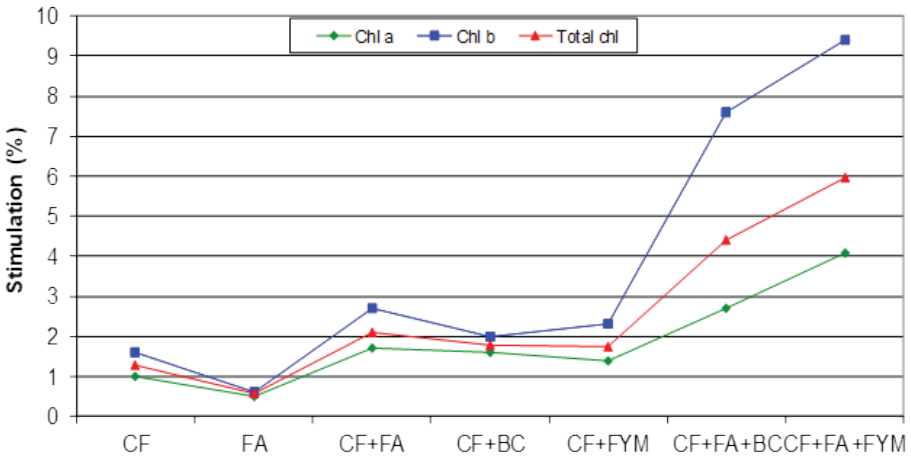

Figure 1. Effect of different fertilization sources on chlorophyll (mg/gm f.w.) of Arkel cultivar at 60 DAS

2010; Tejasvi and Kumar, 2011). Fly ash amendment showed most beneficial effects on the accumulation of chl. a,b and total chlorophyll at 60 DAS (Figure 1). Similar observations also have been made by Gupta *et al*., 2004; Patil and Chaudhari, 2004; Singh and Gupta, 2005; Yunusa *et al*., 2008; Nalawade *et al*., 2009. In the present study, days to 50% flowering and days to maturity gets reduced for the pea cultivar in fly ash amended soil as compared to control. Similar observations were made by Kumar *et al*. (1998). It is evident from data that there was sufficient increase in the number of pods per plant, seeds per pod, size of pods and 100 seed weight in all supplements as compared to FA alone or control (Table 1). The increase was more significant when either FYM or SOM was applied with CF and FA. These results are in conformity with those of Sajwan *et al*., 1995; Kruger and Surridge, 2009; Karmaker *et al*., 2009. There was significant increase in NPP in all soil amendments as compared to control. In fly ash amended soil, an increase of 38.88 % in NPP was recorded over control. The maximum increase in NPP was observed in combined application of organic materials, CF and FA (Table 1). A significant increase in dry matter accumulation was recorded in all soil amendments as compared to control (Table 1). In fly ash amended soil, an increase of 30.04 % was recorded over control. The maximum biomass was registered in combined application of organic materials, CF and FA where the increase in biological yield was 18.75 % over the chemical fertilizers used alone. In fly ash amended soil, only a marginal increase in harvest index over control was recorded. But the increase was significant when organic materials were applied with CF and FA (Table 1). The increase recorded in harvest index was 28.4-29.7 %. The data on harvest index indicate that fly ash cannot replace chemical fertilizers but when supplemented with CF, it proved beneficial. The maximum harvest index was obtained in integrated nutrient supply system.

The results obtained from present investigation have shown that fly ash in combination with organic manures works as an excellent soil conditioner and helps to a great extent to improve the productivity of the soil through fly ash soil amendment technology (FASAT) on sustainable basis. Nonetheless, new knowledge needs to be generated to further minimize soil and groundwater contamination and identify ways to efficiently exploit the fly ash as a soil ameliorating agent for waste land reclamation and biomass production. Also, Long term investigations should be carried out in different agro-climatic zones to assess the temporal effect of fly ash incorporation on physical, chemical and biological properties of the different soils along with careful monitoring of heavy metals and toxic levels of nutrients.

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