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RESEARCH ARTICLE

INFLUENCE OF FLYASH APPLICATION ON GROWTH AND YIELD OF GREEN GRAM

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ABSTRACT

Field experiments were conducted to study the effect of seed pelleting with flyash on growth, gas exchange parameters and seed yield in greengram with different concentrations ranging from 25 to 300g kg^{-1} of seed. Observations on growth and yield parameters viz., plant height, number of branches, number of leaves, leaf area, dry matter production, number of pods, number of seeds per pod, 100 seed weight, seed yield per plant and gas exchange parameters viz., net photosynthetic rate, transpiration rate, stomatal conductance and intercellular CO_2 concentration were recorded. Based on the results, it was observed that greengram seeds treated with flyash @ 250g kg^{-1} recorded increased seed yield with increase in growth and yield parameters.

INTRODUCTION

Mungbean (*Vigna radiata* (L.) wilezek) is one of the important pulse crops of the world. It is a short duration grain legume crop having wider adaptability and low input requirements. It has the unique ability to fix the atmospheric nitrogen (58-109kg/ha) in symbiotic association with Rhizobium bacteria, which not only enables it to meet its own nitrogen requirement but also benefits the succeeding crops (Ali,1992). The green plant and hay are utilized as fodder. Hence mungbeen is considered as an essential component of sustainable agriculture. India is the largest producer and consumer of mungbeen and it alone accounts for about 65% of the world acreage and 54% of the world production of the crop. Despite holding such a great promise, it is often grown in marginal soils with limited inputs making it a low yielding crop. Hence an attempt was made to pellet the seeds with fly ash, commonly available cheaper filler material to increase yield of mungbean. Seed pelleting is a common technique in direct sown crops, which need initial vigour for sustained crop growth and development. Fly ash is generated during the combustion of coal in coal fired thermal power plants and other industries like paper industry; Fly ash contains all the elements as that of soil except organic carbon and nitrogen. Approximately on a average, 95 to 99% of fly ash consists of oxides of Si, Al,Fe & Ca and about 0.5 to 3.5% consists of Na, P,K & S and remained ash with trace elements. These nutrients presents in the fly ash may be helpful in enhancing seed germination, seedling vigour and establishment when applied as soil application or as seed pelleting material. Its average size is <10 µm diameter with low to medium bulk density, high surface area and very light texture.

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Because of these advantages, fly ash was used as pelleting material, additive & amendment material in agriculture application. Hence with this background, field experiments were conducted to study the effect of fly ash seed pelleting on growth and seed yield in mungbean.

MATERIALS AND METHODS

Experiments were conducted to study the effect of seed pelleting with fly ash on growth, gas exchange parameters and seed yield in mungbean with thirteen concentrations viz., 25, 50, 75, 100, 125, 150, 175, 200, 225, 250, 275 and 300g per kg of seed. Observations on growth and yield parameters viz., plant height, number of branches, number of leaves, leaf area, dry matter production, number of pods, number of seeds per pod, 100 seed weight, seed yield per plant and gas exchange parameters viz., net photosynthetic rate, leaf temperature, stomatal conductance and intercellular CO_2 were recorded. The experimental results revealed that mungbean seeds treated with fly ash @ 250g kg^{-1} recorded higher growth, gas exchange parameters and seed yield.

RESULTS AND DISCUSSION

In the present investigation, mungbean seeds pelleted with 250g fly ash recorded higher values for plant height, number of branches and number of leaves per plant (table1). Since fly ash contains sufficient concentration of micro and macronutrients, it can be better utilized in agriculture, as fertilizers (Hodgson and Buckley, 1975;Townsend and Gillham, 1975; Carlson and Adjriano, 1991). Role of Zn through auxin metabolism and B in cell division and elongation may be the reasons for increased plant height.

Table 1. Effect of flyash application on growth and yield characters in green gram

Treatment	Plant height (cm)	No of Branches per plant	Number of leaves Per plant	Leaf area ($cm^2 pl^{-1}$)	Dry matter production ($g pl^{-1}$)	Number of pods per plant	Number of seeds per pod	1000 seed weight (g)	Seed yield ($g pl^{-1}$)
T_0-Control	51.6	3.0	47.00	969.33	0.9895	31.66	10.00	31.35	11.27
T_1-25g kg^{-1}	52.4	3.0	48.66	1011.66	0.9968	32.66	10.33	31.35	11.69
T_2-50g kg^{-1}	53.4	3.1	52.33	1069.33	0.9990	34.66	10.33	31.36	11.75
T_3-75g kg^{-1}	53.6	3.6	56.33	1109.33	1.1775	35.00	10.66	31.45	11.84
T_4-100g kg^{-1}	55.9	4.3	63.33	1187.00	1.2875	36.33	10.66	31.86	11.93
T_5-125g kg^{-1}	56.9	5.0	65.33	1226.66	1.3743	37.66	11.33	32.61	11.97
T_6-150g kg^{-1}	58.7	5.0	70.66	1262.00	1.7588	40.66	11.66	32.65	12.26
T_7-175g kg^{-1}	60.3	5.3	74.33	1304.33	1.7888	41.33	12.00	32.76	12.63
T_8-200g kg^{-1}	62.7	5.6	78.33	1397.40	2.3046	46.00	12.33	32.85	12.84
T_9-225g kg^{-1}	63.5	6.0	81.00	1485.00	2.6841	46.66	13.00	32.96	13.41
T_{10}-250g kg^{-1}	64.1	7.0	82.00	1493.40	2.8335	47.33	14.00	33.78	14.30
T_{11}-275g kg^{-1}	62.8	7.0	80.66	1593.93	2.8613	45.33	12.66	33.46	14.11
T_{12}-300g kg^{-1}	61.9	6.3	78.33	1498.90	2.2453	41.66	12.33	33.31	13.96
CD(P=0.05)	7.1	0.03	8.3	14.3	0.03	4.5	2.3	3.8	1.8

Table 2. Effect of flyash application on gas exchange parameters in green gram

Treatment	Pn (mg CO_2 $m^{-2}s^{-1}$)			Cs (mol m^{-2} s^{-1})			Ci (u mol mol^{-1})			Tr (mg H_2O $m^{-2}s^{-1}$)		
	30 days	40 days	50 days	30 days	40 days	50 days	30 days	40 days	50 days	30 days	40 days	50 days
T_0-Control	11.177	19.786	13.089	0.068	0.508	0.152	174.125	265.585	250.807	5.710	6.292	6.610
T_1-25g kg^{-1}	15.583	20.691	17.080	0.152	0.531	0.204	188.365	266.807	254.125	6.548	6.651	6.913
T_2-50g kg^{-1}	17.449	22.280	19.751	0.156	0.569	0.244	226.415	275.312	254.365	6.586	6.666	7.752
T_3-75g kg^{-1}	19.455	22.698	20.653	0.204	0.623	0.370	254.287	281.899	260.827	8.277	7.066	7.820
T_4-100g kg^{-1}	19.502	22.880	20.975	0.370	0.739	0.429	255.157	284.031	261.365	8.550	7.325	8.129
T_5-125g kg^{-1}	20.191	24.330	21.447	0.402	0.783	0.469	261.045	284.036	264.505	9.059	7.749	8.249
T_6-150g kg^{-1}	20.212	24.897	22.330	0.516	0.826	0.481	266.271	284.644	266.271	9.127	7.820	8.249
T_7-175g kg^{-1}	22.803	25.136	23.136	0.736	0.867	0.516	266.490	286.535	270.125	9.913	8.129	8.157
T_8-200g kg^{-1}	22.914	25.569	23.384	0.734	0.907	0.738	273.069	287.776	275.904	11.406	8.157	8.550
T_9-225g kg^{-1}	23.191	27.384	24.895	0.742	0.926	0.741	274.953	288.437	280.031	11.521	8.249	8.553
T_{10}-250g kg^{-1}	27.436	28.711	28.655	0.909	1.125	0.856	284.125	307.916	320.953	12.854	8.848	11.831
T_{11}-275g kg^{-1}	25.444	27.758	27.116	0.856	1.124	0.756	266.084	293.002	285.125	12.107	8.553	9.606
T_{12}-300g kg^{-1}	23.617	25.751	25.280	0.746	0.944	0.743	261.415	290.07	285.005	11.831	8.331	9.103
CD(P=0.05)	6.41	7.11	6.83	0.01	0.30	0.21	21.3	30.4	33.1	4.71	5.11	6.33

Pn-photosynthetic rate, Tr-transpiration rate, Ci-Intercellular CO_2 concentration and Cs-stomatal conductance.

Similar observations were reported by Sudarsan (1989). Adequate availability of micronutrients might have helped in development of shoots from axillary buds leading to increase in number of branches and leaves. Zinc might have played a vital role through auxin metabolism coupled with counteraction of apical dominance. Concentration of micronutrient elements Fe, Zn and Mn in soil and growing rice and wheat increased with point fly ash but within safe limits (Komal Singh and S.K Bansal, 2010). Adrieno *et al.* (1978) reported that increase in available micronutrients status of soil might be due to reduction in soil pH caused dissolution on micronutrient from solid phase. The concentrations of S, Mo and B in plant tissues increased consistently with application of fly ash to soil. The yield of Brassica species was significantly increased in a sandy loam when fly ash was applied to plant. Mo and Mn concentrations increased and Cu and Ni concentrations unchanged (Woug and Wong, 1990). The yield parameters such as, number as pods per plant, number of seeds per pod, 1000 seed weight and yield per plant were also higher in fly ash treatment @ 250g kg^{-1}. When compared to other treatments and control, maximum number of seeds per pod was recorded in seeds pelleted with 250g fly ash per kg of seeds. The role of B in enhancing pollen viability and germination is well known. Similar reports of increased number of seeds per head in sunflower with boron application was given by Sarkar and Sasmal (1989). Adequate availability of micronutrients might have helped in development of shoots from axillary buds leading to increase in number of branches and leaves. Zinc might have played a vital role through auxin metabolism coupled with counteraction of apical dominance. Concentration of micronutrient elements Fe, Zn and Mn in soil and growing rice and wheat increased with point fly ash but within safe limits (Komal Singh and Bansal, 2010). Adrieno *et al*. (1978) reported that increase in available micronutrients status of soil might be due to reduction in soil pH caused dissolution on micronutrient from solid phase. The concentrations of S, Mo and B in plant tissues increased consistently with application of fly ash to soil. The yield of Brassica species was significantly increased in a sandy loam when fly ash was applied to plant. Mo and Mn concentrations increased and Cu and Ni concentrations unchanged(Woug and Wong, 1990). The yield parameters such as, number as pods per plant, number of seeds per pod, 1000 seed weight and yield per plant were also higher in fly ash treatment @ 250g kg^{-1}. When compared to other treatments and control, maximum number of seeds per pod was recorded in seeds pelleted with 250g fly ash per kg of seeds. The role of B in enhancing pollen viability and germination is well known. Similar reports of increased number of seeds per head in sunflower with boron application was given by Sarkar and Sasmal (1989). Susheela (1996) postulated that increased number of seeds might be due to increased pollen which would have resulted in increased number of filled seeds and the yield.

Increased number of pods with boron application was reported by Meyyappan (1991) in groundnut, Balusamy *et al*, (1966) in soybean. Lallu and Shankar (1995) also reported increased number of silica in rape seed and application. Similar reports of increased number of capsules in sesame with Zn SO_4 was made by Balamurugan (1982).The micronutrients present in the fly ash would have helped in translocation of assimilates to the sink resulting in increased capsule weight. Meyyappan (1991) postulated that application of boron increased translocation of sugars from leaves to the sink leading to increased pod development. Gowda *et al*. (1995) reported increased pod weight and pod yield in groundnut. Increased pod yield with Mn and B application was reported by Meyyappan (1991) in groundnut. All these micronutrients would have increased the nutrient status of the plant, helped in translocation of assimilates resulting in increased seed weight and single seed yield. Application of micronutrients helped in increasing the yield parameters and yield as reported by Meyyappan (1991) in groundnut, Balusamy *et al*, (1996) in soybean. Increased leaf area and dry matter production with the application of micronutrient was reported by Babiker (1986) and Murali (1991) in rice and Meyyappan (1991) in groundnut. Increased yield with micronutrients could be due to enhanced availability and translocation of nutrients resulting in increased capsule number, seed number, and seed weight. Increased yield due to Zn present in fly ash might be due to reduced flower drop, increased capsule set and 1000 seed weight. Their role in carbon assimilation, enzyme activity and protein synthesis was also reported by Meyyappan (1991) which could have increased yield via increased dry matter production.

Around 50-60% more yield of brinjal, around 45% more yield to potato and pea, around 40% more yield of tomato and around 29% more yield of cabbage were recorded in fly ash treated pots when fly ash was applied @25% by weight of soil (Kalpana kumar and Dubey, 2003). Lal *et al.* (1996) observed response of soybean to 16% with fly ash application and drastic reduction beyond that level. Rao *et al.* (1990) showed maximum growth and a biomass accumulation with 15% fly ash application. Kuchanwar *et al.* (1997) reported that in groundnut, application of 10 t ha^{-1} of Koradi fly ash in combination with N and fertilizer improved the uptake of N and P fertilizers to red soil improved the uptake of nutrients and increased the leaves, branches, and height of plant and pot yield. Application of fly ash increased @50 t ha^{-1} yield in green gram (19.13%), black gram (11.67), soybean (14.86%) and groundnut (18.61%) (Sanjay Bryar,2010).

Gas exchange parameters were recorded at 30, 40, 50 days respectively. The maximum leaf photosynthetic rate, transpiration rate, stomatal conductance and intercellular CO_2 concentrations were observed in the treatment of seeds pelleted with 250g of fly ash per kg followed by seeds pelleted with 275g of fly ash per kg (table2.). Similar observations of increased gas exchange parameters viz., leaf photosynthetic rate, transpiration, stomatal conductance and intercellular CO_2 concentration with flyash treatment was reported by Anbarasan (2011) in cowpea. Kalpana kumar and Dubey (2003) attributed increase in chlorophyll content to the enhancement in the photosynthetic efficiency in terms of carbohydrate content with the application of flyash.The minimum leaf photosynthetic rate, transpiration rate, stomatal conductance and intercellular CO_2 concentration were noted in control when compared to the other treatments. To conclude, it was observed that mungbean seeds pelleted with fly ash 250g kg^{-1} increased seed yield by increasing growth and yield parameters.

REFERENCES

Adriano, D.C., Woodford, T.A., and Ciravoio T.C., (1978). Growth and elemental composition of corn and bean seedlings as influenced by soil application of coal ash. *Environ. Qual*. **7**:416-421.

Ali, M., (1992). Weeds are a great threat to *kharif* pulses. Indian farming, 42: 29-30.

Anbarasan, R., (2011). Studies on effect of flyash seed pelleting on seed yield and quality in rice (*Oryza sativa. L)* and cowpea (*Vigna unguiculata L.),* M.Sc.(Ag.) Thesis, Annamalai University, Annamalai Nagar, India.

Balamurugan, L., (1982). Response of sesame to potassium and manganese nutrition. *M.Sc. (Ag) Thesis, Tamilnadu Agrl. Univ*., Coimbatore. India.

Balamurugan, L., and Venkatesan, G., (1988). Response of sesame (S*esamum indicum* L.) to potassium and manganese. *Madras Agric*. J. 70(10): 673-677.

Balusamy, M., Ravichandran, V.K., and Balasubramanian, B.R., (1966). Effect of Zinc, boron and FYM on growth and yield of soybean. *Madras Agric. J*., 83(2): 134.

Carlson, C.L., and Adriano, O.C., (1991). Growth and elemental content of the two tree species growing on abandoned coal flyash basins. *J. Environ. Qual*., 20: 581-587.

Hodgson, D.R., and Buckley, G.P., (1975). A practical approach towards the establishment of trees and shrubs on pulversied fuel ash. In: The Ecology of Resource Degradation and Renewal, (Ed.) Chadwick, M.J. and Goodman G.T. Blackwell Scientific, Oxford, pp.305-329.

Kalpana kumar and Dubey, P.S., (2003). Effect of fly ash on growth and nutritional status of spinach. In:3rd International Conference on Fly Ash Untilisation and Disposal, CBIP, New Delhi, pp: 19-21.

Komal Singh and Bansal, S.K., (2010). Sustainable use of pond flyash in highly percolating sandy loam alluvial soil for enhancing the use efficiency of irrigation water and applied N and K fertilizers in rice-wheat cropping system. Paper presented in Workshop on "Use of Flyashin Agriculture" held on 9th March, 2010 at India Habitat Centre, New Delhi, Pp-2.

Kuchanwar, O.D., Matte, D.B., and Kene, D.R., (1997). Evaluation of graded dose of fly ash and fertilizers on nutrient content and uptake of groundnut grown on vertisol. *J. Soils and Crops*, **7(1):** 1-3.

Lal, J.K., Mishra, B., and Sarkar, AK., (1996). Effect of fly ash on soil microbial and enzymatic activity. *J. Indian Soc. Soil Sci*. 44: 77-80.

Lallu and Shankar, H., (1995). Effect of micro nutrients on Indian mustard. *J. Oilseeds Res*. 12(1): 128-129.

Meyyappan, M., (1991). Effect of foliar application of plant growth regulators and micronutrients on growth, yield and physiology in groundnut. Cv VRI 1. M. Sc. (Ag.) Thesis, Annamalai University, Annamalai Nagar, India.

Murali, T.D., (1991). Studies on the effect of different sources and methods of Zinc application of lowland rice CV CR. 1009. M.Sc. (Ag.) Thesis, Annamalai Universiy, Annamalai Nagar, India.

Rao, D.N., Agarwal, M., and Singh, J., (1990). Study of pollution on sink efficiency, growth response and productivity pattern of plants with respect to fly ash and SO_2. Tech. Rep. (DEO/141/266-85) submitted to Ministry of Envi & Forest, New Delhi, India.

Sanjay Bryar., (2010). Long Term experiment on farmer's field for use of flyash in Maharashtra. Workshop on "Use of Flyash in Agriculture", Organised by C.FARM in association with Potash Research Institute of India, Gurgaon, ICAR New Delhi and DST, New Delhi, held on March, 9, 2010. P.5-6.

Sarkar, R.K., and Sasmal, T.K., (1989). Response of sunflower to application of micronutrients on rice fallow gangetic alluvial soil. *Indian agriculturist*. 33:39-44.

Sudarsan, S., (1989). Influence of zinc and boron on yield and quality of groundnut. M.Sc.(Ag.) Thesis, Tamil Nadu Agrl. Univ. Coimbatore, India.

Susheela, C., (1996). Studies on the effect of phosphorous and boron on the yield and seed setting in sunflower. M.Sc. (Ag.) Thesis, Tamil nadu Agrl. Univ., Coimbatore, India.

Townsend, W.M. and Gillham, E.W.F. (1975). Pulverized fuel as a medium for plant growth. *In:* The Ecology and Resource Degradation and Renewal. (Ed.) M.J. Chadwick and G.T. Good man. Blackwell Scientific, Oxford. Pp.287-304.

Wong, J. W.C., and Wong, M.H., (1990). Effects of flyash on yield and elemental compostion of two vegetables, *Brassica parachinesis* and *B. chinensis*. *Agriculture Ecosystems and Environment*, 30(3-4): 251-264.

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