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EFFECTS OF FLY ASH ON PROTEIN, CARBOHYDRATE AND STARCH IN WHEAT (*TRITICUM AESTIVUM L.*) IN BUNDELKHAND REGION (U.P.), INDIA

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ABSTRACT

For effective and safe management of fly ash, it was used as soil amendment along with recommended does of N,P,K and vermicompost (VC) for the cultivation of wheat. Its impact on yield parameters was recorded during the rabi, season (2013-2014). The experimental design was RBD with nine treatments, each replicated three times. Treatment T8 (20t/ha FA+5t/ha VC) was better than other treatments for protein, carbohydrate and starch. The grain yield was higher by 32% over control and other treatments. The overall results indicate the suitablitiy of fly ash for cultivation of wheat when used along with recommended does of NPK and vermicompost.

Figure : 01 References : 04 Table : 01

KEY WORDS : Carbohydrate, Fly ash, Protein, Starch, Vermicompost.

Introduction

In India major source of electrical energy is coal based thermal power plants, which produce 100 million t/yr of coal combustion residues, called as fly ash, as a solid waste. Fly ash caused increases in the yield of various crops by 20-25% with high nutritional value. The work carried out by several researches[1-4] on fly ash application in agriculture revealed that fly ash had some beneficial as well as undesirable effects on the fertility of soil and crop yield. Wheat is the staple food of many people in India including Uttar Pradesh. The grain yield in wheat is usually improved by using different doses of N,P,K fertilizers. Application of chemical fertilizers in excess have many demerits and adverse effects on soil health, micro flora, physical and physiological properties, fertility *etc*. To solve this problem, soil amendment of fly ash, N,P,K fertilizers and vermicompost was tried for the cultivation of wheat.

Material and Methods

The study was carried out at Bohadpura Agriculture Farm, Orai (Jalaun) U.P. located in sub-tropical zone 25^0 59' N and 79^0 37' E at 141.6 m above mean sea level. The soil was pale brown in colour (10 YR; 6/3), loamy in texture with pH 7.2 *i.e.* slightly alkaline.

The climate in general is typical monsoonal (dry sub-humid) with extremes of temperature and well demarcated by three distinct seasons *viz.* rainy (hot and humid) from July to October, winter (cold and dry) from November to February and summer (hot and dry) from March to June. The average annual

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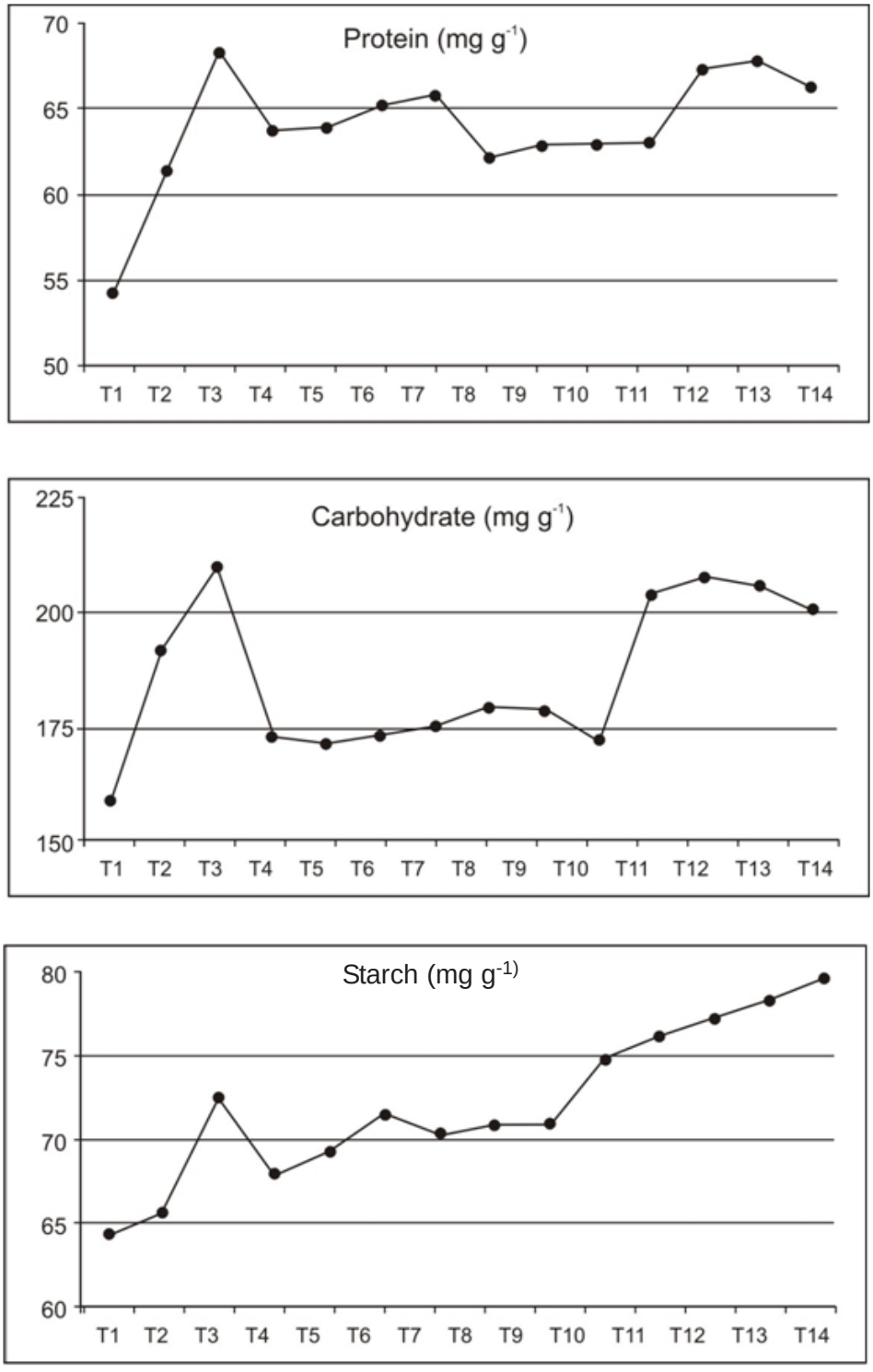

Fig. 1 : Influence of fly ash and vermicompost on biochemical parameters of wheat

temperature is uniformly high (25^0C) but the mean monthly values vary considerably (14.1^0C mean minimum to 34.5^0C mean maximum) . The mean annual precipitation is 1015 mm of which 80% falls between July to October. There are four wet months (July to October) and eight dry months.

Field experiments were conducted in Randomized Block Design (RBD) with nine treatments and three replication of each treatment. Different doses of fly ash and vermicompost with NPK fertilizers were admixed to the soil viz., T0-Soil (control) + NPK, T1-100 t/ha fly ash+NPK, T2-70t/ha fly ash + NPK, T3-40t/ha fly ash + NPK, T4-20 t/ha fly ash + NPK, T5 - 100 t/ha fly ash + 30 t/ha VC + NPK, T6-70 t/ha fly ash + 20 t/ha VC + NPK, T7 - 40 t/ha fly ash + 10 t/ha VC + NPK, T8 - 20 t/ha fly ash + 5 t/ha VC + NPK.

The authentic seeds of wheat *var.* Malvi-234

TABLE-1: Influence of fly ash and vermicompost on biochemical parameters of wheat

Treatment	Protein (mg g^{-1})	Carbohydrate (mg g^{-1})	Starch (mg g^{-1})
$T_{1'}$ Absolute control	54.170	159.460	64.40
$T_{2'}$ NPK recommended dose (120:60:40 kg ha^{-1})	61.330	191.930	65.55
$T_{3'}$ NPK +FYM 10 t ha^{-1}	68.200	209.800	72.45
$T_{4'}$ NPK +Fly ash 100 t ha^{-1}	63.590	172.820	67.85
$T_{5'}$ NPK +Fly ash 70 t ha^{-1}	63.800	171.900	69.15
$T_{6'}$ NPK +Fly ash 40 t ha^{-1}	65.140	173.180	71.30
$T_{7'}$ NPK +Fly ash 20 t ha^{-1}	65.730	174.810	70.15
$T_{8'}$ NPK 50% +Fly ash 100 t ha^{-1}	62.140	179.330	70.70
$T_{9'}$ NPK 75% +Fly ash 70 t ha^{-1}	62.690	178.780	70.80
$T_{10'}$ NPK 50% +Fly ash 100 t ha^{-1} + Vermicompost 2 t ha^{-1}	62.820	171.970	74.75
$T_{11'}$ NPK 75% +Fly ash 70 t ha^{-1} + Vermicompost 2 t ha^{-1}	62.770	203.390	75.90
$T_{12'}$ NPK +Fly ash 40 t ha^{-1} + Vermicompost 1 t ha^{-1}	67.190	207.420	77.05
$T_{13'}$ NPK +Fly ash 20 t ha^{-1} + Vermicompost 1 t ha^{-1}	67.710	205.370	78.20
$T_{14'}$ NPK + Vermicompost 2 t ha^{-1}	66.120	200.020	79.35
Mean	63.814	185.727	71.875
SE (+)	2.025	5.432	2.117
CD at 5%	5.747	15.413	6.006

were obtained from Govt. Agriculture Farm Orai (U.P.). Healthy and Uniform seeds of wheat were selected. The sowing of seeds in the field was done in November 2013 (rabi season). NPK fertilizers were used for all treatments, Nitrogen (120 kg/ha), Phosohorous (60 kg/ha) and Potassium (40 kg/ha). Flow irrigation system was adopted for all the treatments. The inter-cultivation operations were carried out at regular intervals. The parameters like plants height, flag leaf area, length of spike, photosynthetic rate, number of tillers per plant, number of grains per spike, weight of 1000 grains and grain yield were recorded.

Results and Discussion

Influence of different treatments on biochemicals

Parameters of wheat plants

The influence of different treatments of FYM, fly ash and vermicompost application on biochemical properties of wheat are reported in Table and discussed as under:

Protein

The data on protein content in wheat indicated that there was significant change in protein content of wheat plant (Table-1 and Fig. 1). The higher protein content was observed in T_3 : NPK + FYM (68.20 mg g^{-1}). However, it was at par with other treatments except T8: 50% NPK + 100 t ha^{-1} fly ash (62.14 mg g^{-1}), T_2: NPK (61.33 mg g^{-1}) and T_1: Absolute control (54.17 mg g^{-1}). Application of all levels of fly ash along with NPK recorded increase in protein content of wheat. The increase in protein content due to addition of FYM, fly ash and vermicompost might be due to higher uptake of nitrogen due to these treatment.

The stimulated process of protein might have resulted into higher accumulation of proteins. The factors like higher nutrient and water availability, improved vigor and growth can be attributed to stimulate synthesis of protein. The increase in protein content was ascribed to increased nitrogen availability through organic manures to the crop. Similarly, the improved availability of Mg might be playing positive role in protein synthesis in wheat.

Carbohydrates

Significantly higher carbohydrate was recorded in T3:NPK + FYM (209.80 mg g^{-1}) and at par with T_{12} : NPK + 40 t ha^{-1} fly ash + 1 t ha^{-1} vermicompost (207.42 mg g^{-1}), T_{13} : NPK + 20 t ha^{-1} fly ash + 1 t ha^{-1} vermicompost (203.39 mg g^{-1}) and T_{14}: NPK + 1 t ha^{-1} vermicompost (260.02 mg g^{-1}). Further, it was also observed that carbohydrate content was decreased significantly due to application of different levels of fly ash (Table- 1 and Fig. 1).

Increased leaf area, LAI, photosynthetic rate and stomata conductance might have resulted in very high stimulation in carbohydrates.

Starch

The data on starch (Table-1 and Fig. 1) revealed that the higher starch content was observed in T_{14}:NPK + 1 t ha^{-1} vermicompost (79.35 mg g^{-1}). However, it was at par with T_{13}: NPK + 20 t ha^{-1} fly ash + 1 t ha^{-1} vermicompost (78.20 mg g^{-1}), T_{12}: NPK + 40 t ha^{1} fly ash + 1 t ha^{-1} vermicompost (77.050 mg g^{-1}), T_{11}:75% NPK + 70 t ha^{-1} fly ash + 2 t ha^{-1} vermicompost (75.90 mg g^{-1}) and T_{10}: 50% NPK + 100 t ha^{-1} fly ash + 1 t ha^{-1} vermicompost (74.75 mg g^{-1}). Increased synthesis might be due to increased photosynthetic rate and starch synthesis favoured by positive factors in FYM and vermicompost. The enhanced rate of photosynthesis and starch synthesis may be attributed to increased starch content in wheat.

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