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Effect of fertilizers, Vermicompost and heavy metals on pigment content and yield of Wheat

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Abstract

A field experiment was conducted to study the effect of fertilizers in form of nitrogen, phosphorus, potassium, biofertilizer and vermicompost along with heavy metals –Zinc, Nickel and Cadmium on pigments –Chlorophylls and Carotenoids and yield of wheat (*Triticum aestivum*). Four set of experiments with a control (T_1), Soil with urea (250g/plot (T_2), Triple super phosphate 150g/plot (T_3), Potassium sulphate 100 g/plot (T_4), Soil added with bio fertilizer (T_5), Soil with vermicompost (T_6), with $ZnSO_4$ (T_7) with $NiNO_3$ (T_8) and $CdCl_2$ (T_9) were used study the effect on pigment content & yield of wheat (*Triticum aestivum).* All the treatments of agrochemicals showed significantly higher chlorophyll and carotenoid content and yield in wheat crop than control.

Key words : Carotenoid, Chlorophyll, Vermicompost, Wheat, Yield.

Introduction

India is agriculture based country. Most farmers in India need adequate resources to replenish soil fertility and maintain the productivity of soil. Wheat (*Triticul aestivum*) is one of the most important cereal crops cultivated in most parts of the world. Organic fertilizers is the key to improve the sustainability of agricultural farming system and soil productivity. Vermicompost helps in increasing the organic matter content of soil, which helps in increasing the natural productivity of soil[1]. Biofertilizers increase soil fertility, soil biota (Beneficial micro organisms) and water holding capacity of soil. The role of fertilizers and vermicompost has been recently worked out by Zade *et al.*,[2] Kanthaliya *et al*.[3] and Tavassoli *et al*.[4]. Many heavy metals are essential for plants and animals when present in the growing medium in low concentration, they become toxic only when a concentration limit is exceeded.[5]. Impact of heavy metals on growth of plants has been studied by Prakash *et al*.[6], Vijyarengan[7] and

Mahadavian and Somashekar[8].

Materials and Methods

The field experiment was conducted on fertilizers like N.P.K., biofertilizer, vermicompost and heavy metals (Zn, Ni and Cd) during rabi season of 2011-12 at Varanasi (U.P.), using Wheat crop (*Triticum aestivum,* PBW-343). The experiment was laid out in randomized block design with four replications having 28 field plots of 5x3 sq.m. There were nine treatments including control, for nitrogen 250g/plot urea was added. Triple super phosphate 150g/plot and potassium sulphate 100g/plot were added for phosphorus and potassium respectively. For biofertilizer, *Azotobacter* and *Pseudomonas* were used, while vermicompost was produced through *Eisenia fetida.* $ZnSO_4$, $NiNO_3$ and $CdCl_2$ (10 mg kg^{-1} soil) were added for Zn, Ni & Cd. The chlorophyll content was estimated using formula of Maclachlan and Zalik[9], where as carotenoid was determined by the method of Duxbury and Yentsch[10]. The mature grains were collected plot wise for grain yield and was converted to q/ha.

Results and Discussion

It is evident from Table 1, that all the eight treatments have some positive impact on pigment content as well as grain yield. The chlorophyll content, carotenoid content and total yield were found to be as 1.414 mg/g, 1.580 mg/g and 41.045 q/ha in case of controlled contitions. The chlorophyll content, carotenoid content and total yield increased from 1.414 mg/g to 2.015 mg/g; 1.580 mg/g to 1.740 mg/g and 41.045 q/ha to 48.218 q/ha in case of chlorophyll, carotenoid and total yield respectively. The maximum chlorophyll and carotenoid content was found to be in case of T_5 (Biofertilizer) treatment. Similarly total yield was also reported to be maximum in case of T_5 treatment. Vermicompost treatment (T_6) also showed positive impact. As per results obtained, it is evident that heavy metals also show a positive role when added in little quantity in comparison to NPK treatments.

Increase in pigment content and yield in case of T_1 treatment, due to addition nitrogen is also supported by the findings of Khan *et al.*[11] and Saravanmoorthy[12] and Ranjitha Kumari (2007). Their view is, nitrogen plays an important role and stimulates vegetative growth. Carotenoids are photosynthetic pigments and function as non-enzymatic antioxidant protecting plants from oxidative stress (Gruszecki & Strzal-ka, 1991)[13]. An increase in carotenoid content is suggested as a defense strategy of the plants to combat metal stress (Sinha *et al.* 2007)[14]. The enhanced growth in case of vermicompost might be due to presence of more amount of available nitrogen which is essential for the synthesis of structural proteins (Edwards, 1988)[15]. The findings are also supported by Pulikoshi and Amoji[16] and Yesari and Patwardhan[17]. The better growth by addition of potassium is also supported by Malakouti and Sefehr[18]. The increase in pigment content & total yield by addition of biofertilizer is also supported by Gohil *et al.*[19] The heavy metals increase pigment content and total yield of wheat, when added in minute concentration as also reported by Ganeshan and Manoharan[20].

The results obtained indicate that

Table 1. Effect of fertilizers, vermicompost and heavy metals on pigment content and yield of Wheat (2011-12).

S. No.	Treatment	Chlorophyll content (mg/g) fr.wt.	Carotenoid content (mg/g)	Total yield (q/ha)
1.	T_1 - Control (Without treatment)	1.414±0.004	1.580±0.122	41.045±1.025
2.	T_2 - Nitrogen(Urea 250 g/plot)	1.523±0.010	1.672±0.040	40.124±0.980
3.	T_3 - Phosphorus (Triple superphosphate 150g/plot)	1.506±0.008	1.594±0.104	38.642±0.867
4.	T_4 - Potassium (Potassium sulphate 100g/plot)	1.488±0.009	1.565±0.026	37.316±1.035
5.	T_5 - Bio fertilizer (From Azotobacter & Pseudomonas)	2.015±0.002	1.740±0.060	48.218±1.040
6.	T_6 - Vermi-compost (Product from Eisenia fetida)	1.996±0.003	1.726±0.082	42.416±0.761
7.	T_7 - Zinc($ZnSO_4$-10 mg Kg^{-1} soil)	1.604±0.020	1.628±0.014	36.338±0.653
8.	T_8 - Nickel (N_1NO_3-10 mg Kg^{-1} soil)	1.548±0.032	1.646±0.047	31.209±1.024
9.	T_9 - Cadmium ($CdCl_2$-10 mg Kg^{-1} soil)	1.512±0.026	1.563±0.033	30.153±0.760

± Standard Deviation

different fertilizers and heavy metals when added in little quantity increase pigment content and total yield but addition of vermicompost and biofertilizers show very good results.

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