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Effect of Biofertilizers, Chemical fertilizers and Vermicompost on Biochemistry of *Andrographis paniculata* Nees

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ABSTRACT

Andrographis paniculata Nees (Kalmegh) is a medicinal herb and belongs to the family Acanthaceae. It is being effectively used in treating a variety of illnesses. The experiment was conducted in a randomized block design (RBD) with 8 treatments *i.e.* T_1-NT, T_2- VC, T_3-BF, T_4-CF, T_5-BF+VC, T_6-BF+CF, T_7-CF+VC, T_8-BF+CF+VC. The analysis revealed significant increase in chlorophyll and protein content at different stages of plant. At 45DAS, 75 DAS stage, 105 DAS and 135 DAS stage, maximum chlorophyll content was 3.8 mg/g, 4.8 mg/g, 5.1mg/g, 5.9 mg/g and maximum protein content was observed 5.0 mg/g, 5.9 mg/g, 6.6 mg/g, 7.2 mg/g in T_8 plot treated with BF+CF+VC in combination. From these results it can be concluded that the application of bio fertilizers, chemical fertilizers and vermicompost in integrated manner is best approach for increasing biochemical contents *i.e*. chlorophyll, protein. Thus, can be an alternative to chemical fertilizers.

Key words: Biofertilizers, Chemical fertilizers, Vermicompost, INM, Protein, Chlorophyll.

Medicinal plants are very important in modern civilization in order to obtain natural active substances, known as primary metabolites and secondary metabolites. These plants synthesize substances that are useful to maintenance of health in humans and other animals. These include chlorophyll, protein, aromatic substances, alkaloid, terpenoid etc[6]. All metabolites are very important for life cycle of plant. Chlorophyll is the main trigger molecule of green plants. Higher the chlorophyll content greater is the tolerance. It plays a significant role in light reaction of photosynthesis. Similarly, Proteins are biochemical compounds consisting of one or more polypeptides typically folded into a globular or fibrous form, facilitating

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a biological function. *Andrographis paniculata* Nees is medicinal herb, belongs to the family Acanthaceae. It is also reported from China, Java, Malaysia, Bangladesh, and India. It is very effective to treating a variety of illnesses. Chlorophyll and Protein are essential parts of organism and particulate in virtually every process with in cells and every aspect of plant growth and development. That's why the experiment was performed to study the effective integrated use of different fertilizers and compost in plants of different plots to maintain and enhance the chlorophyll and protein content in *A. paniculata*.

The field experiment was conducted at Sarojini Naidu Govt. Girls P.G. (Autonomous) college, Bhopal of Madhya Pradesh. The experiment was conducted in a randomized block design (RBD) with 8 treatment using chemical fertilizers (NPK), vemicompost, and biofertilizers (*Azotobacter*, phosphate solubilizing bacteria) in different combinations including one control treatment. The treatments were T_1 - control (no treatment), T_2 -Vermicompost 5t ha^{-1}, T_1 – Biofertlizers (250g *Azotobacter* ha^{-1} + 250g PSB ha^{-1}), T_4-Chemical fertilizers (60:30:30kg NPK ha^{-1}), T_5 – BF + VC (125g *Azotobacter* + 125g PSB + 5t vermicompost ha^{-1}), T_6 - BF + CF [125g *Azotobacter* + 125g PSB + 50% NPK (RDF) ha^{-1}], T_7 - CF + VC (50% NPK + 5t vermicompost ha^{-1}) and T_8 - BF + CF + VC [250g biofertilizers (125g *Azotobacter* +125g PSB) + 50% NPK (RDF) + 5t VC.

Protein estimation :

The collected plant material of each accession were properly cut into small pieces and weight 1g using electronic analytical balance macerated in a pestle and mortar with 10ml of 20 percent trichloroacetic acid. The homogenate was centrifuged for 15 minutes at 600g. The supernatant was discarded. To the leaf pellet, 5ml of 0.1N NaOH was added and centrifuged for 5 minutes. The supernatant was saved and made up to 10ml of 0.1N NaOH. This extract was used for protein estimation. One ml of the extract was taken in a 10ml test tube and 5ml of reagent 'C' was added. The solution was mixed and kept in darkness for 10 minutes. Later, 0.5ml of Folin phenol reagent was added and the mixture was kept in dark for 30 minutes. The sample was read at 660nm in UV spectrophotpmeter[4]. The values are expressed as mg protein /g sample.

Chlorophyll content :

The amount of chlorophyll in the leaf sample was calculated by the method prescribed by Arnon[2]. Chlorophyll was extracted from 1g of sample using 20ml of 80% acetone. The supernatant was transferred to volumetric flask after centrifugation at 5000rpm for 5 minutes. The extraction was repeated till the residue become colorless. The volume in the flask was made up to 100ml with 80% acetone. The absorbance of the extract was read in spectrophotometer at 645 and 663 nm against 80% acetone blank. The amount of total chlorophyll in the sample was calculated using the formula:-

$$\text{Total chlorophyll (mg/g)} = 20.2\,(A645) + 8.02\,(A663) \times \frac{V}{1000 \times w}$$

Where,

A = Absorbance

V = final volume of chlorophyll extract in 80%

acetone (ml)
W = fresh weight of leaves (g)
The values are expressed as mg chlorophyll/g sample.

Statistical Analysis :

Analysis of observation taken on different variable was carried out to know the degree of variation among all the treatments. The results were obtained through analysis of variance (ANOVA) and SPSS software- version 20, 2011.

At 45DAS, 75 DAS stage, 105 DAS and 135 DAS stage, maximum chlorophyll content was 3.8 mg/g, 4.8 mg/g, 5.1mg/g, 5.9 mg/g in T_8 plot followed by 3.6 mg/g, 4.0 mg/g, 4.8 mg/g, 5.3 mg/g, in T_5 plot and least chlorophyll content was 2.9 mg/g, 3.1 mg/g, 3.6 mg/g, 3.9 mg/g in T_1 plot. Similarly, highest amount of protein content was observed in T_8 plot plants when treated with BF+CF+VC in

Table-1. Effect of INM on Biochemistry of *A.paniculata* at different stages

Plot No.	Treatments		45 DAS (mg/g)		75 DAS(mg/g)		105 DAS(mg/g)		135 DAS(mg/g)	
			Chl.	Pro.	Chl.	Pro.	Chl.	Pro.	Chl.	Pro.
T1	NT		2.9	1.8	3.1	2.1	3.6	3.3	3.9	4.2
T2	VC		3.4	4.7	3.9	5.0	4.7	5.6	5.1	6.1
T3	BF		3.3	4.0	3.7	4.2	4.4	4.8	4.8	5.2
T4	CF		3.2	3.5	3.6	3.9	4.2	4.3	4.6	4.7
T5	BF+VC		3.6	4.9	4.0	5.1	4.8	5.8	5.3	6.3
T6	BF+CF		3.0	2.4	3.3	3.0	3.8	3.7	4.1	4.3
T7	CF+VC		3.1	2.9	3.5	3.1	4.0	3.8	4.3	4.5
T8	BF+CF+VC		3.8	5.0	4.8	5.9	5.1	6.6	5.9	7.2
SA	mean		3.287	3.650	3.737	4.037	4.3250	4.737	4.7500	5.312
SA	SD		0.3044	1.2059	0.5208	1.2693	0.5203	1.1685	0.6676	1.0999
SA	SEm		0.1076	0.4263	0.1841	0.4487	0.1839	0.4131	0.2360	0.3888
SA	95% confidence interval of the difference	Lower	3.0330	2.6418	3.3021	2.9763	3.8900	3.7606	4.1919	4.3929
SA		Upper	3.5420	4.6582	4.1729	5.0987	4.7600	5.7144	5.3081	6.2321

Abbreviations:- NT- No Treatment, BF-biofertilizers, CF- chemical fertilizers, VC- vermicompost, SD- standard deviation, SEm- standard error mean, SA-Statistical Analysis, Chl.-Chlorophyll, Pro.-Protein, DAS- Days After Sowing

combination *i.e.* 5.0 mg/g, 5.9 mg/g, 6.6 mg/g, 7.2 mg/g in 45 DAS, 75 DAS, 105 DAS, and 135 DAS stage followed by 4.9 mg/g, 5.1 mg/g, 5.8 mg/g, 6.3 mg/g in T_5 plot while least protein content was obtained- 1.8 mg/g, 2.1 mg/g, 3.3 mg/g, 4.2 mg/g after 45 DAS, 75 DAS, 105 DAS and 135 DAS plant.

A significant increase in chlorophyll content was recorded in T_8 plot plants treated with combination of BF+CF+VC followed by BF+VC combination. Same observations have been reported by Sanjutha *et al.*,[7]; in *A. paniculata* leaves and Abadi *et al.*,[1] in Wheat leaves. Vijaya *et al.*,[10] reported that VC could be helpful for maximum production of chlorophyll content in *A. paniculata* leaves. Chlorophyll content in Sunflower promoted by BF application[8]. Similarly, The integrated use of these fertilizers in combination *i.e.* BF+CF+VC resulted into maximum protein content in *A. paniculata*, as earlier reported by Gharib *et al.*,[3] in Sweet marjoram plant; Singh *et al.*,[9] in Soya bean and Mathivanan *et al.*,[5] in Ground Nut. The application of bio fertilizers, chemical fertilizers and vermicompost in integrated manner is best approach for increasing biochemical contents *i.e.* chlorophyll, protein. Definitely it will enhance sustainability quality of *A. paniculata*.

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