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**EVALUATION OF THE EFFECT OF NITROGEN SUPPLEMENTATION IN  
THE SOIL ON THE GROWTH AND PRODUCTIVITY OF *PEDILANTHUS  
TITHYMALOIDES* VAR. *GREEN* –A POTENTIAL PETRO CROP**

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**ABSTRACT**

A decline in petroleum supply in recent years has stimulated a search for alternative sources of energy. Biomass has proved to be clean and universal source to harvest solar energy into usable forms. Certain plants produce low molecular weight hydrocarbons which could be converted into petroleum like substances. However, as these plants grow in semi-arid conditions, their productivity is low and the present study is an effort to improve the growth and productivity of one such plant.

*Pedilanthus tithymaloides* var. *Green* is one such petro plant which besides yielding valuable petroleum products also has pharmaceutical importance. Various dosages of nitrogen fertilizer (30-240kg/ha) were supplemented to monitor the growth and productivity of the plant. Maximum plant growth was observed at 60 kg/ha. Maximum dry weight was recorded at 90 kg/ha. 240 kg/ha nitrogen increased hexane extractables to the maximum. Total sugars and chlorophylls were also maximum at 60 kg/ ha nitrogen supplementation.

**Keywords: Petro crops, Nitrogen, growth, biocrude, chlorophyll, sugars**

**INTRODUCTION**

Nitrogen is the most essential element for proper growth and development of plants which increases the yield and its quality by playing a vital role in biochemical and

physiological functions of plant. All vital processes in plants are associated with proteins, of which nitrogen is an essential constituent. Optimum dose of nitrogen increases photosynthetic processes. In many soils, the rate of removal of plant nutrients by crop uptake, leaching and denitrification is well in excess of nutrient release by weathering and mineralization. A negative nutrient balance thus results unless nutrients are applied in the form of fertilizers or manures to make up the difference. Rajasthan soils are generally poor in macro and micro nutrients [1]. Although many petro -crops are found growing in such type of soils, slight increase in nutrient status of soil increased the plant growth. Ayerbe *et al.*, 1984 [2] suggested that moderate amount of nitrogen enhanced the growth in *E. lathyris*. Higher dosages of nitrogen are reported to inhibit growth but phosphorus favoured increase in dry matter production in *Euphorbia* Species [3, 4]. Nitrogen and phosphorus application is reported to increase growth and dry matter production of *Euphorbia* species [5]. Nitrogen is reported to increase the latex contents in *Euphorbia* species [6, 7]. There are several reports on effect of mineral nutrients on the yield of oil yielding crops like, linseed [8]. sunflower [9] and groundnut [10]. However, information regarding role of nutrients in petro crops are lacking. The present investigation deals

with the study of the effect of nitrogen on growth, biocrude, sugars and chlorophyll contents in *Pedilanthus tithymaloides* var. *Green*

## MATERIALS AND METHODS

25 cm earthen pots were filled with 4 kg soil mixed with different dosages of nitrogen fertilizer (30,60,90,120,180 and 240 kg/ha). Experiments were conducted for a period of four months. Plants were uprooted after four months of growth washed and blot dried. Plant length and weight is measured followed by oven drying at 60-degree Celsius temperature till the weight becomes constant. 10 g finely ground dried powdered plant material was packed in thimbles of Whatman filter paper no.-1. The extraction was done in Soxhlet apparatus using hexane for about 18 hrs. at 40-to-50-degree Celsius temperature. Excess of hexane is than distilled out and bio crude is collected and weighed till the weight becomes constant.

### Determination of chlorophyll

One gram of leaves from plants were crushed and homogenized in 80 percent acetone. A pinch of calcium carbonate is also added to check breakdown of chlorophyll and pheophytin formation. Filtrate is collected and volume is made up to 100 ml with 80 percent acetone. Absorbance was measured at 645, 652 and 663nm for determination of chlorophyll a,b and total chlorophyll following Arnon's

method [11] Optical density of test samples was recorded.

#### **Determination of Sugars**

Total soluble sugars in the plant were estimated by phenol sulphuric acid method [12]. The method is sensitive to soluble carbohydrates including sugar derivatives, oligo and polysaccharides. 10 mg of powdered plant material was taken in separate test tubes, mixed with 50 percent alcohol and kept for two hours. The aliquot was boiled on water bath to evaporate alcohol. 10 ml of distilled water was added to the alcohol-free extract and mixed properly. 1ml of the aliquot of the aqueous solution was taken in a separate test tube. One ml of 5% phenol solution was mixed with it. Blank was maintained with water instead of the extract. 5ml of 96% sulphuric acid was rapidly mixed. After standing for 10 minutes at room temperature the contents were mixed. Tubes were placed in a water bath at 25-30 degree Celsius for 20 minutes. The yellow orange colour indicated the presence of sugars. Absorbance was measured at 490nm for hexoses and methylated hexoses. Glucose was used as the standard for estimation.

#### **Statistical methodology**

The observation of each parameter of the experiment were analysed statistically for mean, analysis of variance, standard error mean and critical difference by applying '*F-Test*'.

## **RESULTS AND DISCUSSION**

After growing plants for four months various growth parameters were studied. Shoot length increased gradually up to 90kg/ha which decreased gradually at 120, 180 and 240kg/ha nitrogen supplementation in the soil. Root length on the other hand was maximum at 30kg/ha and reduced gradually at further increased dosages (**Figure 1, Table 1**).

Addition of nitrogen up to 60 kg/ha improved the growth of plants over the control. However, further increase in nitrogen (90,120,180 and 240kg/ha) resulted in a decrease in the fresh weight among which 240kg/ha considerably reduced the growth (**Figure 1**).

Dry weight of above ground parts increased up to 90kg/ha nitrogen whereas, a reduction in dry weight was observed at higher dosages of nitrogen. However, the dry weight of roots increased linearly up to 60kg/ha and decreased with increasing dosages of nitrogen in the soil. The percent dry weight of above ground plant parts was maximum up to 240kg/ha and that of underground parts was at 30kg/ha (**Figure 1**).

The hexane extractables increased with the increasing dosages of nitrogen. A linear increase in hexane extractables was recorded with the increasing dosages of nitrogen up to 240 kg/ha (**Figure 2**). This indicates the possible role of amino acid

intermediates, like serine in the terpenoid biosynthesis [13]. However, Ayerbe et.al. (1984a) [2] did not find significant increase in hydrocarbon yield due to nitrogen application. Sugars were maximum in the plants having maximum biomass production i.e. treated with 60kg/ha and decreased gradually in further subsequent dosages (**Figure 3**). Total chlorophylls were also maximum in 60kg/ha treated plants followed by a gradual decline at increased dosages of nitrogen. N at the rate of 240kg/ha did not support the chlorophyll contents (**Figure 4**).

The level of mineral nutrition in soil or of an externally applied fertilizer is an

important factor that seems to influence the growth and yield potential of the crop. The nitrogen provides a basic skeleton for synthesis of amino acids and protein which may make part of latex up to 20 percent. Besides this, certain proteins may also act as enzymes and catalysts and help in the biosynthesis of latex. Therefore, when the two were combined, might have increased the biocrude accumulation in the plants due to their complementary roles. Nutrients influence plant growth directly as well as cause changes in phytohormone balance and thus regulate the sink-source relationship in the plants studied [14].

Treatment (kg/ha)	Length (cm)		Fresh wt.(g)		Dry wt.(g)		Dry wt. (%)		HE	Sugar	Chlorophyll (mg/g)		
	AG	UG	AG	UG	AG	UG	AG	UG	(%)	(mg/g)	Chla	Chlb	Total
control	26.60	30.28	29.50	16.35	4.65	2.65	15.76	16.21	4.34	23.26	0.50	0.20	0.70
30	26.80	33.26	45.55	18.45	6.70	4.30	14.71	23.31	4.60	27.00	0.50	0.22	0.72
60	34.30	31.53	64.80	33.60	6.73	4.96	10.39	14.76	4.88	124.00	0.80	0.37	1.17
90	37.18	31.14	57.60	28.90	7.30	4.60	12.67	15.92	4.90	54.00	0.65	0.31	0.96
120	32.55	29.90	44.80	24.55	6.20	3.90	13.84	15.89	5.20	27.00	0.60	0.25	0.85
180	31.22	27.88	39.90	24.45	6.15	3.90	15.65	15.95	5.50	26.00	0.58	0.20	0.78
240	30.80	27.17	25.95	13.00	4.90	2.00	18.88	15.39	6.23	24.00	0.41	0.21	0.62
'F' test	Sig.	Sig.	Sig.	Sig.	Sig.	NS							
SEm	1.09	0.32	0.02	3.02	0.28	-							
CD at 5%	2.27	0.67	4.22	6.30	0.59	-							
CD at 1%	3.11	0.91	5.76	8.60	0.79	-							
Sig. = Significant			NS= Non Significant										

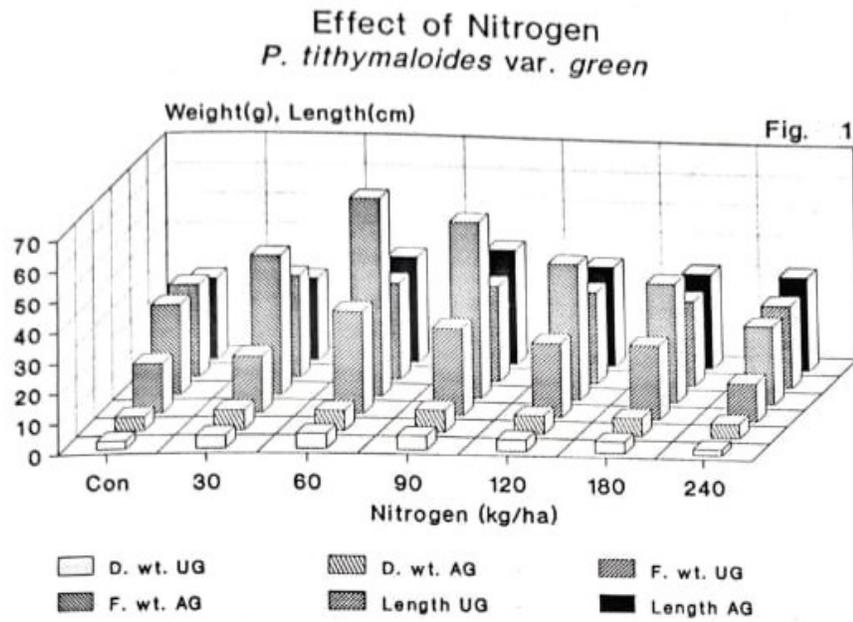


Figure 1: Effect of different dosages of nitrogen on length, fresh weight and dry weight of aboveground and underground parts of plants. Con - Control, without nitrogen supplementation

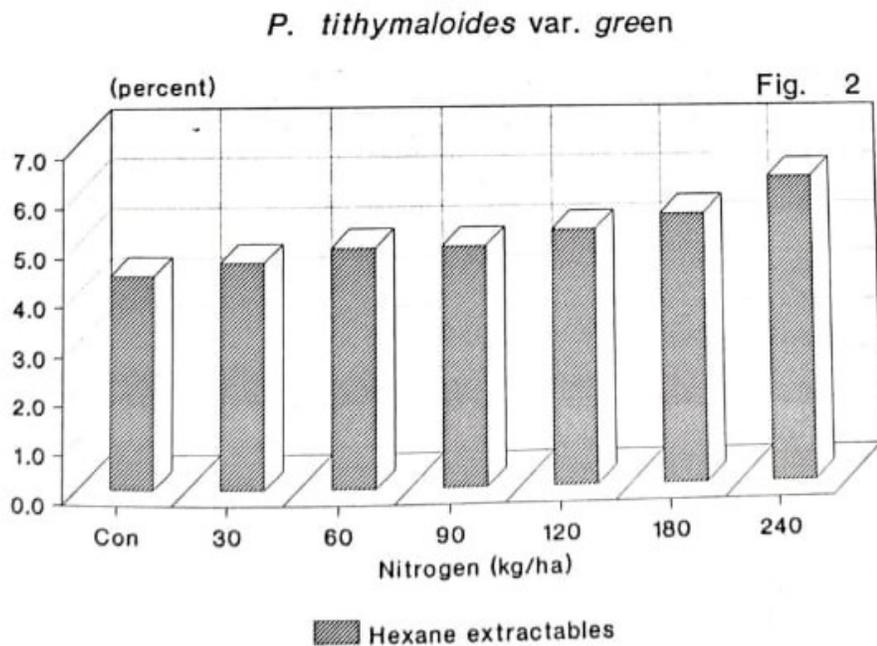


Figure 2: Effect of different dosages of nitrogen on hexane extractables of aboveground parts of plants. Con - Control, without nitrogen supplementation

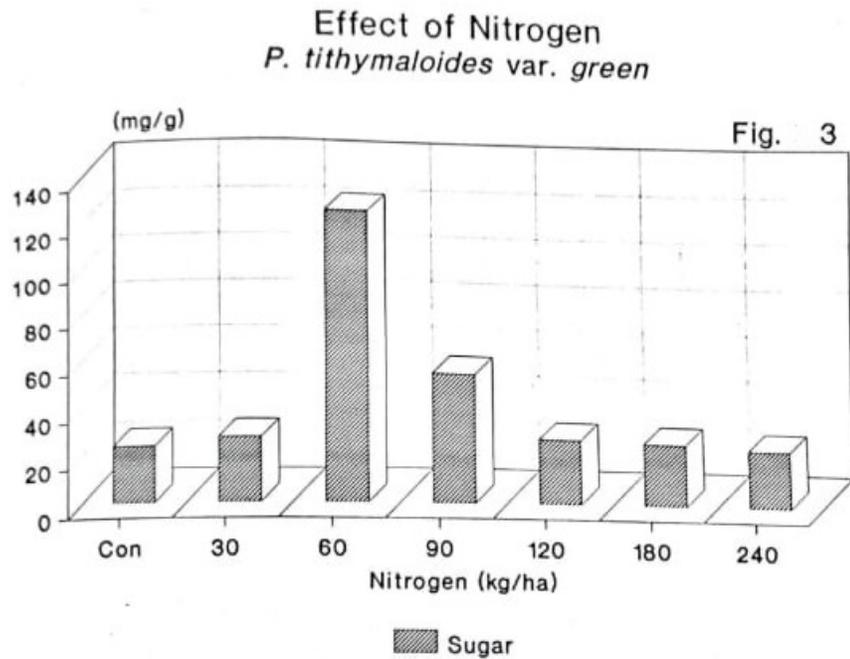


Figure 3: Effect of different dosages of nitrogen on sugar contents of aboveground parts of plants Con - Control, without nitrogen supplementation

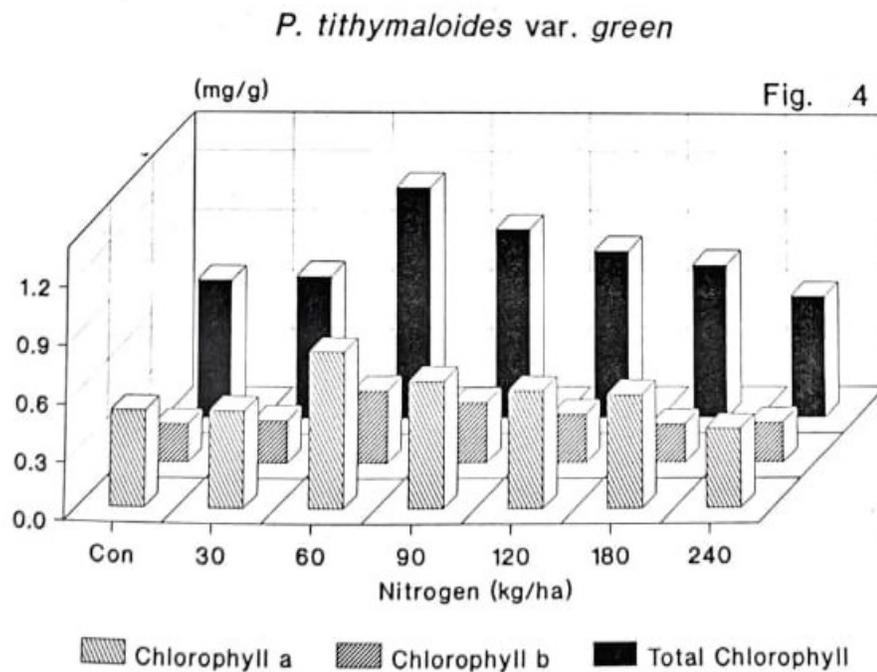


Figure 4: Effect of different dosages of nitrogen on chlorophyll a, b and total chlorophyll contents in the leaves of plants Con - Control, without nitrogen supplementation

## CONCLUSION

The level of mineral nutrients in soil or externally applied fertilizer is an important factor that seems to influence the growth and yield potential of the plant including hydrocarbon biosynthesis.

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