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EFFECTS OF VERMICOMPOST ON PHYSIOLOIGICAL AND BIOCHEMICAL PARAMETERS OF *ARACHIS HYPOGAEA* L. VAR. M-13

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ABSTRACT
Pot experiment was performed to determine the effect of vermicompost on *Arachis hypogaea* L. var. M-13. Seeds of *Arachis hypogaea* L. var. M-13were exposed to different levels of vermicompost *i.e.* 125g, 250g, 500g, 750g, 1000g and a control level (soil without vermicompost). Plants were harvested at three stages *i.e.* pre, peak and post flowering stages. With the increase in vermicompost level the root, shoot and pod length, root, shoot and total dry weight were increased to 50.54, 52.88, 70.52, 69.74, 78.15 and 77.53% respectively. Carbohydrate, Nitrogen and Protein contents increased with increasing level of vermicompost to 47.77, 63.48 and 63.48% respectively.

KEY WORDS: Vermicomposting, *Arachis hypogaea,* Physiological and Biochemical Parameters.

INTRODUCTION

Vermicomposting is an excellent technique for recycling food waste in the apartment as well as composting yard wastes in the backyard. The vermicomposting is bio-oxidation and stabilization of organic material involving the joint action of earthworms and microorganisms. Vermicompost contains not only worm castings, but also bedding materials and organic wastes at various stages of decomposition. It also contains worms at various stages of development and other microorganisms associated with the composting processing. Earthworm castings contain 5 to 11 times more nitrogen, phosphorus and potassium as the surrounding soil. Secretions in the intestinal tracts of earthworms, along with soil passing through the earthworms, make nutrients more concentrated and available for plant uptake, including micronutrients. The earthworms process organic wastes often referred to as vermicompost are finely divided peat like materials with high porosity, aeration, drainage and water holding capacity. (Edwards & burrows, 1998). Present paper deals with the study of the effect of various levels of vermicompost on different parameters like nitrogen, carbohydrate, protein and growth parameters of *Arachis hypogaea* .

MATERIALS & METHODS

Experimental setup

For the experimental study *Arachis hypogaea* L. var. M-13 was selected as test plant. The Seeds of *Arachis hypogaea* were obtained from Durgapura Research Experiment Station, Jaipur. Vermicompost was collected from M.R. Morarka-GDC Rural research foundation.

15 seeds were sown in the beginning in each pot (12" diameter earthen pots). Three replicates were used for each vermicompost level. After seedlings became established, a uniform population of five plants was maintained in each pot. Following different levels of vermicompost were maintained for conducting the experiment.

Level - I	Control (without vermicompost)
Level - II	125 g vermicompost + 9875 g soil
Level - III	250 g vermicompost + 9750 g soil
Level - IV	500 g vermicompost + 9,500 g soil
Level - V	750 g vermicompost + 9,250 g soil
Level - VI	1000 g vermicompost + 9000 g soil.

Growth parameters: The experiment was continued up to the end of post-flowering stage. The plants were harvested at the following three stages.

I. Pre-flowering stage (after 60 days)
II. Peak-flowering stage (after 90 days)
III. Post-flowering stage (after 135 days)

Plants were harvested for growth analysis (like root, shoot and pod length, dry weight of root, shoot & pod and total dry weight). For dry weight determination roots and shoots were separated and dried in hot air oven at 80^0C for 72 hr.

Biochemical analysis

Carbohydrate content was estimated following the Anthrone method (hedge and Hofreiter, 1962). Protein content was determined by following the method of Lowry *et al*. (1951) while nitrogen content was estimated by microkjeldhal's method (Allen, 1931).

Soil analysis

After harvesting at pre, peak and post- flowering stages of *Arachis hypogaea*, soil samples were collected, oven dried, crushed and passed through 2 mm sieve and stored in polythene bags for physico-chemical analysis following the standard method suggested by Maiti (2003).

RESULTS & DISCUSSION

The average root length, shoot length pod length, root dry weight shoot dry weight and total dry weight increased with increasing vermicompost levels. Shoot length was 11.76cm under controlled condition (without vermicompost) at the pre flowering stage, which increased up to 15.86cm at the level of 1000g vermicompost. At the peak flowering stage under controlled condition shoot length was estimated 13.00cm, which increased up to 19.10cm at the level of 1000g vermicompost. Similarly shoot length was 16.24cm at the post flowering stage under controlled condition it increased up to 24.82cm at the level of 1000g vermicompost. Root length was 8.08 cm under controlled condition (without vermicompost) at the pre flowering stage increased up to 11.16cm at the level of 1000 g vermicompost. At the peak flowering stage under controlled condition root length was 8.94cm, which increased up to 12.88cm at the level of 1000g vermicompost. Similarly root length was estimated 11.08 cm at the post flowering stage under controlled condition which increased up to 16.68cm at the level of 1000g vermicompost. Pod length was 3.46 cm under controlled condition (without vermicompost). It increased up to 5.90 Cm at the level of 1000g vermicompost, Table 1.

TABLE 1: Effect of vermicompost on shoot length, Root length, and pod length of *Arachis hypogaea* L. var. M-13, through pot experiment

Treatment level	Shoot length (cm)			Root length (cm)			Pod Length (cm)
	Pre- flowering	Peak-flowering	Post-flowering	Pre- flowering	Peak-flowering	Post-flowering	
Control	11.76±0.716	13.00±0.223	16.24±0.450	8.08±0.690	8.94±0.650	11.08±0.277	3.46±0.194
125 g	12.42±0.537 (5.61)	14.02±0.349 (7.84)	17.94±0.409 (10.46)	8.72±0.396 (7.92)	9.78±0.511 (9.39)	12.28±0.319 (10.83)	3.92±0.178 (13.29)
250 g	13.04±0.512 (10.88)	15.14±0.507 (16.46)	19.38±0.496 (19.33)	9.28±0.834 (14.85)	10.56±0.487 (18.12)	13.40±0.418 (20.93)	4.44±0.051 (28.43)
500 g	13.92±0.622 (18.36)	16.52±0.637 (27.07)	20.90±0.768 (28.69)	9.84±0.687 (21.78)	11.14±0.684 (24.60)	14.44±0.492 (30.32)	4.85±0.121 (40.17)
750 g	14.90±0.764 (26.70)	17.98±0.788 (38.30)	22.90±0.561 (41.00)	10.48±0.432 (29.70)	11.86±0.665 (32.66)	15.56±0.427 (40.43)	5.43±0.073 (56.93)
1000 g	15.86±0.669 (34.86)	19.10±0.728 (46.92)	24.82±0.289 (52.88)	11.16±0.378 (38.11)	12.88±0.363 (44.07)	16.68±0.294 (50.54)	5.90±0.154 (70.52)

*Mean of five replicates ± standard deviation; Data in parenthesis denotes percentage increase

Root dry weight was 0.165g under controlled condition (without vermicompost) at the pre flowering stage which increased up to 0.265g at the level of 1000g vermicompost. At the peak flowering stage under controlled condition root dry weight was 0.239g, which increased up to 0.393g at the level of 1000g vermicompost. Similarly root dry weight was estimated 0.343g at the post flowering stage under controlled condition which increased up to 0.583g at the level of 1000g vermicompost. Shoot dry weight was 2.360g under controlled condition (without vermicompost) at the pre flowering stage which increased up to 3.753g at the level of 1000g vermicompost. At the peak flowering stage under controlled condition shoot dry weight was 2.788g, which increased up to 4.467g at the level of 1000g vermicompost. Similarly shoot dry weight was estimated 4.282g at the post flowering stage under controlled condition which increased up to 7.628g at the level of 1000 g vermicompost. Total dry weight was 2.524g under controlled condition (without vermicompost) at the pre flowering stage which increased up to 4.018g at the level of 1000g vermicompost. At the peak flowering stage under controlled condition total dry weight was 3.027g, which increased up to 4.861g at the level of 1000g vermicompost. Similarly total dry weight was estimated 4.625g at the post flowering stage under controlled condition which increased up to 8.212g at the level of 1000 g vermicompost, Table 2.

The carbohydrate, nitrogen and protein increased with increasing levels of vermicomposting. Carbohydrate content was 9.64 mg/g under controlled condition (without vermicompost) at the pre flowering stage, which increased up to 14.11 mg/g at the level of 1000 g vermicompost. At the peak flowering stage under controlled condition carbohydrate content was 10.18 mg/g which increased up to 15.04 mg/g at the level of 1000g vermicompost. Similarly carbohydrate content was estimated 12.13 mg/g at the post flowering stage under controlled conditions, which increased up to 19.39 mg/g at the level of 1000g vermicompost. Nitrogen was estimate 1.005% under controlled condition (without vermicompost) at the pre flowering stage. It increased up to 1.616% at the level of 1000g vermicompost. At the peak flowering stage under controlled condition nitrogen content was 1.177%, which increased up to 1.925% at the level of 1000g vermicompost. Similarly nitrogen content was 1.538% at the post-flowering stage under controlled condition which increased up to 2.565% at the level of 1000g vermicompost. Protein content was 6.286% under controlled condition (without vermicompost) at the pre-flowering stage, which increased up to 10.10% at the level of 1000g vermicompost. At the peak-flowering stage under controlled condition protein was estimated 7.362%, which increased up to 12.03% at the level of 1000g vermicompost. Similarly protein was estimated 9.618% at the post-flowering stage under controlled condition, which increased up to 16.03% at the level of 1000g vermicompost, Table 3.

According to Pant *et al*., 2009 Vermicompost enhanced plant production, mineral nutrients and total carotenoids, and this effect was most prominent under organic fertilization. Application of vermicompost was reported by Chamani *et al.* (2008) Suthar (2009) Sinha *et al.* (2010) Tharmaraj *et al.* (2011) and Chanda *et al.* (2011) reported that the vermicompost treated plants exhibit faster and higher growth rate and productivity than the control plants. The present study shows that application of vermicompost enhanced the growth percentage in *Arachis hypogaea* L. var. M-13. This confirms observation by the earlier authors (Arancon *et al*., 2003; Edward *et al*., 2004; Alam *et al*., 2007; Ansari, 2008).

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TABLE 2: Effect of vermicompost on Root dry weight, Shoot dry weight and Total dry weight of *Arachis hypogaea* L. var. M-13, through pot experiment

Treatment level	Root dry wt.(g)			Shoot dry wt.(g)			Total dry wt.(g)		
	Pre- flowering	Peak-flowering	Post-flowering	Pre- flowering	Peak-flowering	Post-flowering	Pre- flowering	Peak-flowering	Post-flowering
Control	0.165±0.016	0.239±0.037	0.343±0.044	2.360±0.078	2.788±0.096	4.282±0.314	2.524±0.475	3.027±0.078	4.625±0.345
125 g	0.183±0.019 (11.03)	0.273±0.032 (14.46)	0.396±0.024 (15.18)	2.667±0.272 (13.01)	3.210±0.234 (15.28)	5.033±0.217 (17.55)	2.850±0.567 (12.88)	3.484±0.332 (15.09)	5.429±0.213 (17.37)
250 g	0.208±0.296 (26.42)	0.305±0.042 (27.75)	0.444±0.033 (29.31)	2.997±0.132 (26.97)	3.591±0.113 (28.80)	5.609±0.372 (31.00)	3.205±0.412 (26.93)	3.897±0.475 (28.72)	6.054±0.447 (30.88)
500 g	0.228±0.035 (38.18)	0.332±0.026 (38.87)	0.483±0.028 (40.54)	3.249±0.072 (37.64)	3.892±0.382 (39.57)	6.210±0.243 (45.03)	3.477±0.365 (37.68)	4.224±0.115 (39.52)	6.693±0.053 (44.69)
750 g	0.249±0.026 (51.39)	0.359±0.045 (50.33)	0.536±0.020 (56.02)	3.507±0.255 (48.57)	4.264±0.111 (52.91)	6.806±0.313 (58.95)	3.756±0.098 (48.76)	4.623±0.163 (52.71)	7.373±0.123 (58.74)
1000 g	0.265±0.021 (60.96)	0.393±0.042 (64.54)	0.583±0.032 (69.74)	3.753±0.374 (58.99)	4.467±0.353 (60.22)	7.628±0.100 (78.15)	4.018±0.257 (59.12)	4.861±0.087 (60.56)	8.212±0.114 (77.53)

* Mean of five replicates ± standard deviation; Data in parenthesis denotes percentage increase

TABLE 3: Effect of vermicompost on carbohydrate content, nitrogen content and protein content of *Arachis hypogaea* L. var. M-13, through pot experiment

Treatment level	Carbohydrates (mg/g)			Nitrogen (%)			Protein (%)		
	Pre- flowering	Peak-flowering	Post-flowering	Pre- flowering	Peak-flowering	Post-flowering	Pre- flowering	Peak-flowering	Post-flowering
Control	9.64±0.417	10.18±0.679	12.13±0.219	1.005±0.015	1.177±0.047	1.538±0.063	6.286±0.109	7.362±0.293	9.618±0.396
125 g	10.5±0.370 (9.75)	11.29±0.352 (10.88)	13.61±0.517 (12.17)	1.130±0.073 (12.37)	1.352±0.058 (14.77)	1.775±0.061 (15.36)	7.064±0.452 (12.37)	8.450±0.367 (14.77)	11.09±0.381 (15.36)
250 g	11.50±0.315 (19.29)	12.436±0.290 (22.13)	15.22±0.322 (15.11)	1.252±0.056 (24.49)	1.505±0.037 (27.79)	2.024±0.583 (31.58)	7.826±0.355 (24.49)	9.408±0.236 (27.79)	12.65±0.364 (31.58)
500 g	12.40±0.313 (28.67)	13.47±0.760 (32.31)	16.54±0.357 (16.28)	1.371±0.061 (36.36)	1.641±0.057 (39.39)	2.200±0.066 (42.98)	8.572±0.382 (36.36)	10.26±0.359 (39.39)	13.75±0.418 (42.98)
750 g	13.24±0.313 (37.34)	14.24±0.341 (39.93)	17.51±0.306 (44.25)	1.497±0.044 (48.87)	1.824±0.058 (54.87)	2.433±0.036 (58.41)	9.358±0.279 (48.87)	11.40±0.367 (54.87)	15.21±0.228 (58.41)
1000 g	14.11±0.607 (46.39)	15.04±0.582 (47.77)	19.39±0.631 (59.74)	1.616±0.048 (60.67)	1.925±0.075 (63.48)	2.565±0.036 (66.70)	10.10±0.303 (60.67)	12.03±0.468 (63.48)	16.03±0.227 (66.70)

* Mean of five replicates ± standard deviation; Data in parenthesis denotes percentage increase

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REFERENCES

Alam, M.N., Jahan, M.S., Ali, M.K. Ashraf, M.A. and Islam, M.K. (2007) Effect of vermicompost and chemical fertilizers on growth, yield and yield components of Potato in Barind soils of Bangladesh. *J. Appl. Sci. Res.,* 3(12): 1879-1888.

Allen, W.F. (1931) Accurate and adaptable microkjeldhal methods of nitrogen determination. *Lnd. Eng. Chem. Anal.,* 3: 239-240.

Ansari, A.A. (2008) Effect of vermicompost and vermiwash on the productivity of Spinach (*Spinacia oleracea*), Onion (*Allium cepa*) and Potato (*Solanum tuberosum*). *World J. Agricul. Sci*., 4(5)**:** 554-557.

Ansari, A.A. (2008) Effect of vermicompost on the productivity of Potato (*Solanum tuberosum*), Spinach (*Spinacia oleracea*) and Turnip (*Brassica campestris*). *World J. Agricul. Sci*., 4(3): 333-336.

Arancon, N.Q., Edwards,C.A., Bierman, P., Metzger, J.D., Lee, S. and Welch, C. (2003) Effects of vermicomposts on growth and marketable fruits of field-grown Tomatoes, Peppers and Strawberries. *Pedobiologia.,* 47: 731–735.

Bhat, M.R. and Limaye, S.R. (2012) Nutrient status and plant growth promoting potential of prepared vermicompost. *Intern. J. Environ. Sci.* 3(1): 312-321.

Chamani, E., Joyce, D.C. and Reihanytabar, A. (2008) Vermicompost effects on the growth and flowering of Petunia hybrida 'Dream Neon Rose'. *American-Eurasian J. Agric. and Environ. Sci,.* 3(3): 506-512.

Chanda, G.K., Bhunia, G. and Chakraborty, S. K. (2011) The effect of vermicompost and other fertilizers on cultivation of tomato plants. *J. Horticul. and Forestry,* 3(2): 42-45.

Edwards, C.A., Dominguez, J. & Arancon, N. Q. (2004) The influence of vermicomposts on plant growth and pest incidence. Soil zoology for Sustainable Development in the 21th Century.

Hedge, J. E., and Hofreiter, B.T. (1962) Determination of Reducing sugars. Ln: Method in Carbohydrate Chemistry (Eds.: R.L. Whistler and J.N. Be Miller). M.L. Academic Press, New York, 17.

Lowry, O. H., Rasebrogh, N.J., Farr, A.L. and Raandall, R.J. (1951)Protein measurement with folin-phenol reagent. *J. Biol. Chem.,* 193: 265-275.

Maiti, S.K**.** (2003) Handbook of methods in environmental studies. Vol. 2, ABD Publishers.

Mamta, K.A. Wani and Rao, R.J. (2012) Effect of vermicompost on growth of brinjal plant (*Solanum melongena*) under field conditions. *Journal on New Biological Reports,* 1(1): 25-28.

S. Mathivanan, AL. A., Chidambaram., sundaramoorthy, P. & Kalaikandhan, R. (2012) Effect of vermicompost on germination and biochemical constituents of Ground nut (*Arachis hypogaea. L.*) seedling. *International Journal of Research Biological Sciences*, 2(2): 54-59.

Sinha, J., Biswas, C.K., Ghosh A., & Saha, A. (2010) Efficacy of vermicompost against fertilizers on *Cicer* and *Pisum* and on population diversity of N_2 fixing bacteria. *J. Environ. Biol.,* 31: 287-292.

Suthar, S. (2009) Impact of vermicompost and composted farmyard manure on growth and yield of garlic (*Allium stivum L.)* field crop. *Inter. J. Plant Production.* 3(1):27-38.

Tharmaraj, K., Ganesh P., Kolanjinathan K., Kumar, R. S. and Anandan A. (2011) Influence of vermicompost and vermiwash on physico chemical properties of rice cultivated soil. *Curr. Bot.,* 2(3): 18-21.