



Effect of Vermicompost and Seaweed Extract on Growth and Yield on Local Small Pod Garden Pea (*Pisum sativum* L.) Variety

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Author's contribution

The sole author designed, analysed, interpreted and prepared the manuscript.

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ABSTRACT

The investigation was carried out during the rabi season of 2022-23, from 20 November 2022 to 4 March 2023, at the Chandra Shekhar Azad University of Agriculture and Technology's research station in Kalyanpur, Kanpur, India. The cultivar was a dwarf pod pea type, which is one of the cheapest seeds available in the North Indian Plain. The influence of organic fertilizer vermicompost and Sea weed extract on several aspects of crop physiological growth, development, and economical production was studied.

The experiment was conducted in Simple Block Design on the total area of 100m² area divided in 20 sub plots of 5m² area with total 6.25kg of vermicompost and seaweed extract spray at the post flowering stage at 100ml in required quantity of water.

Considerable positive effect recorded after the application of the above two organic supplements on parameters like Number of pods, number of seeds per pod, length of plant, number of primary

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branches, Length of pods, number of root nodules in roots as this was very important for the nitrogen fixation of atmosphere, number of flowers , green mass production. All the major parameters recorded had shown considerable increment at the particular life stages of the crop.

Keywords: Vermicompost; small poded; simple block design; organic fertilizer; seaweed extract.

1. INTRODUCTION

India's economic reform-led development narrative has converted the country into one of the world's fastest-growing economies. India can become a centre of Organic Fertiliser manufacturing with the correct governmental initiatives. Organic fertiliser is generated from organic sources such as organic compost, animal dung, chicken droppings, and residential sewage.

According to government regulations, organic fertiliser is divided into two categories: biofertilizer and organic manure. Bio-fertilisers are formed of live microorganisms connected to solid or liquid carriers and are valuable for cultivable land, since these microorganisms aid in enhancing soil and/or crop yield.

Rhizobium, Azospirillum, Azotobacter, Phosphobacteria, Blue Green Algae (BGA), Mycorhiza, and Azolla are among examples. Organic manure, on the other hand, is partially decomposed organic waste such as digestate from a biogas plant, compost, and vermicompost that offers nutrients to the soil/crops and increases production.

Vermicompost is a nutrient-rich organic fertiliser and soil conditioner that includes water-soluble nutrients [1]. It is utilised in gardening and organic, sustainable farming.

Seaweed fertiliser (or fertilisers) is a seaweed-based organic fertiliser used in agriculture to improve soil fertility and plant development. The usage of seaweed fertiliser stretches back to antiquity and provides a wide range of soil advantages. Seaweed fertiliser comes in a variety of forms, including refined liquid extracts and dried, pulverised organic material [2,3].

2. MATERIALS AND METHODS

Research was conducted on the well prepared seed bed at proper time of the year in the month of November on 20th, pea seed was sown at the depth of 4-5 cm in the seed bed, 1st irrigation

was done on 21st November as well as 1st fertilizer application on the same day. On 23rd of December weeding was carried out removing unwanted plants and sanitizing manually, then on 24th November 2nd fertilization was done with the vermicompost at the same amount as on 1st fertilization then in 2023 2nd weeding was done on 26th January and 3rd fertilizer application on 27th January, all 20 subplots were sprayed uniformly with sprayer of Orifice Diameter. 1.5 mm. The application of the seaweed extract was also by the sprayer at the time of pre flowering period on 8th of February mixing 100 ml in optimum amount of water and sprayed in the evening.

2.1 Vermicompost

Vermicompost (vermi-compost) is the result of a decomposition process in which several kinds of worms, including red wigglers, white worms, and other earthworms, decompose vegetable or food waste, bedding materials, and vermicast. This is known as vermicomposting, and the cultivation of worms for this purpose is known as vermiculture.

Vermicast (also known as worm castings, worm humus, worm faeces, worm manure, or worm faeces) is the by product of earthworms breaking down organic materials [4]. These excreta have been demonstrated to have lower levels of pollutants and higher nutrient saturation than organic materials prior to vermicomposting [5]. Nutrient content of applied vermicompost in are shown in Table 1.

Table 1. Nutrient content of applied vermicompost

Organic carbon	9.5 – 17.97%
Nitrogen	0.5 – 1.51%
Phosphorus	0.1 – 0.32%
Potassium	0.15 – 0.55%
Sodium	0.06 – 0.31%
Calcium & Magnesium	22.67 to 47.60 meq/100g
Magnesium	
Copper	2 – 9.50 mg kg-1
Iron	2 – 9.30 mg kg-1
Zinc	5.70 – 11.50 mg kg-1
Sulphur	128 – 548 mg kg-1

2.2 Seaweed Extract

Seaweed works as a powerful soil conditioner, bio-remediator, and biological pest control because to its composition of numerous bioactive compounds, with each seaweed phylum delivering different advantages to soil and crop health [6,7].

These advantages might include higher tolerance to abiotic stresses, better soil texture and water retention, and decreased disease incidence. Through carbon storage and nitrogen and phosphorus absorption, seaweed aquaculture and fertiliser development play important roles in biogeochemical nutrient cycle [7,8]. The application of seaweed fertiliser to soils can also change the form and function of microbial communities. Seaweed aquaculture has the

ability to provide ecosystem services by providing human populations with a source of nourishment as well as a method for enhancing water quality in natural systems and aquaculture operations [9-11].

The growing popularity of organic agricultural practises is increasing interest in the numerous applications of seaweed-derived fertilisers and soil additives. While the seaweed fertiliser sector is still in its infancy, it has considerable promise for long-term economic growth and nutrient reduction in coastal environments [12]. However, there are continuous issues related with the usage and manufacture of seaweed fertiliser, such as disease and invasive species expansion, heavy metal build up danger, and the efficiency and refinement of manufacturing processes [13-15].

Table 2. Chemical composition of soil

S. no.	Analysis	Value	Category	Method adopted
1.	Soil pH	7.4	Normal	Glass electrode method {pH meter} Jackson, 1967
2.	Electrical conductivity (ds/m)	0.14	Normal	Conductivity meter at 25°C {Jackson, 1967}
3.	Organic carbon%	0.41	Low	Wakley and Black rapid titration method {Wackley and Black, 1934}
4.	Available Nitrogen {Kg N/ha}	171	Medium	Kjeldahl method {Kjeldahl 1883}
5.	Available phosphorus {P ₂ O ₅ }	13.0	Medium	Olsen's method {Olsen et al., 1954}
6.	Available potash {K ₂ O Kg/ha}	181	Medium	Flame photometer {Barnes et al., 1980}

Table 3. Nutrient content of applied seaweed extract

Organic component	
Carbohydrates	35.01%
Total amino acid	6.10%
Alginate acid	8.51%
Mannitol	4.22%
Betaines	0.038%
Growth regulators	
IAA	0.023%
Cytokinins	0.019%
Macro elements	
N 2.82% P 2.61% K 4.46% Mg 0.64% S 3.01% Ca 0.29%	
Micro elements	
Fe 0.0161% Mn 0.0013% Zn 0.0058%	
B 0.0047%	

Table 4. Soil composition

S.No.	Composition	Content	Category	Method used
1.	Sand %	54.7	-	Bouyoucos
2.	Silt %	22.4	-	Hydrometer
3.	Clay %	23.4	-	Method {Piper, 1967}
4.	Texture Class	-	Sandy Loam	Triangular method

Table 5. Layout of the experiment

SP1	SP5	SP9	SP13	SP17
SP2	SP6	SP10	SP14	SP18
SP3	SP7	SP11	SP15	SP19
SP4	SP8	SP12	SP16	SP20

20 Meters x 5 meters

(SP stands for subplot)

Table 6. Date frame of the experiment

S. No.	Parameters	Date	Remarks
1.	Sowing of seeds	20 th November 2022	At the depth of 4-5 cm.
2.	1st irrigation	21 st November 2022	Check basin method
3.	1st fertilizer application	21 st November 2022	Vermicompost dissolved in water
4.	1st Weeding and sanitization	23 rd December 2022	Manually
5.	2nd fertilizer application	24 th December 2022	Vermicompost dissolved in water
6.	2nd irrigation	20 th January 2023	Check basin method
7.	2nd weeding and sanitization	26 th January 2023	Manually
8.	3rd fertilizer application	26 th January 2023	Vermicompost dissolved in water
9.	Seaweed extract spray	8 th February 2023	Orifice Diameter 1.5 mm.
10.	Harvesting	4 th March 2023	Manually



Fig. 1. 12 January, 2023 , 53rd Day after sowing

Fig. 2. 8 February 2023 , 80th Day after sowing



Fig. 3. Plant height 1.85 meters on 89 DAS

Fig. 4. 100 m² area with abundant flowering



Fig. 5. Harvesting time 4 March



Fig. 6. Full length with roots



Fig. 7. Pri. roots 15.4 in number

Table 7. Major parameters average values recorded

S. No.	Parameters	Average Values Recorded
1	Total Number of pods per plant	38.7 pods
2	Number of seeds per pod	3.8 seeds
3	Number of flowers per plant	37.5
4	Number of primary branches	12.8
5	Number of root nodules	79.5
6	Number of primary roots	15.4
7	Length of plants	185.6
8	Length of pod	6.4 cm
9	Green mass weight with pods	195 gram
10	Weight of pods per plant	34 gram
11	Seed to pod ratio per plant	1.36

3. RESULTS AND DISCUSSION

The recorded values of the above table were taken as average value from each 20 subplots .Five plants were selected from each subplots and values were taken. This whole enquiry took 104 days from 20 November 2022 to 4 March 2023.Total number of pods per plot was 38.7 , 2 pods per secondary branches was developed , total primary branches was 12.8 with the fully developed flowers and leaves.

Full Development of pods from flower to pod took 8 days and the number of pods per plants increased by the use of seaweed extract 100ml sprayed at the time of pre flowering stage cause good growth and development of seeds in the pods. Legumes can create symbiotic relationships with nitrogen-fixing soil bacteria known as rhizobia. This symbiosis results in the formation of nodules on the plant root, inside

which the bacteria may convert air nitrogen into ammonia that the plant can utilise.

This variety is consider as the dwarf pod local cultivar but the length of the overall plant show much apical growth after the seaweed extract application. Pods are small is size just 6.4 cm with average number of seeds per pod was about 3.8 seeds but the overall height was reached upto 185.6cm.which is 237.45% higher than the dwarf pea variety and 93% higher than the hybrid good local cultivar. Both of the experiments were quite similar apart from location, year and using seaweed extract present experiment than taking neemcake. Growth of the green vegetative part was shown good, with the number of flowers per plant was 37.5 which is optimum. white colour flowers bracteate (small and deciduous), bracteolate persistent, pedicellate, heterochlamydeous, complete,

bisexual, pentamerous, zygomorphic and hypogynous.

- Use of organic fertilizers like vermicompost with the seaweed extract accomodate all the nutrients to the plant, nutrients like
- (B) boron.
- (Cu) copper.

- (Fe) iron.
- (Mn) manganese.
- (Zn) zinc.
- (Mo) molybdenum which are important micronutrients for the optimum growth of pea variety.

Table 8. Comparison table of major parameters when vermicompost was applied @5ton per hectare + Neemcake in Rabi season of 2021-2022 at Department of Soil Science, School of Agricultural Science, SGRR University, Dehradun, Uttarakhand, India with present 2022- 23 experiment of 1.875 ton vermicompost per hectare + seaweed extract at Chandra Shekhar Azad University of Agriculture and Technology's research station in Kalyanpur, Kanpur, India on Pea (*Pisum sativum*)

Serial no.	Parameters	Vermi+ Neemcake	Vermi + seaweed ext.	% difference
1.	Plant height	63.89 cm	185.6 cm	190.4 %
2.	Branches per plant	11.28	12.8	13.4%
3.	Number of root nodules	59.91	79.5	32.6%
4.	Number of pods per plant	27.73	38.7	39.5%
5.	Number of seeds per pod	6	3.8	57.8%
6.	yield per hectare (q/ha)	21.29	56.66	166.1%

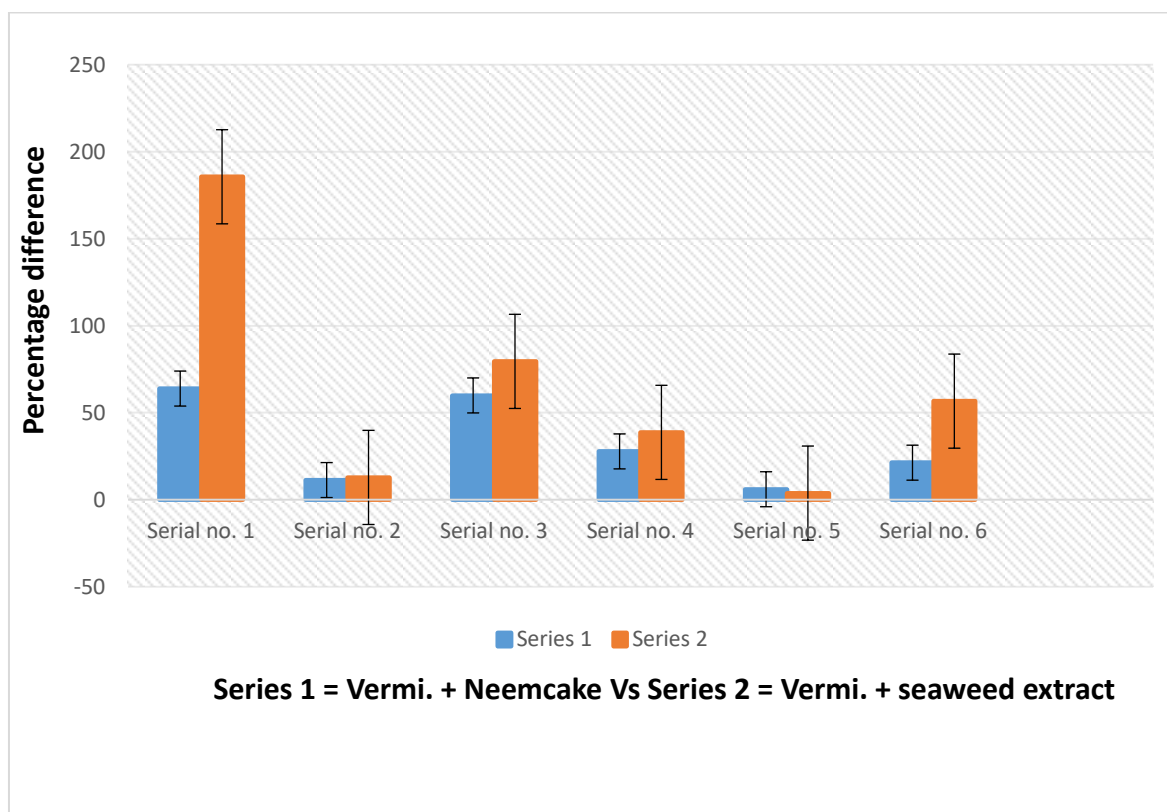


Fig. 8. Percentage differentiation among neemcake and seaweed

3.1 Vermi+ Neemcake

Above observations confirms our latest finding about the significant improvement achieved by the organic fertilizer vermicompost accommodated with seaweed extract on major parameters 190.4% increment in height , 13.4% rise in branches which means more pods per plants, 32.6% higher root nodules causes higher nitrogen fixation as a result 39.5% higher pods per plant was calculated. Total yield per hectare reach upto 56.66 quintal by vermin + seaweed extract use ,166.1% higher than vermi + neemcake. As in our present experiment dwarf poded pea variety was sown and only this parameters had shown 57,8% less number of seeds per pods. Experiment which was done in 2021-2022 at Department of Soil Science, School of Agricultural Science, SGRR University, Dehradun, Uttarakhand, India published in "The Pharma Innovation Journal"2023; 12(3): 5494-5501 Received: 15-02-2023 Accepted: 14-03-2023 by Vijay Kumar Singh, Swati Bamrara and Ankur Sharma taken vermicompost + neemcake as treatment and then applied on pea [16]. While in my my experiment which was sum up in March of 2023 taken vermicompost + seaweed extract as the treatment which was found to be more suitable for the overall optimum growth of (*Pisum sativum* L.)variety. The above table shows considerable differences in both field experiment.

Other factors also cause significant impact like micro climate, soil inherited nutrients, soil biomass but differences can be seen sharply. Proper weeding is very important for the optimum growth otherwise unwanted suppression cause higher yield loss.

4. CONCLUSION

The current study discovered that these organic fertilizers had a significant influence on the development, output, and quality characteristics of local dwarf pod pea cultivar in the Kalyanpur region of the North Indian plain, Kanpur, Uttar Pradesh on production point of you organic fertilizers not comes exactly close to the synthetic fertilizer yield but in the long run organic fertilizers comes to be more advantageous on behalf on soil health as well as for the consumers too as organic food is free from harmful chemicals and human digestive system is more suitable for vegetarian diet so, chemical free plant diet is the best. Vermicompost with the seaweed extract had all

those or help plant to obtain macro, micro and beneficial nutrients for the optimum growth.

COMPETING INTERESTS

Author has declared that no competing interests exist.

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