Journal Homepage: - www.journalijar.com

INTERNATIONAL JOURNAL OF ADVANCED RESEARCH (IJAR)

Article DOI: 10.21474/IJAR01/15818
DOI URL: http://dx.doi.org/10.21474/IJAR01/15818

RESEARCH ARTICLE

THE EFFECT OF VERMICOMPOST APPLIED ON LEAVES AND SOIL ON DIFFERENT DATES ON THE VEGETATIVE PROPERTIES OF PEA (*PISUM SATIVUM* L.)

Gizem Kamci Tekin[1] and Behiye Tuba Bicer[2]

1. Sirnak University, Agricultural Faculty, Department of Field Crops, İdil, Sirnak, Turkey.
2. Dicle University, Agricultural Faculty, Department of Field Crops, Diyarbakir, Turkey.

Manuscript Info

Manuscript History
Received: 05 October 2022
Final Accepted: 09 November 2022
Published: December 2022

Key words:-
Pea, Pisum Sativum, Vermicompost, Absolute Growth Rate, Soil

Abstract

The experiment was conducted from February to July 2021 in the Dicle University, Agriculture Faculty, Field Crops Department Experiment Farm. Vermicompost fertilizer was applied on the 21st and 42nd days (26 March and 16 April) after the emergence of 2000-2500 ml/ha on the soil, and 500 ml/ha on the leaves at the flowering stage. The experiment was laid out in Randomized Block Design with three replications. Plants were harvested at six times 10-day intervals after 45 days emergence. Observations on the number of nodes, stipules, leaves, tendrils and pods per plant, pod fresh and dry weight, and pod length were taken. The number of nodes, stipules, leaves and tendrils per plant was not affected by vermicompost application. Vermicompost applications at 21 and 42 days on the soil were more efficient than the control and on the leaf application.

Introduction:-

The pea (*Pisum sativum* L) is one of the oldest domesticated crops, cultivated for at least 7,000 years. Field peas are now grown in many countries for both human consumption and stock feed. Pea from an agricultural point of view have an important role in the agriculture cycle of their contribution to Nitrogen-Fixing and improved soil fertility (Al Bayati et al., 2019). Like other plants, pea is required good nutrients to grow and develop. Fertilization is the most important production process for a good crop. Organic and chemical materials are used for fertilization. Organic fertilizers not only provide nutrients to the plant, but also provide a good root growth environment for the plant by affecting some physical, chemical and biological properties of the soil. Organic fertilizers used in agricultural production are not only beneficial for the existing plant in the soil, but also create a better environment for the plant to be planted the next year. Organic fertilizers not only increase the water and nutrient holding capacity of the soil, but also the cation exchange capacity, they also make an important contribution to environmental health by preventing nitrogen loss due to leaching more than chemical fertilizers. One of the important sources that can be used in organic fertilization but is not widely used is liquid vermicompost (Barley, 1961; Jakse, and Mihelic, 1999; Kadalli et al., 2000).

Pure earthworm excrement is known as the best of all organic fertilizers available in the market. The microbial activity level of pure earthworm excrement is 10 to 20 times higher than soil. This high microbial diversity increases the formation of chemicals (hormones and other compounds) that promote plant growth, while also producing enzymes and various compounds that suppress the growth of harmful plant pathogens (Logsdon,1994).

Corresponding Author:- Gizem Kamci Tekin
Address:- Sirnak University, Agricultural Faculty, Department of Field Crops, İdil, Sirnak, Turkey.

Appropriate vermicompost application in plant cultivation can contribute to protecting valuable environmental resources by reducing the use of inorganic fertilizers. There was many research on vermicompost applications in pea. Kamergam et al (1999) mentioned that the nutrients present in vermicompost increased the growth of green gram plants in a very short period of time and gave rise to high yield. Abul-Soud et al., (2014) recommended that vermicompost application for encouraging plant growth and quality through increase the available forms of nutrients in pea. Also, the maximum plant ground was recorded at vermicompost 10 t/ha+NPK treatment in garden pea (Chauhan et al., 2010). Pączka et al. (2021) showed that the application of vermicompost to soil positively influenced the average number of flowers and pods. The aim of this study is to examine the effects of vermicompost fertilizer made of worm applied at different growth times on the growth and development of pea.

Materials and Methods:-

The experiment was conducted from February to July 2021 in the Dicle University, Agriculture Faculty, Field Crops Department Experiment Farm. The soil is light-alkaline (pH 7.46), clay texture with about 50% clay content. It contains about 0,79% organic matter, 0.032% nitrogen (N), 13.6 kg ha^{-1} potassium (K) and 0.188 6 kg ha^{-1} available phosphorous (P). The meteorological data during the crop period indicated that the total amount of rainfall received during crop season was 219,8 mm. The maximum rainfall was 83,4 mm in May. April was highly drought (11,0 mm) and hot (16,8 °C). Mean daily maximum air temperatures were ranged from 6,9 in in February to 27,6 °C in June during growing season. Minimum air temperatures were recorded in March.

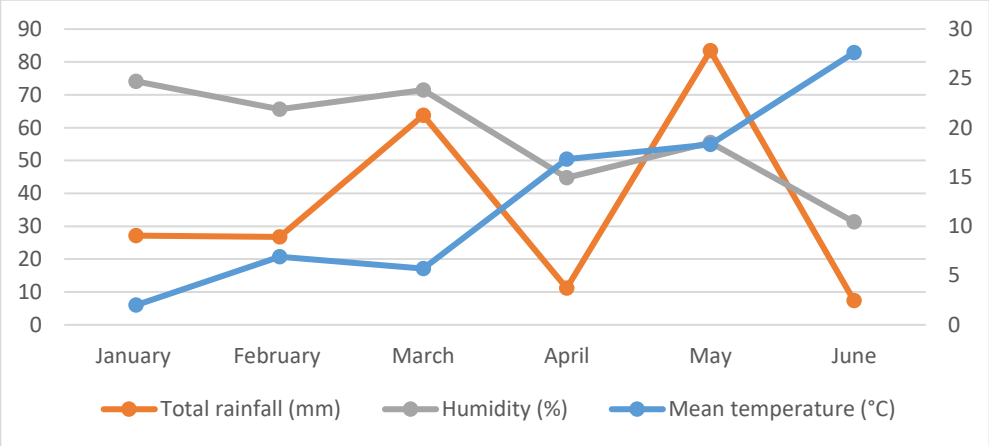

Figure 1:- Meteorological data in Diyarbakir

Utrillo, pea variety, was used, and it is a dwarf pea - semi-dwarf grain type. The pods are straight and contain 9 to 10 dark green seeds. Liquid vermicompost contained total nitrogen (1,0%), organic matter (40%), pH (8,5), humic+fulvic acid (15%) and phosphorus (3,0%). Vermicompost fertilizer was applied at vegetative phase on soil and leaves. Vermicompost fertilizer was applied on the 21st and 42nd days (26 March and 16 April) after the emergence 2000-2500 ml/ha on the soil. Also, vermicompost was applied 500 ml/ha on the leaves at flowering stage. Experiment was laid out in Randomized Block Design with three replications. The plot size was 4 m length, and 4 rows, having row to row distance of 45 cm. Plants were harvested 45 days after emergence. Then plant harvest was recurrence at six times 10-day intervals. Shoots with roots were harvested, shoots were separated into leaves, stems, flowers and pods, and weighted. Plant samples were dried at 80 °C for 72 hours and were weighed to determine the dry weights of leaves and stems. Absolute growth rate (AGR) was calculated: cm day^{-1} (Hunt, 1990)

$$AGR = \frac{h2-h1}{t2-t1} \text{ cm day}^{-1} \text{ (Hunt, 1990)}$$

Where, h1 and h2 are plant height, dry leaf and stem weight $plant^{-1}$ and leaf area $plant^{-1}$ at t1 and t2 times respectively.

Results:-

The effect of vermicompost fertilizer applied on different dates on the leaves and soil on the above-ground plant parts of the pea was investigated. The plants were harvested 6 times at 10-day intervals starting from 45 days after

emer-gence. Number of nodes, stipules, leaves, tendrils and pods per plant, pod fresh and dry weight, and pod length were given in Table 1.

The effect of application times on pod traits were significant, but other traits were no affected by vermicompost application. Vermicompost applications at 21 and 42 days on the soil were more efficient than the one. The highest number of nodes (11,35), stipules (11,40), leaves (23,50) and tendrils (9,40) per plant had in control. However, the number of pods and its weight per plant were affected by vermicompost application. Vermicompost application on the leaf at the flowering stage for pod characteristics was lower than the applied twice on the soil. The highest number of pods per plant (3.25), pod length (9.29 mm), pod fresh (14.41 g) and dry weight per plant were in vermicompost application on the soil. Application of at once vermicompost on the as foliar was similar to the control (Table 1).

Table 1:- Plant vegetative traits of vermicompost applied on the soil and leaves at different times in the growth and development stages.

	Number of nodes plant^{-1}				**Number of stipules plant^{-1}**			
DAE	**Control**	**at 21st and 42nd days**	**at flowering**	**Mean**	**Control**	**at 21st and 42nd days**	**at flowering**	**Mean**
45	6,87	7,33	6,42	6,91 d	7,48	8,67	7,09	7,78 c
55	7,87	9,67	9,46	9,17 c	11,48	10,0	9,79	10,29 b
65	11,42	11,45	10,8	11,23 b	12,08	12,35	10,47	11,58 b
75	13,07	13,87	13,17	13,44 a	19,23	12,7	11,82	14,01 a
85	15,27	14,53	14,52	14,74 a	13,73	13,4	13,17	13,40 a
95	13,62	13,79	13,17	13,55 a	4,38	6,00	6,08	5,63 d
Mean	11,35	11,77	11,26		11,40	10,52	9,74	
	Number of leaves plant^{-1}				**Number of tendrils plant^{-1}**			
DAE	**Control**	**at 21st and 42nd days**	**at flowering**	**Mean**	**Control**	**at 21st and 42nd days**	**at flowering**	**Mean**
45	18,2	18	16,2	17,33 cd	7,2	7,7	7,1	7,28 de
55	20,2	18,3	20,9	19,73 bc	8,7	6,7	8,4	7,79 cd
65	23,3	24,7	23	23,64 b	10,7	7,4	10,8	9,44 bc
75	32,1	28,9	27	28,95 a	11,8	9,9	10,8	10,64 b
85	37,6	30,3	30,4	32,12 a	13,4	15,3	11,5	13,35 a
95	9,6	17,6	17,6	15,55 d	4,6	6,4	6,8	6,01 de
Mean	23,50	22,97	22,52		9,40	8,90	9,23	
	Pod length (mm)				**Number of pods plant^{-1}**			
DAE	**Control**	**at 21st and 42nd days**	**at flowering**	**Mean**	**Control**	**at 21st and 42nd days**	**at flowering**	**Mean**
45								
55								
65	5,39	6,29		5,84 b	2,75	2,56		2,66
75	8,85	10,23	7,67	8,92 a	2,2	3,29	3,18	2,89
85	8,25	10,48	7,85	8,86 a	2,75	3,96	3,18	3,3
95	10,12	10,15	8,55	9,61 a	2,75	3,18	2,47	2,8
Mean	8,15 b	9,29 a	8,02 b		2,61 b	3,25 a	2,94 b	
	Pod fresh weight plant^{-1} (g)				**Pod dry weight plant^{-1} (g)**			
DAE	**Control**	**at 21st and 42nd days**	**at flowering**	**Mean**	**Control**	**at 21st and 42nd days**	**at flowering**	**Mean**
45								
55								
65	0,8	3		1,90	0,34	1,5		0,92
75	7,71	11,33	11,45	10,16	0,97	3,6	1,57	2,05
85	15,48	19,04	11,16	15,23	2,72	5,12	1,64	3,16

95	22,16	24,27	13,32	19,92	5,63	5,15	3,75	4,84
Mean	11,54 b	14,41 a	11,98 b		2,42 b	3,84 a	2,32 b	

The number of nodes per plant varied between 6.91 and 13.55. There was a decrease in soil and leaf applications compared to the control at day 85. The number of stipules ranged from 7.78 to 14.01, with the highest value on the 75th day of developmental stage, and sharply decrease was on the 95th day. Leaf (17.3-32.12) and tendril development (7.28-13.35) continued to increase until the 95th day (Table 1).

Pod production per plant started before the 65th day of control and vermicompost application to the soil. In leaf application, pod production was not detected even on the 75th day. It was concluded that the application of vermicompost only once on the leaf caused a regression in plant growth (Table 1). Sarkar et al. (2007) showed that a small amount of nutrients, particularly Zn, Fe and Mn applied by foliar spraying were significantly increased the yield of crops. Islam et al. (2016) reported that only vermicompost application showed better performance for total biomass production, plant height, number of pods plant-1, pod weight and the photosynthetic rate at the different vegetative stages. Sarma et al., (2014) revealed that vermicompost application significantly increased growth parameters and yield and yield com-ponents.

Absolute growth rate (AGR) for plant height, dry leaf and stem weight per plant and leaf area per plant was given in Figure 2.

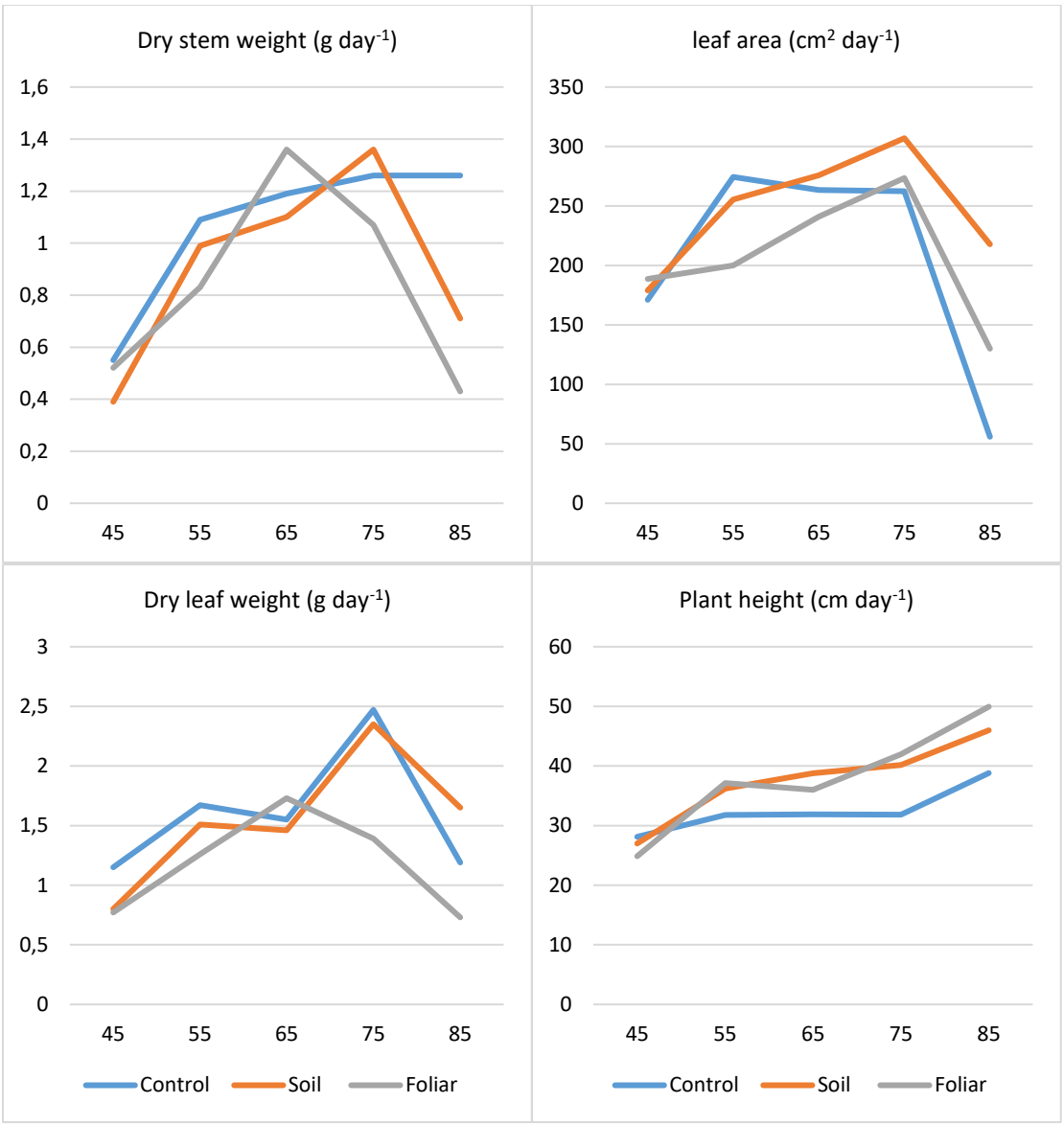

Figure 2:- Absolute growth rate (AGR) for plant height, dry leaf and stem weight and leaf area

Dry stem weight and leaf dry weight absolute growth rate (AGR) showed rapid growth and development until the first 55th day of control and vermicompost application on the soil. The control group could not achieve such a high increase after this observation date. It was determined that the growth was accelerated again on the 75th and 85th days of fertilizer application on the soil. This might be due to the fact that April was dry and May was rainy during the plant development season (Fig 1).

Leaf area absolute growth rate is high in almost all observation periods of vermicompost application on soil. However, the leaf area AGR was even lower than the control at all developmental periods except the 75th day of vermicompost application on the leaf.

Plant height AGR was higher than control in both treatments and plant height increased until the plant matured (Fig 2).

Conclusions:-

In this study, the effect of vermicompost application on one leaf and two times on the soil in pea on vegetative period was investigated. Except for the pod traits, the applications of vermicompost on the number of nodes, leaves and stipules per plant were insignificant. Twice application of vermicompost on the soil was high results in pod traits, length, number and weight. Absolute growth rate (AGR) for plant height, dry leaf and stem weight per plant and leaf area per plant were determined. It was determined that plant height AGR continued day by day until maturity.

References:-

1. Abul-Soud, M., Refaie, K. M. and Abdelraouf, R. E. (2014). Influence of vermicompost and plant density on sustainable production of peas. Arab Univ J Agric Sci., 22(1).
2. Al-Bayati, H. J., Ibraheem, F. F., Allela, W. B. and AL-Taey, D. K. (2019). Role of organic and chemical fertilizer on growth and yield of two cultivars of pea (Pisum sativum L.). Plant Arch., 19 (1), 1249-1253.
3. Barley, K.P. (1961) Plant nutrition levels of vermicast. Adv. Agron., 13:251.
4. Chauhan, H. S., Joshi, S. C. and Rana, D. K. (2010). Response of vermi-compost on Growth and Yield of Pea (Pisum sativum L.) cv. Arkel. Nature and Science, 8(4), 18-21.
5. Hunt, R. Basic Growth Analysis. Edward Arnold, London 1990,10.1007/978-94-010-9117-6
6. Jakse, M. and Mihelic, R. (1999). The influence of organic and mineral fertilisation on vegetable growth and N availability in soil Preliminary results. Acta Hort, 506:69-75
7. Kadalli, G.G. and Devi, L.S., (2000). Siddaramappa, R., John, E. Characterization of humic fractions extracted from coirdust-based composts. Ind. Soc. Soil Sci., 48, 51-55.
8. Kamergam, N., Alagumalai, K. and Daniel, T. (1999). Effect of vermicompost on the growth and yield of green gram (Phaseolus aurus Roxb.). Trop. Agric., 76: 143-146.
9. Logsdon, G. (1994). Worldwide Progress in Vermikomposting, Biocycle.
10. Islam, M.A., Boyce, A.N., Rahman, M.M., Azirun M.S. and Ashraf M.A. (2016). Effects of organic fertilizers on the growth and yield of bush bean, winged bean and yard long bean. Agriculture, Agribusiness and Biotechnology Braz. arch. biol. Technol, 59 (spe). https://doi.org/10.1590/1678-4324-2016160586
11. Pączka, G., Mazur-Pączka, A., Garczyńska, M., Hajduk, E., Kostecka, J., Bartkowska, I. and Butt, K. R. (2021). Use of vermicompost from sugar beet pulp in cultivation of peas (Pisum sativum L.). Agriculture, 11(10), 919. https://doi.org/10.3390/agriculture11100919
12. Sarkar, D., Mandal, B. and Kundu, M.C. (2007). Increasing use efficiency of boron fertilizers by rescheduling the time and methods of application for crops in India. Plant Soil, 301:77-85.
13. Sarma, I., Phukon, M., Borgohain, R., Goswami, J., and Neog, M. (2014). Response of french bean (Phaseolus vulgaris L.) to organic manure, vermicompost and biofertilizers on growth parameters and yield. J. Asian hortic., 9(2), 386-389. DOI : 10.15740/HAS/TAJH/9.2/386-389.