

Economics of Various Treatments of Vermicompost on Growth and Yield Attributes of Pea
(*Pisum sativum*L.) based Intercropping System

ABSTRACT

Intercropping is an ecological friendly technique that can increase sustainability of farming systems, whilst considered as low input systems. An experiment was conducted at the vegetable farm, Department of Vegetable Science, College of Horticulture and Forestry, Jhalrapatan City, Jhalawar during rabi season from November, 2022 to April 2023. The experiment comprised of fifteen treatment combinations having three levels each of vermicompost (0, 2.5, and 5 ton/ha) and five levels of different intercropping system (Sole Pea, Sole Garlic, Pea + Garlic 1:1, 2:1, 2:2) in Factorial Randomized Block Design with three replications. The result of present investigation showed that the effect of vermicompost and intercropping system on individually and combined had significant effect on the economic related attributes. Interaction effect of Vermicompost and Intercropping system significantly increased the economics attributes such as maximum gross return (361172 ₹ ha⁻¹), net profit (272244 ₹ ha⁻¹) and B:C ratio (4.06) was recorded under treatment V₂I₅ (Vermicompost @5ton/ha+ Pea+ Garlic 2:2) as compared to other treatment, respectively. The interaction effect of vermicompost and Intercropping system also significantly increased pea equivalent yield (166.040 q/ha), land equivalent ratio (1.25) under treatment V₂I₅ (Vermicompost@5ton/ha+ Pea+ Garlic 2:2), respectively.

Keywords: Economics, Equivalent yield, Intercropping, Gross return, Net return.

INTRODUCTION

Pisum sativum L. is a member of the Leguminosae family. This herbaceous annual plant can grow up to 20 cm in dwarf size and up to 1.25 meters in height. It is a crop that self-pollinates and produces pods, or edible fruit. Peas are a major crop that is cultivated all over the world. As a leguminous crop, peas have a low nitrogen need because they fix atmospheric nitrogen in symbiosis with nitrogen-fixing bacteria in the root nodules.

As a member of the Alliaceae family, garlic (*Allium sativum* L) is one of the most aromatic herbaceous annual spices. With a distinct strong aroma, it is the second most extensively grown spice crop among allium crops after onion. Originating in central Asia, garlic was later brought to the Mediterranean region during prehistoric times. [1].

Vermicompost is an amazing natural fertilizer that contains growth regulators and hormones that boost plant output. It also makes a substantial contribution to the enhancement of soil structure and is a rich source of minerals, such as potassium, phosphate, and nitrogen that are essential for plant growth [2]. The best way to stabilize crop production is by intercropping, particularly when it comes to vegetable production. Farmers use intercropping because it lowers the incidence of pests and diseases, helps enhance total crop production per unit area, and offers insurance against total crop failure [3].

Growing two or more crops concurrently on the same field for a duration long enough to encompass the vegetative stage is known as intercropping [4]. Among the top 10 vegetable crops in the world, peas (*Pisum sativum* L.) are in the top 10. Peas are used in human diets all over the world and are high in the amino acids tryptophan and lysin, as well as rich in carbs, vitamin A and C, calcium, phosphorus, and protein (21–25%) [5].

In India and Rajasthan, garlic (*Allium sativum* L.) and peas (*Pisum sativum* L.) are two of the most significant vegetable crops. They are grown as garlic bulbs, dry seeds, or pea green pods for both domestic and international markets. Small farmers are the ones who use intercropping systems the most since they maximize unit production and are widely used in third-world nations. Intercropping with legume crops is also a great way to reduce soil erosion and maintain crop productivity. The current study, "Economics of Various Treatments of Vermicompost on Growth and Yield Attributes of Pea (*Pisum sativum* L.) based Intercropping System," was conducted in light of the previously mentioned facts and in recognition of the significance of vermicompost and intercropping systems.

MATERIALS AND METHODS

A field experiment was carried out in vegetable farm at the Department of Vegetable science, College of Horticulture and Forestry, Jhalrapatan, Jhalawar during November, 2022 to April 2023. Treatments were arranged in Factorial Randomized Block Design with three replications. The experiment was carried out in Total of 45 plots and area of each plot was 12 m² (3 m x 4 m). The experiment consisted of two factors and with 3 level of each factors Vermicompost 3 level (0, 2.5, 5 t/ha) and factors two Intercropping system 5 level (Sole Pea, Sole Garlic, Pea+ Garlic 1:1, 2:1, 2:2) with a total of 15 number of treatments. The spacing followed in the pea and garlic R×P (3 m x 4 m). Economics of the treatments is the most important consideration for making any recommendation to the farmers for its wide adoption. For calculating economics, the average treatment yield along with prevailing market rates for inputs and output were used. The net return was calculated by subtracting the cost of

cultivation for each treatment from gross returns gained from the economic yield. B: C ratio was computed by dividing gross returns with cost of cultivation for each treatment. For Pea Equivalent Yield (q/ha), pod yield of pea crop in different intercropping systems was converted into pea yield using prevailing rates of produce in the following expression:

$$\text{Equivalent yield} = \text{Yield of main crop} + \frac{(\text{Yield of inter} \times \text{Price of intercrop})}{\text{Price of main crop}}$$

Land equivalent ratio is the relative land area under crops that is required to produce the yields achieved in intercropping. Land equivalent ratio can be mathematically represented as follows:

$$\text{LER} = \frac{\text{Yield of main crop under the system}}{\text{Yield of main crop as sole crop}} + \frac{\text{Yield of intercrop under the system}}{\text{Yield of intercrop as sole crop}}$$

List 1 : Treatment combinations

S. No.	Treatment notation	Treatment combination
1.	V ₀ I ₁	Vermicompost @0t/ha+ Sole Pea
2.	V ₀ I ₂	Vermicompost @0t/ha+ Sole Garlic
3.	V ₀ I ₃	Vermicompost @0t/ha + Pea + Garlic (1:1)
4.	V ₀ I ₄	Vermicompost @0t/ha +Pea +Garlic (2:1)
5.	V ₀ I ₅	Vermicompost @0t/ha+ Pea + Garlic (2:2)
6.	V ₁ I ₁	Vermicompost @2.5t/ha +Sole Pea
7.	V ₁ I ₂	Vermicompost @2.5t/ha+ Sole Garlic
8.	V ₁ I ₃	Vermicompost @2.5t/ha + Pea + Garlic (1:1)
9.	V ₁ I ₄	Vermicompost @2.5t/ha +Pea +Garlic (2:1)
10.	V ₁ I ₅	Vermicompost @2.5t/ha+ Pea + Garlic (2:2)
11.	V ₂ I ₁	Vermicompost @5t/ha +Sole Pea
12.	V ₂ I ₂	Vermicompost @5t/ha+ Sole Garlic
13.	V ₂ I ₃	Vermicompost @5t/ha +Pea+ Garlic (1:1)
14.	V ₂ I ₄	Vermicompost @5t/ha +Pea+ Garlic (2:1)
15.	V ₂ I ₅	Vermicompost @5t/ha +Pea+ Garlic (2:2)

RESULTS AND DISCUSSION

The result of present investigation showed that the effect of vermicompost and intercropping system on individually and combined they had significant effect on the total cost of cultivation, gross income, net profit and B:C ratio. Interaction effect of Vermicompost and Intercropping system significantly increased the economics attributes as maximum gross return (361172 ₹ ha⁻¹), net profit (272244 ₹ ha⁻¹) and B:C ratio (4.06) was recorded under treatment V₂I₅ (Vermicompost @5ton/ha+ Pea+ Garlic 2:2) while minimum gross return (79670₹ ha⁻¹), net profit (32059 ₹ ha⁻¹) and B:C ratio (1.67) was recorded under treatment V₀I₁ (Vermicompost @0t/ha+ Sole Pea). This might due to results are conformity with the research of Cheng [6] in tomato-garlic based intercropping system, Qasim [7] in pea, Wasaya [8] in wheat and fenugreek. Pea grown with Garlic was found most remunerative which might be due to higher market price of pea and comparatively lower cost for cultivation than all other treatment.

The result of present investigation reflected that of vermicompost and intercropping system had significant effect on pea equivalent yield and LER. The maximum equivalent yield (166.040 q/ha), and land equivalent ratio (1.25) was found in treatment V₂I₅ (Vermicompost @5ton/ha + Pea + Garlic 2:2) as compared to minimum pea equivalent yield (46.320 q/ha) and LER (1.00) was found in treatment V₀I₂ (Sole Garlic). This might be due to proportionately less reduction in yield of pea as compared with sole with resulting better yield of component crop leading to higher PEY. The findings are in conformity with the research of Adhikary[9] in baby corn-based vegetable intercropping systems, Abdelkader[10] in onion, fennel and coriander plants, Wartha[11] in intercropping indices of groundnut and cowpea with mustard, Habtamu [12] in intercropping of wheat with faba bean, Chongloi[13] in oat and pea based intercropping system, Kumar [14] in coriander intercropping system and Parsoya [15] in intercropping of ajwain.

Table 1. Economics of vermicompost and Pea based intercropping system

Treatment notation	Treatment combination	Total cost of cultivation	Gross return (Rs ha ⁻¹)	Net return (Rs ha ⁻¹)	B:C ratio
V ₀ I ₁	Vermicompost @0t/ha+ Sole Pea	47611	79670	32059	1.67
V ₀ I ₂	Vermicompost @0t/ha+ Sole Garlic	69825	83376	13551	1.19
V ₀ I ₃	Vermicompost @0t/ha + Pea + Garlic (1:1)	63928	206920	142992	3.24
V ₀ I ₄	Vermicompost @0t/ha +Pea +Garlic (2:1)	57769	186144	128375	3.22
V ₀ I ₅	Vermicompost @0t/ha+ Pea + Garlic (2:2)	63928	216496	152568	3.39
V ₁ I ₁	Vermicompost @2.5t/ha + Sole Pea	60111	102100	41989	1.70
V ₁ I ₂	Vermicompost @2.5t/ha+ Sole Garlic	82325	101106	18781	1.23
V ₁ I ₃	Vermicompost @2.5t/ha + Pea + Garlic (1:1)	76428	267120	190692	3.50
V ₁ I ₄	Vermicompost @2.5t/ha +Pea +Garlic (2:1)	70269	239120	168851	3.40
V ₁ I ₅	Vermicompost @2.5t/ha+ Pea + Garlic (2:2)	76428	269724	193296	3.53
V ₂ I ₁	Vermicompost @5t/ha + Sole Pea	72611	125000	52389	1.72
V ₂ I ₂	Vermicompost @5t/ha+ Sole Garlic	94825	145080	50255	1.53
V ₂ I ₃	Vermicompost @5t/ha +Pea+ Garlic (1:1)	88928	337932	249004	3.80
V ₂ I ₄	Vermicompost @5t/ha +Pea +Garlic (2:1)	82769	308252	225483	3.72
V ₂ I ₅	Vermicompost @5t/ha+ Pea + Garlic (2:2)	88928	361172	272244	4.06

Table 2. Effect of vermicompost and intercropping system on pea equivalent yield (q/ha) and land equivalent ratio (LER)

Treatment notation	Treatment combination	Pea equivalent yield (q/ha)	Land equivalent ratio (LER)
V ₀ I ₁	Vermicompost @0t/ha+ Sole Pea	79.67	1.00
V ₀ I ₂	Vermicompost @0t/ha+ Sole Garlic	46.32	1.00
V ₀ I ₃	Vermicompost @0t/ha + Pea + Garlic (1:1)	92.15	1.13
V ₀ I ₄	Vermicompost @0t/ha +Pea +Garlic (2:1)	82.78	1.02
V ₀ I ₅	Vermicompost @0t/ha+ Pea + Garlic (2:2)	96.42	1.18
V ₁ I ₁	Vermicompost @2.5t/ha + Sole Pea	102	1.00
V ₁ I ₂	Vermicompost @2.5t/ha+ Sole Garlic	56.17	1.00
V ₁ I ₃	Vermicompost @2.5t/ha + Pea + Garlic (1:1)	93.4	1.14
V ₁ I ₄	Vermicompost @2.5t/ha +Pea +Garlic (2:1)	85.4	1.05
V ₁ I ₅	Vermicompost @2.5t/ha+ Pea + Garlic (2:2)	97.33	1.23
V ₂ I ₁	Vermicompost @5t/ha + Sole Pea	123	1.00
V ₂ I ₂	Vermicompost @5t/ha+ Sole Garlic	80.6	1.00
V ₂ I ₃	Vermicompost @5t/ha +Pea+ Garlic (1:1)	153.01	1.16
V ₂ I ₄	Vermicompost @5t/ha +Pea +Garlic (2:1)	144.09	1.09
V ₂ I ₅	Vermicompost @5t/ha+ Pea + Garlic (2:2)	166.04	1.25
	S.E. (m) ±	1.57	0.01
	C.D. (P=0.05)	4.57	0.03

CONCLUSION

On the basis of the results obtained in the present investigation, the following conclusion may be drawn. Interaction effect of Vermicompost and Intercropping system significantly increased the economics attributes i.e., maximum gross return (361172 ₹ ha⁻¹), net profit (272244 ₹ ha⁻¹) and B:C ratio (4.06), pea equivalent yield (166.040 q/ha), land equivalent ratio (1.25) was recorded under treatment V₂I₅ (Vermicompost @5ton/ha+ Pea+ Garlic 2:2) as compared to other treatment, respectively.

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