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Feasibility of vermi-farming in peanut (*Arachis hypogaea*)-vegetable pea (*Pisum sativum*) cropping system

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ABSTRACT

A study was undertaken to improve the pod yield of 9 groundnut (*Arachis hypogaea* L.) and grain yield of vegetable pea (*Pisum sativum* L.) for creating possibility of pollution-free environment. Release of earthworms as vermiculture @ 60,000/ha (6/m^2) in peanut was found significantly better, giving higher pod yield (12.16 g/ha) than all other ingredient combinations except farmyard manure (FYM) @ 100 q/ha + vermiculture @ 60,000/ha (13.20 q/ha). The use of FYM @ 100 q/ha + release of earthworm in peanut significantly increased the yield of succeeding crop of vegetable pea (23.62q/ha) over all the treatments except the use of FYM @ 100 q/ha in combination with vermiculture @ 60,000/ha (24.10 q/ha). Thus the peanut and vegetable pea could successfully be raised under sequential cropping by the use of FYM @ 100 q/ha + vermiculture @ 60,000/ha to peanut and $N_{15} + P_{40}$ kg/ha as a starter dose to vegetable pea besides better management of natural resources and residue for higher productivity and monetary return.

Key words : Vermiculture, Peanut, Vegetable pea, Earthworm

Organic farming is gaining importance in India, but it faces the problem of the availability of required quantity of organic manures due to use of cow dung as fuel. However, a large amount of residues is available at farms that may be utilized for composting and effectively recycled in the system itself as organic manure. These residues can quickly be converted into a good compost by using the technology that converts organic material into compost at a faster rate. The earthworms in general are beneficial to agriculture. They are good friends of the cultivators, as they continually plough and make the soil friable. The earthworm's value as a supercomposter has been proved beyond doubt (Venkataramani, 1995). These creatures help mix materials, aerate the heap and hasten the decay of organic matter. Composting through earthworms is advantageous in preventing leaching of nutrients and even in conserving nutrients, bacteria, enzymes, vitamins and moisture

content.

The constraints faced by the farmers are lack of adequate facilities for soil testing in the peanut-growing area of south-western semi-arid zone, which are mostly deficient in soil organic matter. Therefore the groundnut (peanut) cultivation is not possible here without sufficient addition of organic matter. To improve the peanut production under peanut-vegetable pea cropping system, the present experiment was planned and executed under location-base study.

MATERIALS AND METHODS

A field experiment was conducted during 1996-97 and 1997-98 at Regional Research Station of the University at Mainpuri. The soil was sandy loam, having pH 8.5, organic carbon 0.45%, total nitrogen 0.04%, available phosphorus 10 kg/ha and available potassium 278 kg/ha. Thus the fertility status of the experimental soil was low. The treatments comprised conventional system ($N_{20} + P_{30} + K_{45}$ kg/ha), farmyard mannure (FYM) @ 100 q/ha, vermiculture @ 60,000/ha, FYM @ 100 q/ha + vermiculture @ 60,000/ha, and FYM @ 100 q/ha + vermiculture @ 60,000/ha + neem-leaf powder @ 100 kg/ha. FYM at 100 q/ha + neem-leaf powder @ 100 kg/ha. FYM was applied to peanut 1 month before sowing, whereas NPK and botanical pesticides were applied at the time of sowing as per treatment. The vermiculture was released in furrows at peanut planting before planking. The peanut cv 'Amber ' was planted in rows 45 cm apart, using 75 kg kernel/ha in the first fortnight of July, harvested after 115 days in the first fortnight on November, during both the experimental years.

The succeeding crop of vegetable pea cv 'Azad P-1' was planted in rows 30 cm apart, using 100 kg seed/ha in the second fortnight of November and was harvested after 118 days in second fortnight of March. Vegetable pea was raised on the residue of natural resources with the starter dose of $N_{15} + P_{40}$ kg/ha compared with $N_{40} + P_{60}$ kg/ha applied in conventional system. The irrigations were given to vegetable pea as and when required. The experiment was carried out in randomized block design (RBD) with three replications.

RESULTS AND DISCUSSION

Effect on peanut

Effect on growth characters: Significantly highest plant stand was noted in conventional system (2,46,295 plants/ha), whereas minimum was observed with the use of neem-leaf powder @ 100 kg/ha (1,24,483 plants/ha). A special point was that the application of neem-leaf powder @ 100 kg/ha, alone or in combination with other ingredient, significantly reduced the plant stand of peanut during both the years, because its allelopathic effect adversely affected the germination of peanut kernels also as both were sown in the same furrows. The plants affected with significantly higher bud necrosis disease were also counted in the conventional system (30.85 %) and the least were noted in vermiculture + neem-leaf powder @ 100 kg/ha (12.43 %). The application of FYM, vermiculture and neem-leaf powder alone or in combination reduced the incidence of bud-necrosis disease (Table 1).

Table 1. Growth and yield-contributing traits and yield of peanut

Treatment	Plant stand/ha			Plants affected with bud necrosis disease/ha (%)			Pods/plant			Pod yield (q/ha)		
	1996-97	1997-98	Av.	1996-97	1997-98	Av.	1996-97	1997-98	Av.	1996-97	1997-98	Av.
1. Conventional system	243,210	249,381	246,295	30.96	30.74	30.85	15.66	15.77	15.71	9.62	9.68	9.65
2. FYM @ 100 q/ha	223,864	228,805	226,334	23.44	23.97	23.70	17.66	17.88	17.77	11.36	11.71	11.53
3. Vermiculture @ 60,000/ha	229,420	238,064	233,742	18.59	18.92	18.75	20.77	21.10	20.93	12.09	12.24	12.16
4. FYM @ 100 q/ha+vermiculture @ 60,000/ha	241,562	248,969	245,265	15.48	15.79	15.63	22.33	23.00	22.66	12.81	13.60	13.20
5. Neem-leaf powder (NLP) @ 100 kg/ha	122,013	126,953	124,483	15.14	15.44	15.29	23.33	23.77	23.55	10.12	10.62	10.37
6. FYM @ 100 q/ha + NLP @ 100 kg/ha	145,266	154,937	150,101	13.40	13.40	13.40	24.33	25.11	24.72	10.33	10.67	10.50
7. Vermiculture @ 60,000/ha + NLP @ 100 kg/ha	148,556	156,171	152,363	11.93	12.93	12.43	24.77	25.44	25.10	11.57	11.89	11.73
8. FYM @ 100 q/ha + vermiculture @ 60,000/ha+ NLP @ 100 kg/ha	154,321	160,693	157,507	14.87	15.34	15.10	24.66	25.33	24.99	11.57	11.97	11.77
CD (P = 0.05)	31,645	29,978	–	9.61	8.79	–	N.S.	6.18	–	1.48	0.91	–

Table 2. Effect of natural resources residue on pods weight, grains/plant and grain yield of vegetable pea

Treatment	Pod weight/plant (g)			Grains/plant			Grain yield (q/ha)		
	1996-97	1997-98	Av.	1996-97	1997-98	Av.	1996-97	1997-98	Av.
1. Conventional system (R.D. 40, 60 kg NP/ha)	11.44	11.88	11.66	44.11	46.22	45.16	17.20	20.59	18.89
2. FYM @ 100 g/ha	12.77	13.22	12.99	52.11	54.22	53.16	18.06	22.85	20.45
3. Vermiculture @ 60,000/ha	13.99	14.33	14.16	58.33	60.33	59.33	21.40	25.85	23.62
4. FYM @ 100 q/ha+vermi-culture @ 60,000/ha	14.55	14.99	14.77	62.22	64.33	63.27	21.53	26.68	24.10
5. Neem-leaf powder (NLP) @ 100 kg/ha	11.44	11.88	11.66	44.00	46.00	45.00	16.90	19.43	18.16
6. FYM @ 100 q/ha + NLP @ 100 kg/ha	11.99	12.44	12.21	46.33	48.44	47.38	17.60	20.43	19.01
7. Vermiculture @ 60,000/ha + NLP @ 100 kg/ha	12.10	12.55	12.32	46.44	50.22	48.33	17.86	21.26	19.56
8. FYM @ 100 q/ha+vermicul-ture @ 60,000/ha+NLP @ 100 kg/ha	12.00	12.44	12.22	48.00	48.44	48.22	17.80	21.68	19.74
CD (P = 0.05)	0.63	0.94	–	3.88	4.20	–	0.60	1.45	–

Effect on yield attributes of peanut

The minimum pods/plant were recorded in conventional system (15.71 pods/plant), and the highest in vermiculture @ 60,000/ ha+neem-leaf powder @ 100 kg/ha (Table 1).

The different treatments did not influence significantly the pod weight/plant, kernel weight/plant and 100-kernel weight, during both the experimental seasons. However, these yield attributes were found highest in combination of vermiculture @ 60,00/ha and FYM @ 100 q/ha/. The release of earthworms in combination with FYM provided better environment for pods and kernel development due to more organic casting of earthworms.

Effect on pod yield and shelling percentage

The release of earthworms as a vermiculture @ 60,000/ha ($6/m^2$) gave higher pod yield when compared with conventional system (9.65 q/ha) and use of neem-leaf powder @ 100 kg/ha (10.37 q/ ha) and FYM @ 100 q/ha + neem-leaf powder @ 100 kg/ha (10.50 q/ha). The efficiency of vermiculture increased by 8.50% when released in amended field of FYM @ 100 q/ha (13.20 q/ha).

Among all the treatments, application of FYM @ 100 q/ha + vermiculture @ 60,000/ha recorded higher pod yield compared with other ingredient combinations. These results confirm the findings of Agasimani *et al.* (1994).

Farmyard manure, never fed directly to the plants as manure, is not the food of plants but of the living organisms present in the soil like earthworms and bacteria. In the present situation, the released earthworms made the soil rich and aerable. The earthworm castings were more at pegging stage and, as these are rich in nitrogen (2.5%), sulphur (2.9%) and potash (1.4%), they helped in easy pegging into the soil and retained more moisture, leading to better pod developed in the combination of FYM and earthworms. Vermicompost acted as a good medium for growth and development of microbes in the soil and made the nutrients available for plant uptake (Kale *et al.*, 1987) and thus increased the pod yield.

The application of neem-leaf powder alone or in combination with other ingredients reduced the germination of peanut kernels, causing insignificant reduction in pod yield under these treatments. This may be due to alellopathic effect of higher dose of neem-leaf powder.

The shelling percentage was not affected due to various ingredient combinations.

Effect on growth, yield-attributing traits and seed yield of succeeding crop of vegetable pea

Vegetable pea was sown after peanut to utilize the benefit of natural resources applied to peanut during the rainy season.

The residue of FYM @ 100 q/ha, in combination of vermiculture @ 60,000/ha with starter dose of $N_{15} + P_{40}$ kg/ha, maximised the growth and yield-attributing traits of vegetable pea, i.e. pods/plant, pod weight/plant, grains/pod, grain weight/plant and 100-seed weight, closely followed by residue of vermiculture @ 60,000/ha with starter dose of $N_{15}+P_{40}$ kg/ha (Table 2).

The release of earthworm in peanut during rainy season and $N_{15} + P_{40}$ kg/ha applied to vegetable pea at sowing as starter dose increased the grain yield of

succeeding vegetable pea (23.62 q/ha) sown in winter season over all the treatments except residue of FYM @ 100 q/ha applied in association of vermiculture and starter dose of N_{15}+P_{40} kg/ha used invegetable pea (24.10 q/ha). The better growth and yield-attributing traits under residue of FYM @ 100 q/ha in association of vermiculture @ 60,000/ha and in residue of vermiculture alone with starter dose of N_{15} + P_{40} kg/ha applied to vegetable pea increased the grain yield significantly in comparison with other treatments.

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