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RESEARCH ARTICLE

Effect of crop intensification in garden pea grown under natural farming system

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Abstract

Intercropping with legumes makes efficient use of land and other resources, resulting in lower production costs. The reported work evaluates the effect of crop intensification in garden peas grown under a natural farming system in which pea was intercropped with radish, coriander, spinach and fenugreek. This experiment was conducted during the *rabi* season 2021-2022 in the Department of Vegetable Science, College of Horticulture, Dr Yashwant Singh Parmar University of Horticulture and Forestry, Nauni, Solan (HP). The result revealed that garden pea cv. 'Pb-89' intercropped with radish and fenugreek under natural farming system produced maximum crop equivalent yield (174.17 q ha^{-1}) with net returns of Rs. 396214 ha^{-1} and B:C ratio of 3.14 followed by the treatment in which pea intercropped with radish and spinach having with crop equivalent yield of 170.50 q ha^{-1}, net returns of Rs. 382806 ha^{-1} and B:C ratio of 2.97 in comparison to control (Sole crop of pea: RDF @ Urea 55 kg ha^{-1} + SSP 375 kg ha^{-1} + MOP 100 kg ha^{-1} + FYM @ 200 q ha^{-1}). However, the land equivalent ratio was found to be maximum (1.93) under treatment T_6 followed by T_{11} with LER of 1.72 and minimum LER was recorded under T_2 i.e., 0.87.

Keywords: Crop intensification, Economics, Pea, Natural farming, Yield.

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Introduction

The garden pea (*Pisum sativum* L.) is an important winter vegetable crop grown throughout the world and belongs to the family Fabaceae. According to Central Asia, the Near East, Abyssinia and the Mediterranean are believed as the centers of origin for pea (Vavilov, 1926), but the Mediterranean is known as the primary center of diversity. India is the second largest in pea production after China. In India, it is grown in area of 0.05 million hectares with a production of 6.07 million MT (NHB, 2022). Himachal Pradesh is the 5th leading pea-producing state of India, with an area of 26,000 ha and a production of 328.80 '000 MT (NHB, 2022; Pathak et al., 2024). Pea has high nutritive value and is rich in digestible proteins (7%) along with carbohydrates and vitamins, utilized for the pod purpose and also used as a pulse crop.

The long-term use of synthetic chemicals, pesticides and irrigation has led to environmental degradation and negative impacts on soil health. Natural farming means farming by following nature's principles and without the use of chemical inputs. Natural farming practices make use of cow-based inputs *viz. Beejamrit*, *Jeevamrit*, *Ghanjeevamrit* for the treatment of seeds, soil application and other natural sources for plant protection. Intercropping, contours and bunds, local earthworm species and cow dung are significant constituents of natural farming practices. Garden pea, on the other hand, is a short-season shallow-rooted legume crop that requires comparatively less amount of fertilizers. Intercropping short-duration legume vegetables is beneficial as it promotes soil health by enhancing soil fertility, increasing soil nitrogen status, weed control, reducing soil erosion, and higher yields than a single crop (Willey, 1979), along with a handsome economic return. Low productivity may be attributed to poor infrastructure, poor irrigation, small fragmented land holdings, low investment capacity of the farmers and the perishable nature of the vegetables also results in the inability on the part of producers to manage supply in assembling markets. Thus, pea intercropping not only improves crop yield but also encircles the agroecosystem by utilizing the plant complementarily concept for the acquisition of soil resources and the facilitation of rhizosphere processes, which is all due to the interaction of plants, soil, and microorganisms (Lai et al., 2022). Hence, the current investigation was undertaken to study the impact of crop intensification on the growth, yield, and quality of peas and to identify the available nutrients and micro-flora in the soil along with the economics of crop intensification under the natural farming system.

Materials and Methods

The present work was carried out from November 2021 to April 2022 at Subhash Palekar Model Farm, Department of Entomology and Quality Analysis Laboratory, Department of Vegetable Science, College of Horticulture, Dr Yashwant Singh Parmar University of Horticulture and Forestry, Nauni, Solan, Himachal Pradesh, India. The main crop (pea) variety was 'Pb-89'. The intercrops were radish cv. 'Japanese White', spinach cv. 'Pusa Harit', coriander cv. 'Solan Selection' and fenugreek cv. 'IC-74'. All the crops were sown on 1st November 2021. The experiment was laid out in a Randomized Complete Block Design with 13 treatments and a total 3 replications. Each plot size was 3.60 m^2 having five rows of pea at the spacing of 60 × 7.5 cm and four rows of intercrops was also sown in the center of pea crop rows having 7.50-10 cm spacing from plant to plant as per the treatment combination except for the control, *i.e.,* T_1 (Sole crop of pea under chemical farming) and T_2 (Sole crop of pea under natural farming) were having five rows of pea only. In total, there were 39 plots. Before laying out the experiment, random soil samples were collected from the different spots of the experimental field at 0-15 cm depth and the composite sample was prepared and analyzed for various physico-chemical properties of the soil. The initial values of soil pH, EC, organic carbon, available nitrogen, phosphorous, potassium, iron, copper, zinc, manganese, and viable microbial count before planting the crop in both natural farming (SPNF) and chemical farming (CF) are given in Table 2. The treatments used in this experiment are described in Table 1.

Before sowing, calculated concentrations of recommended doses of fertilizers, *i.e.,* FYM, nitrogen (1/2-1/3rd), phosphorus and potash, were mixed thoroughly in treatment T_1. The remaining N was given in splits as prescribed for the pea crop. In all the remaining 12 plots, *Ghanjeevamrit* was incorporated in the soil @ 10 q ha^{-1}. Before sowing, seeds were treated with *Beejamrit*. Drenching with *Jeevamrit* was done @ 10% at fortnightly intervals, started 15 days after sowing and continued till the last application, which was 15 days before harvesting. *Agniastr* and *Bramhastr* were sprayed at alternate weeks @ 3% and *Khatti Lassi* @ 3% was sprayed three times, first before flowering, second at flowering and third spray was given at pod formation stage. These three were taken as plant protection measures under natural farming. The observations were recorded for different agro-morphological, biochemical, soil characteristics, microbial counts and socio-economic parameters.

Results and Discussions

Growth parameters

Plant height is an important plant growth parameter that determines crop yield. It is noticeable from data (Table 3) that the maximum plant height (94.81 cm) was recorded in treatment T_2 whereas the minimum plant height (88.38 cm) was found under T_3. It might be due to the minimum competition between the sole crops and intercrops for carbon dioxide, water, light, nutrients and space and better use of light, nutrients, water and labor by the sole crop. Similar findings were recorded by Qasim et al., (2013) in pea and Megawer et al., (2010) in cowpeas. There were significant differences in the number of primary branches of garden peas among different treatment combinations. Maximum numbers of primary branches (4.48) were recorded in treatment T_4, which was statistically at par with T_1 and T_6

Table 1: Details of treatments

Treatments	*Treatment Details*
T_1	Sole crop of pea (RDF* @ Urea 55 kg ha^{-1} + SSP 375 kg ha^{-1} + MOP 100 kg ha^{-1} + FYM @ 200 q ha^{-1})
T_2	Sole crop (pea) under natural farming
T_3	Pea intercropped with radish
T_4	Pea intercropped with coriander
T_5	Pea intercropped with spinach
T_6	Pea intercropped with fenugreek
T_7	Pea intercropped with radish + coriander
T_8	Pea intercropped with radish + spinach
T_9	Pea intercropped with radish + fenugreek
T_{10}	Pea intercropped with coriander + spinach
T_{11}	Pea intercropped with coriander + fenugreek
T_{12}	Pea intercropped with spinach + fenugreek
T_{13}	Pea intercropped with (Radish, Coriander, Fenugreek, Spinach) in alternate rows

*RDF: Recommended dose of Fertilizers

Table 2: Physico-chemical properties of soil before planting of crop(s)

Chemical analysis			
Soil properties	*Value obtained (SPNF)*	*Value obtained (CF)*	*References*
Soil pH	6.98	7.1	Digital pH meter (Jackson, 1967)
Soil EC (dS m^{-1})	0.17	0.20	Digital conductivity meter (Jackson, 1967)
Organic carbon (%)	0.81	0.70	Rapid titration method (Walkley and Black, 1934)
Available Nitrogen (kg ha^{-1})	295	313	Alkaline potassium permanganate method (Subbiah and Asija, 1956)
Available Phosphorous (kg ha^{-1})	27.5	32.1	Alkaline sodium bicarbonate method (Olsen et al., 1954)
Available Potassium (kg ha^{-1})	268	295	Normal neutral ammonium acetate method (Merwin and Peech, 1951)
Available Iron (mg kg^{-1})	42.90	41.5	DTPA extractable micronutrient cations (Lindsay and Norvell, 1978)
Available copper (mg kg^{-1})	2.1	2.6	
Available Zinc (mg kg^{-1})	4.53	4.12	
Available Manganese (mg kg^{-1})	4.09	3.75	
MICROBIOLOGICAL ANALYSIS			
Viable microbial count	Initial (SPNF)	Initial (CF)	Reference
Bacteria (10^7cfu g^{-1} soil)	110.23	101.5	(Subba Rao, 1999)
Fungi (10^2 cfu g^{-1} soil)	14.3	11.23	
Actinomycetes (10^2 cfu g^{-1} soil)	16.11	13.42	

Table 3: Effect of crop intensification in garden pea grown under natural farming system on various agro-morphological and biochemical traits

Treatments	*Plant height (cm)*	*No. of primary branches*	*Harvest duration (days)*	*Pod Length (cm)*	*Pod weight (g)*	*Number of pods per plant*	*Pod yield per hectare (q ha^{-1})*	*Land equivalent ratio*	*Shelling percentage*	*Protein (%)*	*TSS (°B)*
T1	92.65	4.34	14.50	9.52	5.33	23.00	120.83	1.00	53.33	20.15	15.97
T2	94.81	4.11	15.20	9.65	6.37	18.47	105.11	0.87	45.60	19.44	17.17
T3	88.38	3.91	15.50	9.27	5.13	18.30	104.44	1.30	50.60	18.67	19.75
T4	92.07	4.48	15.50	9.29	5.07	20.63	112.67	1.25	45.80	19.12	19.07
T5	91.13	4.13	15.40	9.49	5.23	18.33	107.11	1.17	50.30	19.81	16.83
T6	92.33	4.30	15.90	9.46	5.13	24.67	122.22	1.93	43.82	21.20	17.00
T7	91.40	4.01	15.30	9.84	5.70	19.30	102.22	1.39	43.57	18.50	17.27
T8	88.62	3.94	15.30	9.31	5.53	20.40	114.30	1.44	46.77	17.62	14.61
T9	90.67	4.13	15.40	9.42	5.43	19.50	107.56	1.67	44.90	20.71	17.40
T10	89.57	3.86	15.60	8.82	5.13	19.85	109.78	1.25	46.93	18.29	15.71
T11	92.33	4.17	15.70	9.48	5.47	22.26	117.78	1.72	44.77	20.10	18.47
T12	90.22	3.82	15.10	9.42	5.23	18.33	99.78	1.51	45.50	19.70	15.80
T13	89.73	3.70	15.40	8.92	5.57	18.00	98.44	1.44	48.33	17.83	16.41
Mean	91.07	4.07	15.40	9.37	5.41	20.08	109.40	-	46.94	19.32	17.04
$CD_{0.05}$	3.19	0.30	0.50	0.45	0.68	3.95	4.79	-	NS	NS	NS

with a number of primary branches were 4.34 and 4.30, respectively. As coriander have lesser shoot growth and receive more sunshine, resulting in more photosynthesis and direct transfer of fixed nitrogen from pea resulting in its good vegetative growth which in turn reduces competition between the pea and coriander for essential nutrients, leading to an increase in the number of branches per pea plant (Abdelkader et al., 2019).

The data recorded on pod length is shown in Table 3. Maximum pod length (9.84 cm) was found when pea intercropped in T_7 and, which was at par with treatment T_2, T_1, T_5, T_{11}, T_6, T_9 and T_{12}. On the other hand, the minimum pod length (8.82 cm) was recorded in treatment $T_{10.}$ This could also be due to less competition for essential nutrients and better use of solar energy, water, space and soil among the crops. The result is similar to the findings of Abdelkader et

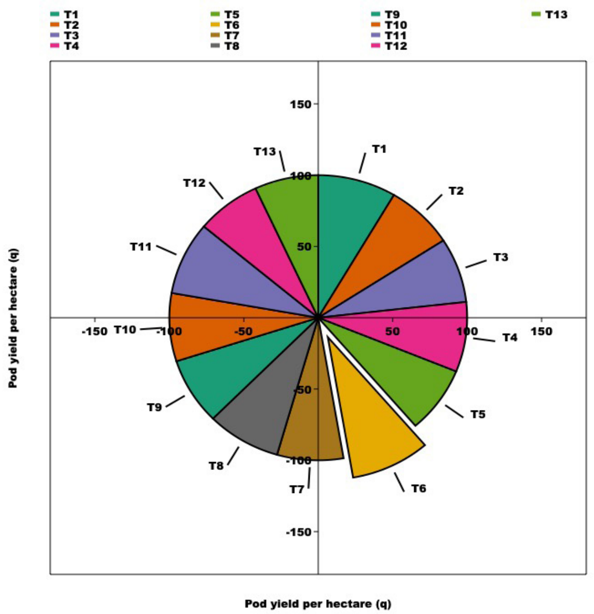

Figure 1: Mean values of pod yield per hectare for different treatments in pea

al., (2019) and Attallah et al., (2021) in pea. Data in Table 3 showed that different intercrops had a significant effect on pod weight of garden pea grown under a natural farming system. Maximum average pod weight (6.37 g) was reported in T_2 followed by T_7 and minimum pod weight (5.07 g) was recorded under T_4. The minimum pod weight (5.07 g) was recorded under treatment T_4. Because of the lesser competition and hence good vegetative growth, which directly influences sexual growth, pod weight was highest when pea was grown alone. The result is in conformity with the findings of Qasim et al., (2013) and Dhar et al., (2013).

A significant variation regarding the number of pods per plant has been noticed among different treatment combinations. Analysis of variance in Table 3 revealed that the number of pods per plant (24.67) was maximum when pea intercropped with fenugreek (T_6). It might be due to the reason that fenugreek itself is a legume crop that has a symbiotic relationship with the soil bacteria *Rhizobium meliloti*, which fixes atmospheric nitrogen and makes it more available to the rhizosphere (Abdullah and Fouad, 2016). The result is in close agreement with that of El-Mehy et al. (2022). On account of better performance of yielding attributes, maximum pod yield (per hectare) was recorded under T_6 when pea intercropped with fenugreek with a yield of 122.22 q ha^{-1} followed by T_1 and T_{11} with 120.83 q ha^{-1} and 117.78 q ha^{-1} respectively represented in Table 3 and Figure 1 while minimum under T_{13} (98.44 q ha^{-1}). Pea and fenugreek both are legume crops, fixes atmospheric nitrogen with the help of *Rhizobium spp.* which might reduce competition for nutrients between pea and fenugreek. Our findings are in concomitant with Attallah et al. (2021) in pea-lettuce and Moghaddam et al. (2019) in pea-spinach intercropping.

Crop equivalent yield (CEY) and land equivalent ratio (LER)

CEY (174.17 q ha^{-1}) under treatment T_9 followed by T_8 with crop equivalent yield of 170.50 q ha^{-1} while minimum (105.11 q ha^{-1}) was recorded under T_2 (Table 6). Component crops have a combined effect of better utilization of growth resources than sole cropping of companion crops and more

Table 4: Effect of crop intensification in garden pea grown under natural farming system on different soil characteristics

Treatments	*pH*	*Electrical conductivity ($dS\ m^{-1}$)*	*Organic carbon (%)*	*Nitrogen ($kg\ ha^{-1}$)*	*Phosphorous ($kg\ ha^{-1}$)*	*Potassium ($kg\ ha^{-1}$)*	*Iron ($mg\ kg^{-1}$)*	*Copper ($mg\ kg^{-1}$)*	*Zinc ($mg\ kg^{-1}$)*	*Manganese ($mg\ kg^{-1}$)*
T1	7.05	0.24	0.75	325.12	38.59	301.43	42.21	2.08	4.12	3.96
T2	6.93	0.18	0.90	315.01	31.78	282.75	50.74	2.23	4.18	4.10
T3	6.90	0.20	0.89	313.53	32.30	280.12	51.60	2.17	4.20	4.12
T4	6.95	0.21	0.93	324.87	34.09	279.15	52.86	2.21	4.22	4.09
T5	6.92	0.19	0.91	322.80	32.97	283.11	51.64	2.20	4.24	4.05
T6	6.91	0.22	0.99	330.30	34.62	286.03	53.91	2.27	4.26	4.16
T7	6.94	0.19	0.94	316.27	30.54	275.17	51.15	2.14	4.28	4.11
T8	6.91	0.21	0.88	310.63	31.90	278.29	50.80	2.25	4.30	4.02
T9	6.89	0.20	0.94	321.36	32.99	283.23	53.46	2.11	4.29	4.14
T10	6.93	0.22	0.90	317.87	32.49	284.15	52.24	2.22	4.25	4.13
T11	6.90	0.19	0.96	328.30	33.44	281.21	55.28	2.29	4.31	4.18
T12	6.92	0.21	0.93	326.04	34.16	282.57	54.85	2.26	4.26	4.16
T13	6.93	0.20	0.91	314.60	31.53	279.59	51.37	2.24	4.23	4.06
Mean	6.93	0.20	0.91	320.52	33.18	282.83	51.70	2.20	4.24	4.10
$CD_{0.05}$	NS	NS	NS	12.10	NS	NS	NS	NS	NS	NS

Table 5: Effect of crop intensification on microbial count under natural farming system

Treatments	*Soil*			*Rhizosphere of pea*		
	Bacteria (10^7cfu g^{-1})	*Fungi (10^2 cfu g^{-1})*	*Actinomycetes (10^2 cfu g^{-1})*	*Bacteria (10^7cfu g^{-1})*	*Fungi (10^2cfu g^{-1})*	*Actinomycetes (10^2cfu g^{-1})*
T1	111.27	14.65	15.12	116.50	16.56	16.42
T2	115.76	16.94	18.15	123.47	18.93	19.68
T3	122.45	18.20	18.35	125.33	22.36	20.15
T4	124.87	19.73	19.78	135.59	23.20	20.00
T5	126.00	18.65	20.25	134.18	20.82	22.61
T6	137.61	20.30	22.21	142.67	24.15	23.39
T7	119.75	17.34	19.34	128.00	19.31	24.60
T8	121.53	19.56	18.67	131.88	21.47	20.97
T9	123.39	17.83	19.71	122.00	20.77	21.76
T10	130.62	19.47	18.48	134.33	22.06	20.03
T11	136.81	20.21	21.60	138.20	22.04	24.46
T12	133.30	20.03	19.67	137.00	21.88	21.62
T13	123.84	17.28	20.06	127.90	20.72	21.53
Mean	125.17	18.48	19.34	130.54	21.10	21.32
$CD_{0.05}$	5.28	0.70	1.11	4.75	1.50	2.46

efficient conversion, resulting in higher yields per unit area than sole crops. Vermam et al. (2005) also recorded the maximum equivalent yield of pigeon pea (34.36 q ha^{-1}) when intercropped with sorghum. LER was found to be maximum (1.93) under treatment T_6 followed by T_{11} with LER of 1.72. However, minimum LER was recorded under T_2, *i.e.*, 0.87, represented in Table 3. LER compares the efficiency of intercropping in using environmental resources to that of monocropping. Also, the land is used more efficiently in the intercropping system. The critical value is the value of unity. When the LER is greater than one, intercropping promotes the growth and yield of the intercropped species, whereas when the LER is less than one, intercropping has a negative impact on the species' growth and yield. The result got supported from the findings of Zivanov et al. (2018) in the fenugreek-normal-leafed pea and Abdelkader et al. (2019) in pea-coriander intercropping.

Table 6: Effect of crop intensification on the economics of pea production

Treatments	*Crop equivalent yield (q ha^{-1})*	*Cost of cultivation (0000 ₹ ha^{-1})*	*Gross income (0000 ₹ ha^{-1})*	*Net income (0000 ₹ ha^{-1})*	*B:C ratio*
T1	120.83	15.004	36.250	21.245	1.42
T2	105.11	12.225	31.533	19.308	1.58
T3	156.79	12.826	47.037	34.210	2.67
T4	134.10	12.377	40.229	27.852	2.25
T5	133.65	12.981	40.094	27.113	2.09
T6	165.18	12.470	49.554	37.084	2.97
T7	158.97	12.583	47.691	35.108	2.79
T8	170.50	12.870	51.151	38.280	2.97
T9	174.17	12.630	52.251	39.621	3.14
T10	136.55	12.646	40.965	28.319	2.24
T11	158.52	12.405	47.570	35.151	2.83
T12	144.24	12.364	43.272	30.907	2.50
T13	154.35	13.185	46.306	33.120	2.51

Qualitative traits

Shelling percentage is an important character in peas, which determines the yield of pea. It is clear from the data in Table 3 that shelling percentage, protein content and total soluble solids (TSS) were not affected by different treatments, as the results obtained were non-significant. T_1 recorded a maximum shelling percentage (53.33%) and the maximum protein content (21.20%) was found in T_6. Attallah et al. (2021) also reported the maximum protein percentage in pea-lettuce intercropping, while T_3 recorded the maximum total soluble solids (19.75°B).

Soil parameters

The effect of crop intensification on soil pH and electrical conductivity was found to be non-significant (Table 4). The highest pH (7.05) and EC (0.24 dS m^{-1}) were reported in T_1. RDF alone has maximum electrical conductivity, which could be attributed to soluble salts accumulation at the surface where fertilizers were applied alone. Intercropping had a non-significant effect on organic carbon. The treatment T_6 had shown maximum value for organic carbon (0.99%), while minimum organic carbon content (0.75%) was found in T_1. However, the maximum nitrogen content (330.3 kg ha^{-1}) in soil was recorded under treatment T_6 and the minimum nitrogen content (310.63 kg ha^{-1}) was found in treatment T_8. This could be attributed to root exudates from the main crop and intercrops providing carbon and energy to soil microbes, resulting in microbial multiplication and conversion of more unavailable nitrogen into available nitrogen. Also, nodule numbers increased in the intercropping system when compared to the sole cropping. Similar findings are reported by Chapagain and Riseman (2014). There were no significant differences recorded in available phosphorus and potassium content in soil before sowing and after harvesting due to different intercropping systems. T_1 recorded maximum phosphorous (38.59 kg ha^{-1}) and potassium content (301.43 kg ha^{-1}) as represented in Table 4. Maximum iron content (55.28 mg kg^{-1}) was recorded under $T_{11,}$ whereas minimum iron content (42.21 mg kg^{-1}) was under T_1. The mean content of copper was found to be a maximum (2.29 mg kg^{-1}) in treatment T_{11} and a minimum (2.08 mg kg^{-1}) under T_1. In contrast, maximum zinc content (4.31 mg kg^{-1}) was recorded under treatment $T_{11,}$ whereas minimum zinc content was recorded (4.12 mg kg^{-1}) under T_1. The manganese content in soil in was found to be maximum (4.18 mg kg^{-1}) under T_{11} and minimum manganese content (3.96 mg kg^{-1}) was recorded under T_1.

Total microbial count in the soil (cfu g^{-1})

It is evident from the data in Table 5 that the microbial population in the soil was significantly affected by crop intensification. Maximum bacterial (137.61 × 10^7 cfu g^{-1} soil), fungal (20.30 × 10^2 cfu g^{-1}) and actinomycetes count (22.21× 10^2 cfu g^{-1} soil) was recorded in T_6. As intercropping system had a significant impact on the (microbial population) fungal, bacterial, and actinomycetes populations. It increases the soil microbial activity and the diazotrophic population (Solanki et al. 2017) followed by Mohamed (2013) in pea intercropping.

Total microbial count in the rhizosphere (cfu g^{-1})

The microbial population in the rhizosphere of pea was significantly affected by crop intensification. Maximum bacterial population of 142.67 × 10^7 cfu g^{-1} soil and maximum fungi population (24.15 × 10^2 cfu g^{-1} soil) were recorded by the treatment T_6 and actinomycetes population (24.60× 10^2 cfu g^{-1} soil) was found maximum under treatment T_7. Intercropping had shown a significant effect on soil microorganisms, *i.e.,* fungi, bacteria and actinomycetes under the rhizospheric zone of pea. Legume-cereal intercropping has a significant impact on the number and population diversity of rhizospheric microorganisms. According to Lai et al. (2022) the diversity of rhizospheric soil microbial community structure was generally greater in the intercropping system than in the monocropping system.

Economic analysis

The data on the economics of treatments is represented in Table 6. The higher gross returns of ₹ 522514.1 ha^{-1} with net returns of ₹ 396214 ha^{-1} and maximum B:C ratio of 3.14 was recorded in treatment T_9 followed by T_8 with gross returns of ₹ 511511.1 ha^{-1}, net returns of ₹ 382806 1 ha^{-1} and B:C ratio of 2.97. Crop production economics, as measured by net return and benefit-cost ratio, have a greater influence on the practical utility and farmer acceptance of any technology. Intercropping systems may increase the yield of either the main crop or both crops as compared to sole cropping. It might reduce the total yield of one or both crops. However, economic returns are more important than the yield in intercropping systems. The present results also got support from the findings of Attallah et al. (2021) who obtained maximum economic returns from pea-lettuce and Qasim et al. (2013) from the pea-turnip intercropping system.

Conclusion

Natural farming practices are more helpful in giving higher returns and are at par with chemical farming. Based on the findings of the present investigation, it was concluded that for higher monetary returns, farmers could successfully adopt intercropping practices under natural farming with a minimum cost of production as compared to chemical farming. Under the current agroecological circumstances in Himachal Pradesh, pea as a main crop can be successfully intercropped with radish + fenugreek followed by radish + spinach.

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सारांश

फसलों के बीच में फलियों के साथ बोने जाने से भूमि और अन्य संसाधनों का कुशल उपयोग होता है, जिससे उत्पादन लागत कम होती है। रिपोर्ट काम ने विभिन्न फसलों के बीच में फलियों के साथ बोने जाने के प्रभाव की मूल्यांकन किया है, जिसमें मटर को मूल्यांकन किया गया था जो प्राकृतिक खेती प्रणाली के तहत मूली, धनिया, पालक और मेथी के साथ बोने गए थे। यह प्रयोग रबी मौसम 2021-2022 में डिपार्टमेंट ऑफ वेजिटेबल साइंस, कॉलेज ऑफ हॉर्टिकल्चर, डॉ. यशवंत सिंह परमार यूनिवर्सिटी ऑफ हॉर्टिकल्चर और फॉरेस्ट्री, नौनी, सोलन (हिमाचल प्रदेश) में किया गया था। परिणाम ने दिखाया कि सब्ज़ी मटर जीवनकृषि प्रणाली के तहत राधिश और मेथी के साथ बोने गए थे, उन्होंने अधिकतम फसल समकालिक उपज (174.17 क्यू हेक्टेयर-1) पैदा की थी, जिसमें राशि का निवासी था। 3,96,214 हेक्टेयर-1 और बी: सी अनुपात 3.14 था, जिसके बाद उन्होंने मूली और पालक के साथ मटर को बोने गए थे, जिसमें फसल समकालिक उपज 170.50 क्यू हेक्टेयर-1, राशि का निवासी 3,82,806 हेक्टेयर-1 और बी: सी अनुपात 2.97 था, जो नियंत्रण के साथ तुलना में (मटर की एकल फसल: यूरिया 55 किलोग्राम हेक्टेयर-1 + एसएसपी 375 किलोग्राम हेक्टेयर-1 + एमओपी 100 किलोग्राम हेक्टेयर-1 +फार्मयार. यहाँ परिणामों में दिखाया गया है कि भूमि समकालिक अनुपात (LER) उपयुक्त फसलों के बीच में अधिकतम था। उपयुक्त फसलों के बीच में भूमि समकालिक अनुपात (LER) ट्रीटमेंट T_6 के तहत 1.93 था, जिसके बाद T_{11} में LER 1.72 था और न्यूनतम LER T_2 के तहत दर्ज किया गया था, अर्थात 0.87।