

Effect of intercropping on yield and economics of cabbage

P. CHOUDHURI AND J. C. JANA

Department of Vegetable and Spice crops
Uttar Banga Krishi Viswavidyalaya
Pundibari-736165, Coochbehar

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India ranks second in vegetable production in the world. Vegetable crops occupy an important role in diversification of agriculture and has played pivotal role in food and nutritional security of ever growing population of India. The vegetable requirement of our country is estimated at 100 million tones by the turn of century and 225 million tones by 2020 (Anon., 2011). But it is also alarming that per capita land resources in India are very limited (0.12 ha) which will further be decreased by the turn of century due to explosive increase in population. West Bengal, especially northern part, is ideally suitable for cultivation of different vegetable crops. In West Bengal 76% farmers are marginal in nature. On the other hand, due to continuous application of chemical fertilizers, amount of soil nutrient reserve is gradually depleting. Hence, effective land utilization through intensive cropping is urgently needed. Realizing all these, intercropping of compatible crops can be of great value in achieving the improved productivity with sustainable soil health. Intercropping is practiced with the aim of maximizing plant competition rather than plant competition for maximum crop yield (Sullivan, 2001). Considering all these facts the present study has been undertaken to study the influence of intercropping in cabbage on residual soil fertility status.

The experiment was conducted at the Instructional Farm of UBKV during *rabi* seasons of 2008-09 and 2009-10 by combining nine treatment combinations of different intercrops in 1:1 row ratio without reducing the spacing of cabbage and was laid out in randomized block design (RBD) with four replications. The treatments were T₁- sole cabbage (control); T₂- sole beet; T₃- sole pea; T₄- sole palak; T₅- sole coriander; T₆- cabbage + beet; T₇- cabbage + pea; T₈- cabbage+ palak; T₉-cabbage+ coriander. The recommended dose of organic manure (15 t ha⁻¹) and inorganic fertilizers (150:80:75 kg N:P:K ha⁻¹) were applied in cabbage. Thirty days old seedlings of cabbage cv. Green Express were transplanted at a spacing of 50 cm x 50 cm during 1st fortnight of November for both the years. Seeds of the intercrops were sown in between rows of cabbage. Recommended package of practices were followed for all the intercrops.

The results pertaining to yield parameters of cabbage showed that sole cropping of cabbage recorded maximum values for head weight (1370.0 g), head circumference (13.61cm), compactness of cabbage head (8.36), number of marketable heads per plot (46.00), yield per hectare (37.11 t).

Table 1: Effect of intercropping on yield characters of cabbage

Treatments	Head weight (g)			Head circumference (cm)			Head compactness		
	2008-09	2009-10	Pooled	2008-09	2009-10	Pooled	2008-09	2009-10	Pooled
Cabbage (sole)	1450.00	1290.00	1370.00	16.28	17.01	16.65	8.91	8.05	8.48
Cabbage+ beet	900.12	765.00	832.56	11.20	11.62	11.41	8.05	6.63	7.34
Cabbage+pea	1240.00	1040.00	1140.00	14.20	13.02	13.61	8.73	7.99	8.36
Cabbage+palak	1010.00	950.00	980.00	12.89	13.05	12.97	7.84	7.28	7.56
Cabbage + coriander	1100.00	989.00	1040.00	14.05	12.51	13.28	7.83	7.91	7.87
SEm (±)	81.10	86.68	78.95	0.50	0.66	0.61	0.40	0.74	0.57
LSD (0.05)	249.88	267.07	228.73	1.54	2.04	1.76	1.22	2.27	1.64

Cabbage + pea intercropping combination was found second best treatment after sole cropping of cabbage as it recorded next best values for head weight (1140.0 g), head circumference (16.65 cm), compactness of cabbage head (8.48), number of marketable heads per plot (44.50), yield per hectare (33.27 t ha⁻¹). But as per cabbage equivalent yield was concerned, it was found that cabbage + pea system of

intercropping recorded significantly maximum value (44.39 t ha⁻¹) for this parameter and which was 19.62 % more over sole cropping of cabbage (37.11 t ha⁻¹). The maximum values for cabbage equivalent yield in cabbage and pea intercropping treatment might be due to higher yield of the main crop i.e cabbage and greater market price of the component crop i.e. pea.

Table 2: Effect of intercropping on yield characters of cabbage

Treatments	No. of marketable (heads plot ⁻¹)			Yield (t ha ⁻¹)			Cabbage equivalent yield (t ha ⁻¹)		
	2008-09	2009-10	Pooled	2008-09	2009-10	Pooled	2008-09	2009-10	Pooled
Cabbage (sole)	47.00	45.00	46.00	39.07	35.14	37.11	39.07	35.14	37.11
Cabbage+beet	40.33	39.00	39.67	28.23	25.91	27.07	32.47	31.72	32.10
Cabbage+pea	47.00	45.33	44.50	36.53	30.01	33.27	47.03	41.74	44.39
Cabbage+palak	42.02	41.11	41.57	33.01	27.87	30.44	35.64	30.99	33.32
Cabbage + coriander	43.09	41.91	42.50	34.09	29.03	31.56	36.89	32.30	34.60
SEm (±)	0.35	0.88	0.67	1.57	2.03	1.73	1.32	1.33	1.32
LSD (0.05)	1.06	2.70	1.95	4.84	6.25	5.01	4.05	4.11	3.81

Maximum values for most of the yield parameters in sole cabbage plots may be attributed to efficient utilization of space and light interception along with nutrient uptake and availability of applied nutrients which ultimately increased the production of assimilates and the rate of biosynthesis of various metabolic activities leading to increased rate of growth and development, which is expressed in higher head weight. Among intercropping treatments, cabbage + pea system of intercropping recorded next best values for these yield attributes. Similar type of observations were also recorded by Sharma *et al.* (1988) in cabbage + broad bean intercropping system where highest head yield of cabbage (37.5 t ha⁻¹) was

recorded in sole cropping of cabbage followed by the same with pea but radish (cv. Pusa Himani) or turnip (cv. Purple Top White Globe) adversely affected the yield of cabbage and by Giri (2002) in cabbage based intercropping system where it was noticed that highest head diameter (19.80 cm) was obtained in cabbage sole cropping followed by cabbage + french bean intercropping treatment (18.52 cm). Nayek (2001) observed the same trend in cabbage based intercropping system. Among all the treatment combinations, cabbage + beet intercropping system recorded minimum values for all the yield parameters which might be due to more competition effect from beet.

Table 3: Economics of cabbage based intercropping

Treatments	Yield (t ha ⁻¹)	Gross income (₹)	Treatment cost (₹)			Net return (₹)	Benefit :Cost ratio (BCR)
			Fixed cost	Variable cost	Total cost		
Cabbage (sole)	37.11	148440.00	18625.00	20004.25	38629.25	109810.75	2.84
Beet (sole)	21.88	49230.00	17922.50	13028.30	30950.80	18279.20	0.59
Pea (sole)	5.63	67560.00	19047.50	11915.75	30963.25	36596.75	1.18
Palak (sole)	12.80	38400.00	17227.50	10956.00	28183.50	10216.50	0.36
Coriander (sole)	3.16	20540.00	9000.50	6255.00	14255.00	6285.00	0.44
Cabbage+beet	32.10	128400.00	24457.50	20004.25	44461.75	83938.25	1.89
Cabbage+pea	44.39	177560.00	24832.50	20004.25	44836.75	132723.25	2.96
Cabbage+palak	33.32	133280.00	23562.50	20004.25	43566.75	89713.25	2.06
Cabbage+coriander	34.60	138400.00	22642.50	20004.25	42646.75	95753.25	2.25

Note: Sale price of cabbage head @ ₹4 kg⁻¹; beet @ ₹2.25 kg⁻¹; pea @ ₹12 kg⁻¹; palak @ ₹3 kg⁻¹; coriander @ ₹6.50 kg⁻¹

After perusal of data related to economics of production it was observed that cabbage + pea intercropping system was most remunerative as it recorded highest net return and B:C ratio (₹ 1,32,723.25 and 2.96, respectively) followed by sole cropping of cabbage (₹ 1,09,810.75 and 2.84). Sole cropping of palak was least economical (₹ 9016.50

and 0.31, respectively). Among the intercropping system cabbage + beet was found least remunerative as it recorded lowest net return and B:C ratio (₹ 83,938.25 and 1.89 respectively). After cabbage and pea intercropping combination, cabbage + coriander (net return of ₹ 95753.25 and B:C ratio of 2.25, respectively) followed by cabbage+palak (net return

of ₹ 89713.25 and B:C ratio of 2.06, respectively) intercropping systems were found most remunerative. Among different combinations, cabbage, grown with pea was found most remunerative which might be due to maximum cabbage equivalent yield, higher price of pea and comparatively lower cost for cultivation than all other treatments. But due to comparatively higher cost of cultivation and comparatively lower cabbage equivalent yield than most of the treatments cabbage, grown with beet was least remunerative than all other treatments. This result was in conformity with the findings of Singh (1997) who found that growing cabbage with legume spice like fenugreek recorded highest monetary return (₹71778 ha⁻¹) followed by that is with coriander (₹71580 ha⁻¹). Since legume like pea improves the soil health and comparatively fetches higher price the cabbage equivalent yield is higher and which ultimately giving higher B:C ratio than all other treatments. Based on the performance of the present experiment, intercropping of cabbage with pea was found best combination to maximize yield and remuneration of cabbage under *terai* ecological zone of West Bengal.

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