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Original article

Evaluation of cabbage intercropped with seed spices on black clay soil

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ABSTRACT

Due to depleting per capita land consistent stress on improving factor productivity has warranted many alternative cropping strategies. The effect of intercropping beetroot (Beta vulgaris, Cv. Datroit Dark Red), radish (Raphanus sativum, Cv. Japanese White), fenugreek (Trigonella foenumgraecum, Cv. Pusa Early Bunching), coriander (Coriandrum sativum, Cv. Local), Spinach (Spinacia oleracea, Cv. Pusa Jyoti) and sorrel (Rumex acetosa, Cv. Local) on the growth, yield and quality of cabbage as main winter crop was tested in a black clay soil (Typic Haplustert), low in available nitrogen and optimum in available P and K under hot sub-humid tropical climate of Central India. Higher values for all the growth parameters of cabbage were recorded as a sole crop. Nevertheless, cabbage plus radish produced maximum net yield followed by cabbage plus spinach and cabbage plus coriander. No difference in total soluble solids was observed either when cabbage was taken alone (10.1° brix) or in combination with intercrops (9.0-10.0° brix). The study hence suggested the superiority of intercropped cabbage over sole crop.

1. Introduction

Intercropping has been acclaimed internationally as the most reliable approach of harnessing the sustainability in vegetable production (Coolman and Hoyt 1993; Theunissen et al. 1997; Varghese 1999a). Several studies in the past have affirmed the importance of intercropping as a cropping strategy against mono cultured

crop failure (Thomson and Kelly 1959; Mehrotra and Ali 1970). With the release of early and diverse vegetable varieties, it is evident that intercropping when based on sound production principles, could probably be more productive, profitable, sustainable; and withstanding against aberrant weather conditions. Earlier Varghese (1999b) showed that intercropped vegetables would be a suitable choice for improving the vegetable production per unit area in black clay soils of Central India. The increasing demographic pressure on the per capita availability of arable land has therefore, led to the adoption of many alternative crop planning, in order to obtain better land use efficiency and productivity. The present investigation was carried out to determine the interactive effect of cabbage and six other vegetables grown as intercrops on the growth, yield and quality of the main crop, besides changes in soil fertility status.

2. Materials and methods

The experiment was conducted at the Experimental Farm, Department of Horticulture, College of Agriculture, Nagpur, Maharashtra in a black clay soil derived from basalt type of parent material and was taxonomically classified as Typic Haplustert. The test soil had clay texture, pH 7.4-7.6, EC 0.21-0.25 dSm-1, CaCO3 1.4-2.1 mg 100 g-1 , 110.0-112.1 mg kg-1 available N, 9.4-11.0 mg kg-1 available P and 154.8-172.0 mg kg-1 available K. Climate of the area was characterized by hot and dry pre-monsoon with an annual rainfall ranging from 750-1350 mm of which 80-90% received during monsoon months. The mean temperature during the experiment ranged between 15-22°C.

The treatment combination consisted of cabbage (Brassica oleracea, Cv. Pride of India) as main crop in combination with six intercrops viz., beetroot (Beta vulgaris, Cv. Datroit Dark Red), radish (Raphanus sativum, Cv. Japanese White), fenugreek (Trigonella foenumgraecum, Cv. Pusa Early Bunching), coriander (Coriandrum sativum, Cv. Local), Spinach (Spinacia oleracea, Cv. Pusa Jyoti) and sorrel (Rumex acetosa, Cv. Local) and tested in a randomised complete block design replicated four times. The plant to plant and row to row spacing was maintained at 45 x 45 cm having plant density of 49,383 plants ha-1 on net experimental plot basis. The ridges, 45 cm apart, were prepared and 33 days old uniform sized cabbage seedlings were transplanted on one side of the ridge, keeping 45 cm spacing between seedlings. One seedling was planted per spot on November 10, 1986. The intercrops were sown on the other side of the ridge on November 15, 1986. Recommended fertilizer rates of 150 kgNha-1 and 50 kg P2O5 ha-1 were applied only to the main crop in the form of urea and single superphosphate, respectively. Fertilizer was placed in bands to exploit available space without incurring additional input for intercrops. No K was added on account of high initial available K status. Entire of phosphorus was applied at the time of transplanting, while nitrogen was applied in two split doses, after 10 and 30 days of transplanting. A total of 12 irrigations were given during entire growth period at an interval of 6-8 days.

2.1. Observation and analysis

The biometrical observations were made on average plant height, number of leaves plant, leaf area plant. The post-harvest parameters of head diameter, height, weight and density of cabbage were recorded in addition to yield of the main crop and the intercrops.

The volume of cabbage head was estimated by water displacement method and expressed in form of density. The ascorbic acid content was determined titrimetrically as described by Ranganna (1986). The total soluble solids in the main crop cabbage were analysed using hand refractometer. The soil samples collected before transplanting and after crop harvest, were dried at an ambient temperature, ground, and sieved through 2 mm sieve. The samples were analysed for available N through steam distillation (Subbiah and Asiza 1956), P using phosphomolybdate blue colour method (Jackson 1973) and K flame photometrically.

3. Results and discussion

At harvest stage, cabbage grown alone showed maximum height, which was significantly superior to that of intercropped cabbage, except for cabbage grown with sorrel (Table 1). The cabbage intercropped with radish was the shortest, but this was not significantly different from cabbage grown with beetroot and spinach. It has been shown that radish root exudates inhibit germination of cabbage and consequently its growth (Omar et. al., 1989). Monocultured cabbage also recorded the highest maximum leaf number and leaf area, which were significantly different from those of cabbage plants intercropped with sorrel, fenugreek, coriander and spinach (Table 1).

Cabbage grown with radish and beetroot had the lowest leaf area and leaf number. However, cabbage grown with sorrel produced significantly higher leaf area than cabbage grown with spinach, coriander and fenugreek.

The other growth characters showed similar pattern of response, with cabbage grown alone having greater head diameter, height, density and weight than those intercropped. However, cabbage intercropped with fenugreek, coriander, spinach and sorrel produced similar head diameters (Table 1). With the exception of cabbage grown with sorrel, head height in intercropped cabbage was significantly superior to that of cabbage grown alone. The weight of cabbage head was higher in sole cropping than in intercropping. The head density of mono cropped cabbage was superior to that of intercropped cabbage with the exception of cabbage grown with sorrel. These parameters provided an indication that probably a proper growth of main crop cabbage may be obtained provided a compatible intercrop is chosen. A more precise effect of interactions between the main crop and the intercrops could be seen on the resultant net productivity.

Table 1

Mean plant height number of leaves plant-1, leaf area plant-1, diameter, height, weight and density of cabbage head in relation to various intercrop treatments.

Growth parameters			**Post-harvest parameters**				
Treatments	**Plant height (cm)**	**No of leaves Plant-1**	**Leaf area Plant-1 (cm2)**	**Head diameter (cm)**	**Head height (cm)**	**Head weight Plant-1 (kg)**	**Head density cm-3**
Cabbage alone	28.6	26.5	958.4	16.0	17.5	1.29	0.64
Cabbage plus beetroot	25.8	22.9	858.24	14.9	15.4	0.95	0.52
Cabbage plus radish	25.2	22.9	870.1	13.8	15.0	0.90	0.50
Cabbage plus fenugreek	27.1	24.9	915.2	15.3	16.9	1.19	0.58
Cabbage plus coriander	26.8	23.3	905.6	15.1	15.6	1.17	0.56
Cabbage plus spinach	26.1	23.2	904.2	14.6	15.5	1.05	0.55
Cabbage plus sorrel	28.1	25.1	932.3	15.5	17.2	1.23	0.61
Sem+	0.41	0.59	4.1	0.34	0.56	0.01	0.02
CD(p=0.05)	1.21	1.75	12.1	1.01	1.66	0.02	0.05

Sem = Standard error of mean; CD =Critical difference

Table 2

Dry matter accumulation in main intercrop and crop yield in relation to various intercrop treatments.

Treatments	**Cabbage yield (Kgha-1)**	**Intercrop yield (kgha-1)**	**Net yield (kgha-1)**
Cabbage alone	32760.0	-	32760.0
Cabbage plus beetroot	26920.0	5580.0	325]0.0
Cabbage plus radish	26480.0	27280.0	53760.0
Cabbage plus fenugreek	30030.0	68040.0	36880.0
Cabbage plus coriander	29510.0	7930.0	37450.0
Cabbage plus spinach	27830.0	19160.0	46990.0
Cabbage plus sorrel	31450.0	4980.0	36440.0
Sem+	550.0	-	620.0
CD (p=0.05)	1650.0	-	1830.0

Sem = Standard error of mean. CD =Critical difference

Table 3
Quality of cabbage and soil fertility change in relation to various cabbage based intercrop treatments.

Treatments	Quality Parameters		Change in soil fertility (mg kg-1)		
	Vitamin C (mg 100 -1)	Total soluble solids (0Brix)	N	P	K
Cabbage alone	28.8	10.1	112.1 (108.2)	12.2 (10.4)	150.4 (162.4)
Cabbage plus Beetroot	24.1	9.4	108.4 (110.4)	9.4 (10.1)	162.0 (168.4)
Cabbage plus Radish	24.7	9.0	118.2 (1220)	10.1 (11.0)	172.0 (180.4)
Cabbage plus Fenugreek	27.8	9.9	100.6 (114.6)	10.8 (9.8)	161.9 (172.0)
Cabbage plus Coriander	26.8	9.2	101.2 (116.4)	11.2 (11.0)	162.4 (163.4)
Cabbage plus Spinach	25.2	9.6	104.6 (112.4)	10.8 (11.4)	160.2 (164.2)
Cabbage plus Sorrel	27.9	10.0	110.0 (108.2)	11.0 (]0.2)	154.8 (160.0)
Sem+	0.24	0.24	NS	NS	NS
CD (p=0.05)	0.71	0.71	-	-	-

Sem = Standard error of mean. CD =Critical difference.
* Initial values, **Values at crop harvest.

The cabbage yield was followed by sorrel, fenugreek, coriander, spinach, beetroot and radish intercrops (Table 2). The highest yield of intercrop radish was followed by spinach and coriander. The total yield (main crop plus intercrop yield) showed a different pattern. The treatment cabbage with radish was far superior followed by cabbage with spinach. Net yield of other intercrops was also significantly superior to cabbage alone except the beetroot intercrop. These observations warranted the utility of intercrops in improving the productivity via land use efficiency. Studies conducted by Rahangdale et al. (1995) indicated better net yield of cabbage intercropped with radish compared to monocrop cabbage in a clay soil of Akola, Maharashtra. Vitamins and total soluble solids are important quality parameters of vegetables. Vitamin C content was significantly higher when cabbage was grown as a mono crop (Table 3). Vitamins C content was relatively higher in the maincrop, when cabbage was grown with fenugreek, coriander and sorrec, compared to other intercrops. No significant difference was observed when cabbage alone was compared with cabbage intercropped with beetroot (9.40 brix), spinach, fenugreek and sorrel for total soluble solids of cabbage. These treatments were superior to other treatments such as cabbage intercropped with radish and coriander. This shows that quality of cabbage as a main crop can be maintained at optimum along with several species as intercrop. The magnitude of change in soil fertility due to imposition of differential nutrient demand is claimed to be one of the bases of suitability of crop combination. The change in available N, P and K status after the crop harvest, compared to initial level indicated no significant difference amongst any of the intercrop treatments when compared with the sole crop (Table 3). The confirms that intercropped cabbage can be successfully raised without inducing any depletion in soil fertility. The practice of intercropping in vegetable culture is still not a popular and common practice in India. Any attempt to improve total productivity of vegetables under a given agro-climate would, therefore, open new frontiers for better use of available resources vis-a-vis sustainability on a long term basis. The results of the present study have provided a sound basis that cabbage intercropped with other vegetables like radish, spinach or sorrel would be highly remunerative compared to sole crop of cabbage.

References

Coolman, R.M., Hoyt, G.D., 1993. Increasing sustainability by intercropping. Hort. Tech., 3(3), 309-12.

Jackson, M.L., 1973. Soil Chemical Analysis. Prentice Hall of India Pvt. Ltd. New Delhi. India., pp. 111-183.

Mehrotra, O.N., Ali, A.A., 1970. A scientific analysis of mixed cropping. Sci. Culture., 36(4), 196.

Omar, N.M., Gomaa, H.M., Bhairy, A.G., Ali, A.H., 1989. Seed germination and seedling growth of tomato as affected by root exudates of cabbage. cauliflower and radish. Egypt. 1. Hor., 6(2), 165-171.

Ranganna, S., 1986. Handbook of Analysis and Quality Control for Fruit and Vegetable Products. Tata Mc Graw Hill Publication Co. Ltd . New Delhi., pp 881-882.

Rahangdale, S.M., Urnale, S.B., Shriram, A.S., Mahorkar, V.K., 1995. Effect of intercrops on growth and yield of cabbage. Punjabrao Krishi Vidyapeeth Res. J., 19 (2), 196-197.

Subbiah, B.V. Asiza, L.G., 1956. A rapid method of available N estimation. Curr. Sci., 25, 159-160.

Theunissen, J., Booij, C.J.H., Scheling, G., Noorlander, J., 1992. Intercropping white cabbage with clover. Bulletin OILB/SROP., 15 (4), 104-114.

Thompson, H.C. Kelly, W.C., 1959. Vegetable Crops. Tata McGraw Hill Publishing Co. Ltd.New Delhi., pp.150-152.

Varghese, L., 1999. Sustainability of Intercropping Vegetable farming in Typic Haplustart. Int. Conf. Manag. Natural Res. for Sustainable Agricultural Production in 21st Century. New Delhi. India. February., 14-18, 2000.

Varghese, L., 1999., Evaluation of cabbage based intercropping systems in Typic Haplustart. Abstract, 4th Agricultural Science Congress, Jaipur (Rajasthan), India. February., 21-24, 1999 pg. 257.