



P-ISSN: 2349-8528

E-ISSN: 2321-4902

IJCS 2019; 7(4): 296-298

© 2019 IJCS

Received: 04-05-2019

Accepted: 06-06-2019

Justy D VarugheseDepartment of Horticulture,
CAU, Imphal, Manipur, India**AK Bijaya Devi**Department of Horticulture,
CAU, Imphal, Manipur, India**K James Singh**Department of Horticulture,
CAU, Imphal, Manipur, India**S Jekendra Singh**Department of SSAC, CAU,
Imphal, Manipur, India**Ann Maria Joseph**Department of SSAC, CAU,
Imphal, Manipur, India**Arathy J**Department of Horticulture,
JNKVV Jabalpur, ⁴Department
of Horticulture, SASRD,
Nagaland University,
Medzhiphema, Nagaland, India**Ashwini Ananda**Department of Horticulture,
JNKVV Jabalpur, ⁴Department
of Horticulture, SASRD,
Nagaland University,
Medzhiphema, Nagaland, India**Correspondence****Justy D Varughese**Department of Horticulture,
CAU, Imphal, Manipur, India

Intercropping of knol khol and pea with cabbage (*Brassica oleracea* L. var. *capitata*) cv. Rareball and its effect on growth and quality of cabbage

Justy D Varughese, AK Bijaya Devi, K James Singh, S Jekendra Singh, Ann Maria Joseph, Arathy J and Ashwini Ananda

Abstract

The present investigation was conducted in *rabi* season 2017-18 in College of Agriculture, CAU, Imphal from October, 2017 to March, 2018. The experiment was conducted in Randomized Block Design (RBD) with seven treatments comprising of sole crops and intercropping with five replications. For all the growth parameters recorded it was found that cabbage sole cropping (T_3) was found to be the best and among the intercropping systems, cabbage intercropped with single row of pea (T_6) was found to be superior. On the analysis of quality parameters such as Vitamin C and TSS, it was found that TSS was not found to be significant but Vitamin C was found to be significant and the highest Vitamin C (34.75mg/100g) was recorded in cabbage intercropped with double row of pea (T_7) and the least Vitamin C (20.58 mg/100g) was observed in cabbage sole cropping (T_3).

Keywords: Growth, vitamin C, intercropping, TSS

Introduction

Cabbage (*Brassica oleracea* L. var. *capitata*) is one of the most economically important members of genus *Brassica*. It belongs to the family *Cruciferae* with chromosome number $2n=2x=18$. It is the most popular vegetable in the world in respect to area, production and availability almost round the year. In India, cabbage ranks second next to cauliflower in area and production. It is grown to a larger extent in the southern, eastern and coastal areas of India. Cabbage also possesses anti-cancerous property. It protects against bowel cancer due to the presence of a compound indole-3-carbinol. Intercropping is a type of multiple cropping system in which two or more crops are grown on the same field in a year. Intercropping two or more crops on the same area can often produce better yields than their sole crops (Mead and Willey 1980) [6]. Globally, population increase and industrialization have resulted in cultivable land being decreased gradually. Arable lands are under pressure to produce food for human consumption, especially in developing countries in Asia and Africa where growers have own small plots of land (Awal *et al.*, 2007) [3]. Cropping intensity in space dimension is achieved in case of intercropping. The advantages of intercropping are risk minimization, effective use of available resources, efficient use of labour, increased crop productivity, erosion control and food security (Addo-quaye *et al.*, 2011) [1]. Cabbage is a crop which requires wider spacing. The space can be utilized for cultivating crops such as pea, knol khol etc. in order to achieve better return and also for better land utilization. Knol khol and pea have an upright growth habit and hence do not interfere with the canopy of cabbage. Peas being a leguminous crop fix atmospheric nitrogen and make nitrogen available to cabbage for better growth. Though knol khol belongs to the same family as that of cabbage, it is a short duration crop which does not interfere with the cabbage growth especially during head formation period.

Materials and Methods

The present investigation was conducted in *rabi* season 2017-18 in College of Agriculture, CAU, Imphal from October, 2017 to March, 2018. The experiment was conducted in Randomized Block Design (RBD) with seven treatments comprising of sole crops and intercropping with five replications. The various treatments were: Cabbage intercropped with single row of knol khol (T_1), cabbage intercropped with double row of knol khol (T_2), cabbage sole cropping (T_3), knol khol sole crop (T_4), pea sole crop (T_5),

cabbage intercropped with single row of pea (T₆) and cabbage intercropped with double row of pea (T₇). Cabbage, knol khol and pea were planted at a spacing of 60 x 45 cm, 30 x 30 cm and 30x 10 cm respectively. The number of cabbage plants (24) remained same in sole cropping as well as intercropping whereas the number of knol khol in single row, double row and sole crop were 24, 48 and 72, respectively. In case of pea, the numbers of plants in single, double and sole crop were 72, 144 and 216, respectively. Cultural practices such as weeding, earthing up and application of manures were carried out regularly. The growth parameters were recorded in field using a meter scale. The growth parameters recorded were plant height (cm), number of leaves per plant, canopy (cm²) and leaf area. The destructive samples were collected at 45, 60 and 75 DAT.

TSS of cabbage head was determined after harvest using digital hand refractometer. About 10-20 g of cabbage head was crushed and the juice pipetted out for the estimation of TSS. Vitamin C was determined as per the procedure given by Sadasivam and Theymoli (1987) [9]. The procedure for Vitamin C determination is as follows: Pipette out 5 ml of the working standard solution into a 100 ml beaker. Add 10 ml of 4% oxalic acid and titrate against the dye. End point is the appearance of pink colour which persists for a few minutes (V₁ ml). Extract 5 g of the freshly cut cabbage leaves with a small volume of 4 % oxalic acid and crushed in a mortar with pestle. Volume made up to 100 ml with 4% oxalic acid and centrifuge at 700 rpm for 10 minutes. Pipette out 5 ml of the supernatant in a 100 ml beaker. Add 10 ml of 4% oxalic acid and titrate against the dye until the appearance of slight pink colour that persists for some minutes (V₂ ml). The ascorbic acid was calculated as per the following formula and reported in mg/100g edible portion.

$$\text{Amount of Vitamin C mg/100g sample} = \frac{0.5 \text{ mg} \times V_2 \times 100 \times 100}{V_1 \times 5 \times \text{Weight of the sample}}$$

Results and Discussion

The various growth parameters recorded were found to be significantly affected by intercropping. Throughout the growth period, cabbage sole cropping (T₃) was found to be the best in terms of various growth parameters, this can be attributed to the lack of competition in sole cropping compared to intercropping. These findings were in accordance to findings of Pramanik *et al.* (2018) [8], Varghese *et al.* (1990) [11] and Nascimento *et al.* (2018) [7]. Among the various intercropping systems, cabbage intercropped with single row of pea (T₆) was found to be better compared to other treatments and cabbage intercropped with double row of knol khol (T₂) recorded the least growth parameters. The growth parameters recorded are illustrated in table 1. The destructive samples also recorded the same pattern as mentioned above. The better performance of cabbage intercropped with single row of pea (T₆) compared to other intercropping systems can be attributed to the nitrogen fixation capability of pea. The better availability of nutrients and lesser number of plants must have promoted the growth of cabbage. The similar results were obtained by Choudhuri and Jana (2012) [4] in an intercropping system where cabbage was intercropped with pea. The antagonistic effect of knol khol on cabbage as they tend to be from the same botanical family might have resulted in lower growth parameters of cabbage, in cabbage intercropped with double row of knol khol (T₂). Ashwini *et al.* (2017) [2] in a research based on intercropping of cabbage with broad bean and knol khol, also reported a decrease in growth parameters of cabbage when cabbage was intercropped with knol khol.

Table 1: Effect of intercropping on growth of cabbage at 75 DAT

Treatments	Plant Height (cm)	Number of open leaves	Canopy (cm ²)	Leaf Area (cm ²)
T ₁	26.26	15.94	509	30.36
T ₂	25.92	14.96	492.96	29.93
T ₃	30.24	18.34	629.92	34.48
T ₄	-	-	-	-
T ₅	-	-	-	-
T ₆	28.86	17.36	533	32.01
T ₇	26.57	16.82	513.6	31.98
S.EM(±)	4.80	0.52	6.21	1.13
C.D (0.05)	NS	1.56	18.63	NS

Table 2: Effect of intercropping on growth parameters of destructive samples at 75 DAT

Treatments	Plant Height (cm)	Number of open leaves	Leaf Area (cm ²)	Fresh Weight (g)	Dry Weight (g)
T ₁	26.36	16.52	27.58	799.83	90.19
T ₂	24.6	16.04	26.65	523.92	78.60
T ₃	31.92	19.48	31.83	1057.49	120.15
T ₄	-	-	-	-	-
T ₅	-	-	-	-	-
T ₆	28.42	18.06	29.39	842.98	112.89
T ₇	27.06	17.68	28.63	803.27	109.96
S.EM(±)	4.97	0.41	0.64	17.13	2.50
C.D (0.05)	NS	1.23	1.94	51.36	7.50

The TSS was found to be non-significant at harvest it indicates that TSS was not affected by intercropping. Vitamin C was found to be significant at harvest. The highest Vitamin C was recorded in cabbage intercropped with double row of pea (T₇) with Vitamin C of 34.75 mg/100g and the least Vitamin C was recorded in cabbage sole cropping with Vitamin C of 20.58 mg/100g. Jiulan *et al.* (2011) [5] also reported that the crude protein content and vitamin C content

of potato tubers was improved when potato was intercropped with kidney bean. Thapa (2015) [10] in an experiment on garlic based intercropping system with different short duration vegetable and spice crops like mustard, carrot, coriander and garden pea also observed that maximum protein content (5.20 %) of garlic bulb was recorded with garlic + garden pea intercropping system.

Table 3: Effect of intercropping on weight, size, TSS and Vitamin C of cabbage head at 90 DAT

Treatments	Weight of the head (g)	Size of the head (cm ²)	TSS (°Brix)	Vitamin C (mg/100g)
T ₁	1070.40	180.01	3.06	27.40
T ₂	878.52	153.01	3.1	23.31
T ₃	1660.68	280.68	3.3	20.58
T ₄	-	-	-	-
T ₅	-	-	-	-
T ₆	1449.29	239.94	3.21	29.16
T ₇	1201.22	204.56	3.08	34.75
S.E.M(±)	44.95	18.40	0.21	2.42
C.D (0.05)	134.78	55.16	NS	7.27

Conclusion

From the present investigation, it was found that with respect to growth of cabbage sole cropping (T₃) was found to be the best. Among the intercropping systems, cabbage intercropped with single row of pea (T₆) was found to be the better compared to other intercropping systems and the least growth was recorded in cabbage intercropped with double row of knol khol (T₂). However, in case of Vitamin C the highest vitamin C was recorded in cabbage intercropped with double row of pea (T₇) and the least Vitamin C was recorded in cabbage sole cropping (T₃).

References

- Addo-Quaye AA, Darkwa AA, Ocloo GK. Growth analysis of component crops in a maize-soybean intercropping system as affected by time of planting and spatial arrangement. *ARPN J Agric. Bio. Sci.* 2011; 6(6):34-44.
- Ashwini A, Bijaya AKD, Abhinandhan S, Satyaprakash B, Bairwa MK. Cabbage (*Brassica oleracea* L. var. *capitata*) cv. Rareball introduction with Knol Khol and Broad Bean intercropping: yield efficiency under foot hills of Imphal-West. *Pharma Innov.* 2017; 6(10):339-341.
- Awal MA, Pramanik MHR, Hossen MA. Interspecies competition, growth and yield in barley-peanut intercropping. *Asian J Plant Sci.* 2007; 6:577-584.
- Choudhuri P, Jana JC. Effect of intercropping on yield and economics of cabbage. *J Crop Weed.* 2012; 8(1):155-157.
- Jiulan G, Ruifeng S, Jiafang HE, Song Q, Houjun X, Ruirong Z *et al.* Effect of different cropping patterns and nitrogenous fertilizer forms on potato yield and quality. *Chin. Potato J.* 2011; 1:36-41.
- Mead R, Willey RW. The concept of a land equivalent ratio and advantages in yield from intercropping. *Expl. Agri.* 1980; 16:217-28.
- Nascimento CS, Filho ABC, Cortez JWM, Nascimento CS, Neto FB, Grangeiro C. Effect of population density of lettuce intercropped with rocket on productivity and land-use efficiency. *Plos One*, 2018, 1-14.
- Pramanik S, Singh J, Kumar V, Shrivastava GK, Saxena RR. Effect of intercropping on the growth, yield parameters and yield of tomato and vegetable intercrops in solid soilless culture under protected condition. *J Pharma Phytochem.* 2018; 7(4):1655-1658.
- Sadasivam S, Theymoli B. In: Practical manual in biochemistry, Tamil Nadu Agricultural University, Coimbatore (T.N.) India, 1987, 14.
- Thapa A. Effect of intercropping on garlic (*Allium sativum* L.). M.Sc. Thesis, submitted to Uttar Banga Krishi Viswavidyalaya Cooch Behar, 2015.
- Varghese LT, Umale SB, Kawthalar MP. Effect of intercrops on the growth and yield of cabbage. *South Indian Horti.* 1990; 38(4):196-198.