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Influence of organic manures and fertilizers on nutrient uptake, yield and quality in cabbage-baby corn cropping sequence

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ABSTRACT

Field experiments were conducted at Acharya N.G. Ranga Agricultural University, Hyderabad, Andhra Pradesh, India, during *rabi* and *kharif* seasons of 2010 and 2011 to study direct, cumulative, or residual effect of organic manures (Farmyard Manure, Vermicompost, Poultry Manure, *Neem* Cake, and combinations thereof) along with the recommended dose of fertilizers (RDF) and absolute Control, on nutrient uptake, yield and quality in cabbage-baby corn cropping sequence system. Results showed that application of recommended dose of fertilizers [N, P and K (100:50:50 kg ha^{-1})] recorded highest yield in cabbage (38.91t ha^{-1}), which was comparable to combined application (2.89t ha^{-1}) of poultry manure and neem cake (37.9t ha^{-1}). In baby corn, maximum yield (6.12t ha^{-1}) was recorded with recommended dose of fertilizers, followed by the combined use of poultry manure and *neem* cake (5.80t ha^{-1}). Among various treatments, residual effect and combined application of poultry manure and *neem* cake to a preceding cabbage crop, recorded maximum yield in baby corn (4.71t ha^{-1}) over other treatments. Similar trend was seen in nutrient uptake by cabbage and baby corn (cumulative and residual). Highest protein and ascorbic acid content in cabbage, residual and cumulative baby corn was recorded with application of poultry manure + *neem* cake (2.89t ha^{-1}), and poultry manure + FYM (6.11t ha^{-1}) respectively.

Key words: Manures, cabbage, baby corn, cumulative, residual, nutrient uptake, quality

INTRODUCTION

Cabbage is one of the most popular winter vegetables grown in India. It is cultivated over 0.372mha with a total production of 8.534mt and average productivity of 22.9t/ha (Indian Horticulture Database, 2013). Major cabbage producing states are Uttar Pradesh, Odisha, Bihar, Assam, West Bengal, Maharashtra and Karnataka. Cabbage is used as salad, boiled vegetable, dehydrated vegetable, cooked curries, and pickles. Cabbage is rich in minerals and Vitamin A, B1, B2 and C. Cabbage plants thrive well in a relatively cool, moist climate. In the plains, cabbage is grown mainly as a winter crop whereas, in the hills, it is grown as a spring and early-summer crop. Sandy-loam soil is generally considered most suitable for an early maturing crop, even through clay-loam or silt-loam soil is suitable too. Cabbage does not grow well in highly acidic soils (optimum pH range for growing cabbage ranges between 5.5 and 6.5.) It is a shallow-rooted crop with high nutrient requirement. As nutrients are a major contributing factor, appropriate management practices are essential to achieve optimum yield in this crop.

Baby corn has gained popularity as a vegetable in Delhi, U.P, Haryana, Maharashtra, Karnataka, Andhra Pradesh and Meghalaya. It is used in spicy food preparations, soups, *pulav*, Chinese foods, *etc*. Pickled and canned baby corn ears have a great potential for export to European and American markets. Recently, a new market for baby corn ears has emerged in India and around the world. With an assured market for their produce, farmers are finding baby corn an attractive crop to cultivate. It requires well-drained sandy-loam to silty-loam soil for cultivation. It can also be grown in well-drained black soils (Agritech, 2010). Cabbage-baby corn is one of the emerging cropping systems in India and is a practically feasible, viable, economical and eco-friendly enterprise for sustaining soil fertility and productivity. Growing awareness of health and environmental issues associated with the intensive use of chemical inputs has led to interest in alternate forms of agriculture globally. In contrast to this, organic agriculture is the best way and is a good management system for ensuring a healthy agro-ecosystem, including concerns on biodiversity, biological cycles and soil biological activity (FAO,

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1999). Increased use of inorganic fertilizers in crop production is determined to soil health and quality (Yadav, 2003). Awareness of crop quality and soil health has accelarated the attention of people towards organic farming (Sharma *et al*, 2008). Balanced use of nutrients through organic sources like farm yard manure, poultry manure, vermicompost, green manuring, *neem* cake and biofertilizers, are prerequisites for sustaining soil fertility and producing maximal crop yields with optimal input levels (Dahiphale *et al*, 2003). Organic carbon build-up is appreciable and significant in the case of organic matter applied to soil, and, organic manures leave behind residues sufficient quantity of residues for the next crop in the sequence (Singh *et al*, 1996; Baruah *et al*, 1999). In view of these facts, field experiments were conducted to study the influence of organic manures on yield and quality in cabbage and cumulative and residual effect of organic manures on yield and quality in baby corn in a cabbage-baby corn cropping sequence.

MATERIAL AND METHODS

Field experiments were conducted during *rabi* and *kharif* seasons of 2010 and 2011 at College Farm, College of Agriculture, Acharya N.G. Ranga Agricultural University (ANGRAU), Rajendranagar, Hyderabad, located on 17°19' North latitude and 78°28' East longitude at an altitude of 535m above MSL. The experiments were carried out under field conditions with cabbage in *rabi* 2010 and baby corn in *kharif* 2011 seasons. A composite soil sample (15cm) was collected before commencing the study to visualize physico-chemical characteristics of the soil. Properties of the initial soil sample and composition of different organic manures used in the study are presented in Table 1. The experimental soil was sandy clay loam in texture, slightly alkaline in reaction, low in available nitrogen (183kg ha^{-1}), and medium in available P_2O_5 (25.1kg ha^{-1}) and K_2O (213kg ha^{-1}). Cabbage var. Golden Acre was transplanted during *rabi* 2010 at a spacing of 60cm x 45cm. The experiment was laid out in Randomized Block Design, with three replications. The experiment consisted of 12 treatments, viz., T_1- Control; T_2 - Recommended Dose of Fertilizers (RDF); T_3 - 100% RDN (Recommended Dose of Nitrogen) through FYM (9.34t ha^{-1}); T_4 - 100 % RDN through vermicompost (8.92t ha^{-1}); T_5 - 100% RDN through poultry manure (2.88t ha^{-1}); T_6 - 100% RDN through *neem* cake (2.91t ha^{-1}); T_7 - 50% RDN through FYM (4.67t ha^{-1}) + 50% RDN through vermicompost (4.46t ha^{-1}); T_8- 50% RDN through FYM (4.67t ha^{-1}) + 50% RDN through poultry manure (1.44t ha^{-1}); T_9- 50% RDN through FYM (4.67t ha^{-1}) + 50% RDN through *neem* cake (1.45t ha^{-1}); T_{10}- 50% RDN through vermicompost (4.46t ha^{-1}) + 50% RDN through poultry manure (1.44t ha^{-1}); T_{11}- 50% RDN through vermicompost (4.46t ha^{-1}) + 50% RDN through *neem* cake (1.45t ha^{-1}); and, T_{12}- 50% RDN through poultry manure (1.44t ha^{-1}) + 50% RDN through *neem* cake (1.45t ha^{-1}). All organic materials were applied to the soil 15 days before planting and mixed thoroughly. Organic sources of the nutrients were supplied on the basis of recommended dose of nitrogen for the crops (100kg ha^{-1}). Based on nitrogen contents we calculated the total quantity of organic manure required under each treatment (Table 5). Recommended dose of N, P and K (100:50:50kg ha^{-1}) fertilizers in the form of urea (46% N), single super phosphate (16% P_2O_5) and muriate of potash (60% K_2O) was applied to the cabbage crop. The entire quantum of phosphorus and potassium was applied as a basal dose, whereas, nitrogen was applied in two equal splits as basal dose and then at 30 days after planting.

After harvesting cabbage crop, the field was divided into two sectors: one plot was used for growing baby corn with application manures and recommended doses of fertilizers (100:50:50kg ha^{-1} of N, P and K) as per treatments mentioned above; the other plot was used for assessing residual effect on baby corn, without further applying manures or fertilizers. Baby corn var. Golden Baby was sown at a spacing of 45cm x 20cm during *kharif* 2011.

Table 1. Properties of the experimental soil and N, P and K content of manures

Soil properties	Initial values
Bulk density (mg m^{-3})	1.63
Textural class	Sandy clay loam
Porosity (%)	41.20
Water holding capacity (%)	37.02
Soil reaction (pH)	8.15
Electrical Conductivity (EC) (dS m^{-1})	0.38
Cation Exchange Capacity (CEC) (c mol (p^+) kg^{-1})	22.21
Organic carbon (g kg^{-1})	8.2
Nitrogen (kg N ha^{-1})	183.00
Phosphorus (kg P_2O_5 ha^{-1})	25.18
Potassium (kg K_2O ha^{-1})	213.00
Iron (mg kg^{-1})	3.25
Manganese (mg kg^{-1})	2.24
Zinc (mg kg^{-1})	0.48
Copper (mg kg^{-1})	0.49

Nutrient composition of different organic manures used

Type of manure	EC (dS m^{-1})	Total amount of nutrients (%)		
		N	P	K
FYM	1.12	1.07	0.40	0.78
Poultry manure	1.62	3.47	1.33	1.12
Vermicompost	0.35	1.12	0.40	0.73
Neem Cake	1.45	3.43	0.30	1.21

Plant samples of cabbage and baby corn were collected from the field as per standard procedures at flowering. After recording their dry weight, plant samples were ground in a Willey mill and analyzed for N, P and K content. Total nitrogen of plant samples was analyzed by the Kjeldahl method. Total phosphorus was estimated using vanado-molybdate yellow colour method, while total potassium was analyzed using flame photometry (Jackson, 1973). Ascorbic acid (Vitamin C) content was estimated by the dichlorophenol indophenol dye method, and expressed in mg $100g^{-1}$ (Ranganna, 1986). Nitrogen content in the plant samples was analyzed using Micro-Kjeldahl digestion (Walinga *et al*, 1989), where the samples were converted to their protein content by multiplying the values obtained with 6.25. Data generated from the experimental plots were analyzed using SAS 9.3 version of the statistical package (SAS Institute Inc, 2011). Analysis of variance (ANOVA) was performed using PROC ANOVA. Means were separated using Fisher's least significant difference (LSD) test at a probability level of p d" 0.05.

RESULTS AND DISCUSSION

Influence of organic manures and fertilizers on cabbage

Cabbage yield was significantly higher with chemical fertilizers and organic manures compared to the Control (Table 2). Highest yield (38.9t ha^{-1}) was recorded with application of recommended dose of fertilizers and was comparable with application of poultry manure + *neem* cake (37.9t ha^{-1}). This could be due to rapid availability and utilization of nitrogen for various internal processes in the plant in these treatments. Among the manure combinations, poultry manure and *neem* cake recorded highest yield. Similar results were obtained with application of different levels of decomposed poultry manure (DPM) in cabbage by Ijoyah and Sophie (2009).

Quality parameters studied in cabbage were significantly influenced by organic manures rather than chemical fertilizers or in the Control. However, higher protein (18.17%) and ascorbic acid (35.44mg $100g^{-1}$) content was recorded with application of poultry manure + *neem* cake, and, farm yard manure + poultry manure, respectively. Similarly, ascorbic acid content in cabbage heads was shown to be significantly influenced by application of organic manures by Mahendran and Kumar (1997). Absolute Control recorded lowest protein (16.1%) and ascorbic acid (31.42mg $100g^{-1}$) content. Rai *et al* (2008) and Zango *et al* (2009) also reported earlier that application of FYM at 20t ha^{-1} to cabbage increased its biochemical constituents (Vitamin C or ascorbic acid) over application of Recommended Dose of Fertilizer. Application of organic manures may have helped improve physico-chemical properties of the soil, imparting favourable soil structure for root growth and soil enzymes (the latter continue to break down organic matter in the soil to release nutrients and make them available near the rhizosphere for absorption by plant roots, thereby improving fruit quality) (Chaoui *et al*, 2003).

It can be observed from Table 2 that organic manures and chemical fertilizers significantly influence uptake of all major nutrients in cabbage at maturity. Higher uptake of N (44.08kg ha^{-1}), P (12.38kg ha^{-1}) and K (39.96kg ha^{-1}) were recorded with recommended dose of fertilizers. Among the organic manures, poultry manure + *neem* cake, and, farm

Table 2. Influence of organic manures and fertilizers on nutrient uptake, quality and yield in cabbage during *rabi* 2010

Treatment	Nutrient uptake (kg ha^{-1})			Fruit quality		Yield(t ha^{-1})
	N	P	K	Protein (%)	Ascorbic acid (mg $100g^{-1}$)	
Control	14.7	3.2	15.3	16.1	31.4	18.7
Recommended Dose of Fertilizer (RDF)	44.0	12.3	39.9	16.5	32.3	38.9
Farm yard manure	30.8	9.1	32.1	17.1	34.1	34.3
Vermicompost	26.7	6.4	31.4	17.2	34.3	27.1
Poultry manure	36.0	10.0	32.4	17.2	34.6	32.9
Neem cake	30.6	7.6	32.9	17.3	34.4	30.3
Farm yard manure + Vermicompost	26.2	8.2	31.6	17.7	35.2	31.9
Farm yard manure + Poultry manure	38.8	11.8	35.1	18.0	35.4	35.2
Farm yard manure + *Neem* cake	33.3	7.8	33.9	17.8	35.1	32.9
Vermicompost + Poultry manure	30.3	9.5	28.7	17.8	34.6	29.1
Vermicompost + *Neem* cake	28.2	6.4	28.0	17.8	34.0	29.0
Poultry manure + *Neem* cake	37.2	10.5	36.1	18.1	34.8	37.9
Mean	31.4	8.6	31.4	17.4	34.3	31.5
S.E m±	2.23	0.64	1.65	0.08	0.10	1.56
CD *(P ≤ 0.05)*	6.53	1.86	4.85	0.22	0.28	4.56

yard manure + poultry manure as combinations showed superior N, P and K uptake over other combinations and were statistically at par. Application of organic sources may have enhanced availablility of macro and micro nutrients in the soil significantly, consequently improving the uptake of nutrients. Vimala *et al* (2006) reported application of organic manures to have significant effects on N, P and K content of the cabbage crop. Significantly lower N, P and K uptake by cabbage was recorded in the Control.

Cumulative and residual effect of organic manures and fertilizers on baby corn

Yield of baby corn significantly increased with application of organic manures and chemical fertilizers, over the Control (Table 4). Significantly high yield (6.12t ha^{-1}) was obtained with recommended dose of fertilizers applied both to cabbage and baby corn. Treatments T8, T9 and T12 were at par with RDF. Similar results were also reported by Amakinde and Ayoola (2009). Residual effect of the organic manures and chemical fertilizers, applied to cabbage to study yield, fruit quality and nutrient uptake on the following baby corn cultivation is shown in Tables 3 and 4. Yield of baby corn markedly increased owing to residual effect of the organic manures applied to the preceding cabbage crop, than in the recommended NPK fertilizer and absolute Control. The residual effect of poultry manure + *neem* cake applied to the preceding cabbage crop gave the highest yield in baby corn (4.71t ha^{-1}), which was comparable with farm yard manure + *neem* cake (4.57t ha^{-1}). The superiority of residual effect of poultry manure + *neem* cake, and, farm yard manure + *neem* cake can be attributed to slow decomposition of these manures, which probably

Table 3. Cumulative and residual effects of organic manures and fertilizers on nutrient uptake (kg ha^{-1}) in baby corn during *kharif* 2011

Treatment	Nitrogen (kg ha^{-1})		Phosphorus (kg ha^{-1})		Potassium (kg ha^{-1})	
	Cumulative	Residual	Cumulative	Residual	Cumulative	Residual
Control	64.8	63.6	5.1	5.2	49.8	44.7
Recommended Dose of Fertilizer (RDF)	221.0	66.0	15.3	7.9	106.4	55.3
Farm yard manure	131.6	94.3	14.3	13.8	88.0	69.8
Vermicompost	111.2	77.4	10.3	6.9	86.7	68.8
Poultry manure	142.2	114.8	16.1	15.1	100.4	81.1
Neem cake	138.1	122.5	14.1	13.9	91.8	83.8
Farm yard manure + Vermicompost	114.8	92.2	19.3	11.8	93.3	72.3
Farm yard manure + Poultry manure	183.8	144.9	22.0	17.3	103.8	87.9
Farm yard manure + *Neem* cake	183.6	146.6	17.9	13.5	101.8	93.6
Vermicompost + Poultry manure	126.7	100.3	18.9	16.4	97.9	64.2
Vermicompost + *Neem* cake	125.6	103.8	15.7	12.6	90.4	73.2
Poultry manure + *Neem* cake	187.1	153.0	18.3	16.3	104.9	94.4
Mean	144.2	106.6	15.6	12.5	92.9	74.1
S.E m±	4.59	5.87	1.18	1.30	3.97	4.36
LSD (*P ≤0.05*)	13.5	17.2	3.46	3.81	11.6	12.8

Table 4. Cumulative and residual effects of organic manures and fertilizers on fruit quality and yield in baby corn during *kharif* 2011

Treatment	Protein content (%)		Ascorbic acid (mg 100g^{-1})		Yield (t ha^{-1})	
	Cumulative	Residual	Cumulative	Residual	Cumulative	Residual
Control	11.3	11.3	12.1	11.9	2.65	2.53
Recommended Dose of Fertilizer (RDF)	11.8	11.4	12.2	11.9	6.12	2.62
Farm yard manure	14.2	12.2	13.3	12.0	4.84	3.26
Vermicompost	14.2	11.8	13.1	11.9	4.16	2.80
Poultry manure	14.3	12.3	13.4	12.2	5.14	3.83
Neem cake	14.3	12.4	13.3	12.2	4.26	3.91
Farm yard manure + Vermicompost	15.3	12.8	13.8	12.3	4.78	3.28
Farm yard manure + Poultry manure	15.6	12.9	14.0	12.4	5.51	4.22
Farm yard manure + *Neem* cake	14.9	13.1	13.9	12.4	5.94	4.57
Vermicompost + Poultry manure	15.0	12.0	13.7	12.3	5.19	3.57
Vermicompost + *Neem* cake	14.9	12.1	13.7	12.3	4.73	3.06
Poultry manure + *Neem* cake	15.6	13.6	14.0	12.7	5.80	4.71
Mean	14.3	12.3	13.4	12.2	4.92	3.53
S.E m±	0.18	0.13	0.17	0.12	0.29	0.27
CD *(P ≤ 0.05)*	0.52	0.37	0.48	0.36	0.85	0.80

Table 5. Economics of cabbage –baby corn cropping sequence

Treatment	Quantity of manure applied (t ha^{-1})	Cabbage (Regular + Residual)2010			Cabbage–baby corn (2010-2011)		
		Total cost of cultivation (Rs)	Net returns (Rs)	B:C ratio	Total cost of cultivation (Rs)	Net returns (Rs)	B:C ratio
Control	-	111175	113985	1.02	111175	116825	1.05
Recommended dose of fertilizer (RDF)	-	115108	274612	2.38	119041	354779	2.98
Farm yard manure	9.34	129867	240993	1.85	148557	253303	1.70
Vermicompost	8.92	146887	153693	1.04	182601	144699	0.79
Poultry manure	2.88	122703	250737	2.04	134223	264197	1.96
Neem cake	2.91	143240	212080	1.48	175305	180755	1.03
Farm yard manure + Vermicompost	9.13	138377	214503	1.55	165579	215501	1.30
Farm yard manure + Poultry manure	6.11	126285	274815	2.17	141390	285890	2.02
Farm yard manure + *Neem* cake	6.12	136548	253772	1.85	161925	259345	1.60
Vermicompost + Poultry manure	5.90	134795	199715	1.48	158412	210928	1.33
Vermicompost + *Neem* cake	5.92	145058	177322	1.22	178947	179693	1.00
Poultry manure + *Neem* cake	2.89	132966	302354	2.27	154758	303222	1.95

released nutrients more slowly compared to other organic materials or chemical fertilizers (Kavitha *et al*, 2010). The beneficial residual effect of organic manures on yield could be due also to enhanced supply of nutrients during the entire growing season of baby corn.

Significant difference was observed in protein and ascorbic acid content in baby corn by application of chemical fertilizers and organic manures. Among these, a combination of poultry manure + *neem* cake, applied both to cabbage and baby corn, recorded higher protein (15.68%) and ascorbic acid (14.08mg 100g^{-1}) content over other manure combinations or fertilizers. Application of organic manures at regular intervals has been shown to have a capacity to improve protein content of baby corn crop (Mithun Saha and Mondal, 2006). Similar results were observed for protein and ascorbic acid content in baby corn influenced by manures and fertilizers applied to the previous cabbage crop (Kumar *et al*, 2008). Padamwar and Dakore (2010) reported that application of organic manures viz., vermicompost, farm yard manure and biofertilizers improved protein and Vitamin C content of cole crops. Most organic manure combinations improved the quality of both cabbage and baby corn (Zango *et al*, 2009). Manure-treated plots showed higher residual recovery than fertilizer-treated plots, in both the seasons. Similarly, Kavitha *et al* (2010) studied direct and residual effect of organic manures on cabbage and reported organic manures to significantly increase yield and quality of the edible parts (ascorbic acid and protein content, TSS of cabbage) compared to the Control.

Influence of cumulative and residual effect of organic manures and chemical fertilizers on nutrient uptake by baby corn is presented in Table 3. N, P and K uptake in baby corn sown after cabbage significantly varied with application of organic manures, either alone or in combination, and chemical fertilizers over the Control. The higher N and K uptake of baby corn was achieved by applying fertilizers to both cabbage and baby corn, and was at par with combined application of poultry manure and *neem* cake. This may have been due to a higher and rapid release by fertilizers of the required nutrients (Deshpande *et al*, 2007). Application of recommended dose of fertilizers significantly increased plant growth, uptake of N, P and K, and yield in maize (Upperi *et al*, 2011; Sunil Kumar and Dhar Rai, 2005). However, higher P uptake in baby corn was accomplished with cumulative application of farm yard manure + poultry manure, to both cabbage and baby corn, over the recommended dose of fertilizers and Control. Higher P uptake may also be attributed to a possible increase in P supply and its reduced fixation in soil. The solubilization action of organic acids produced during degradation of organic materials perhaps caused better release of native and applied P available to the crop. It propounded that organic manures can not only enhance P uptake, but also increase uptake of other nutrients (Vimala *et al*, 2006). Among manure combinations, poultry manure + *neem* cake and FYM + poultry manure improved nutrient uptake in baby corn.

Significant residual effect of organic manures and chemical fertilizers applied to the preceding cabbage crop was observed on N, P and K uptake in baby corn. Organic manure treatments increased N, P and K uptake in baby corn more than did fertilizers, or that observed in the Control. Among various manure combinations, poultry manure + *neem* cake recorded higher N and K uptake and this was on par with farm-yard manure and *neem* cake combination. Higher P uptake was seen with application of farm-yard

manure + poultry manure. Lower N, P and K uptake was recorded with the recommended dose of fertilizers and its Control. Application of poultry manure (PM) and its combination resulted in higher residual effect on soil chemical composition and increased plant dry matter, yield, nutrient uptake and grain yield in maize significantly (Adeniyan and Ojeniyi, 2003). Recovery of residual nutrients was greater with *neem* cake and poultry manure combinations. Generally, most of the organic manure treated plots gave better results over the Control. Similarly, Sangeeta Mohanty and Lenka (2007) reported significant increase in residual effect of the organic manures on a subsequent crop than did inorganic fertilizers. Residual effect of organic manures was also shown to be evident in available major and micronutrients in the soil (Thind *et al*, 2002).

Economics

Pooled data in cabbage and residual effect on baby corn with reference to economics is illustrated in Table 5. Recommended dose of fertilizers recorded higher net returns (Rs. 2,74,612) and benefit:cost ratio (2.38). Other manure combinations like T8 and T12 were at par with RDF. Lowest B:C ratio was obtained in Absolute Control (1.02). When the cost of cultivation of both seasons'. Cabbage-baby corn sequence was analyzes, highest B:C ratio was obtained in RDF (T2) (2.98), followed by FYM + poultry manure (T8) (2.02), and, poultry manure (T5) (1.96). Lowest B:C ratio was obtained with vermicompost (T4) (0.79).

Thus, the highest yields and net returns were obtained with fertilizer treatment. Organic manure treatment combinations like *neem* cake, poultry manure and FYM also gave good net returns and B:C ratio, but there were slightly lower compared to the fertilizer treatment. In all, manures performed better than the Control. Similarly, field experiments of Hochmuth *et al* (1993) on cabbage showed marketable yield to increase with use of recommended dose of fertilizers and poultry manure. Beneficial effects of fertilizer treatment due to better availability of nutrients to plants and their uptake was fastest with fertilizer application in the early stages, and from organic sources at later stages. This strategy possibly prolongs the period of nutrient availability to the plant.

From the present investigation, it can be concluded that application of recommended dose of fertilizers records higher yield and nutrient uptake in cabbage and baby corn, a value at par with application of poultry manure + *neem* cake (T_{12}) and farm yard manure and poultry manure (T_8). Quality parameters in both crops improved with application of organic manures rather than with fertilizers. The residual effect of manures, viz, poultry manure, farm yard manure and *neem* cake was favourable and resulted in better growth in baby corn. Application of fertilizer may be good in the short-term for getting maximum yield and net income to the farmers; but, in the long run, to ensure sustainable crop production with good fruit quality, soil quality, health and economics, a combination of poultry manure with cake (T_{12}) and farm yard manure (T_8), is found to be better in the cabbage-baby corn cropping sequence.

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