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Site Specific Nutrient Application on Yield, Quality and Post Harvest Life of Cauliflower (*Brassica oleracea* L.)

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ABSTRACT. *A balanced nutrient application was used to measure the yield, quality and post harvest life of cauliflower. Soils collected from two experimental sites at Dodangolla and Pelwehera were analysed for available nutrients and a balanced nutrient treatment was formulated. Field experiments were conducted for 4 consecutive seasons comparing the balanced nutrient treatment with other treatments including the Department of Agriculture (DOA) recommendation, and different combination of N, P, K, secondary and micronutrients using a Randomized Complete Block Design. Soil analysis indicated deficient levels of N, P, K in both locations, and Ca, S, B, Mn, only at Dodangolla. Cultural practices and crop protection were done according to the recommendations of the DOA. During the vegetative stage, plant height at one week after transplanting and 50% flowering, number of leaves at 50% flowering, Leaf Area Index at 50% flowering, number of days to flowering, time period for curd maturity were measured and recorded for each treatment. The average cauliflower curd yield in the field varied between 130 -254 g/ plant (5.19 - 10.16 t/ha). Plants grown with the balanced nutrient treatment gave the highest dry matter curd yield while the minus treatments of N, P, and K gave significantly lower curd yields, confirming the deficiencies predicted by soil testing. The superiority of the balanced nutrient treatment over other fertilizer combinations in obtaining higher curd yields was also confirmed.*

No significant difference was observed among the treatments in any of the curd quality parameters measured. Although, no significant difference were observed between the four storage conditions, curds of the low nitrogen fertiliser treatment stored at different storage conditions started to decay later than the other treatments.

Benefit cost ratio analysis confirmed that the balanced nutrient fertiliser treatment is more profitable as it gave the highest gross return above fertilizer cost (GRF) than the DOA or any other fertiliser treatment.

INTRODUCTION

In Sri Lanka, Cauliflower (*Brassica oleracea* L.) has been recognized as an up country vegetable. Presently, Sri Lanka imports 21 tons of cauliflower which is valued at Rs.

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2,692,000 (DOA 2007), because of the demand for cauliflower as it is nutritious and an important dietary component in many tropical countries. Inadequate and unbalanced supply of mineral nutrients may be a reason for the lower yields of vegetables in Sri Lanka. Brar and Arora (1997) reported that microelements could increase the yield in Cauliflower and Wenqiang *et al.* (2004) found that balanced fertilization increases cauliflower yields and marketability.

Several researchers have investigated the availability and behaviour of micronutrients and alleviation of micronutrient deficiencies and toxicities in soils (Deb, 1992; Kumaragamage and Indraratne, 2002). Kumaragamage and Indraratne (2002) tested 25 soils from different Agro-ecological regions in Sri Lanka and found widespread deficiencies of macro, secondary and micronutrients in most of the soils. Tisdale *et al*. (1985) reported that micronutrients play a major role in determining the yield and quality of vegetable crops. In Sri Lanka the deficiencies of micronutrients in soil may be another reason for lower yields in vegetable crops (Deb, 1992). Nutrient imbalance in soil produces low fertiliser use efficiency (Bandara and Silva, 2000) and reduced farmer profit (Fairhurst and Doberman, 2002). When a nutrient content of soil is reduced to a limiting level, yield falls dramatically even when large amounts of other nutrients are applied (Bandara and Silva, 2000).

Nitrogen is an essential plant nutrient that is involved in physiological processes and enzyme activities. Farmers use urea excessively, to enhance flowering, curd set and increase curd size in cauliflower. Cauliflower is perishable and tissue deterioration occurs during cold storage. High nitrogen contents with deficits of other nutrients could reduce the storage life of cauliflower (Kirthisinghe, 2006). Therefore, the present study was carried out to determine the effect of balanced nutrient supply at pre harvest stage on yield, quality and post harvest life of cauliflower variety 'Fuji' and an economic analysis was done by calculating Benefit Cost Ratio (BCR) for each treatment.

MATERIALS AND METHODS

The Field experiments were conducted at Pelwehera and Dodangolla for 4 consecutive seasons from Maha 2003 to Yala 2005 using cauliflower (*B. oleracea*) variety 'Fuji'. The experimental design was a Randomised Complete Block Design (RCBD) with nine treatments at CIC farm, Pelwehera in the Low country Dry zone where only N, P and K were deficient according to the soil analysis (Table 1), and ten treatments at University Experimental Station, Dodangolla in Mid country Intermediate zone where, N, P, K, Ca, S, B, Mn were found deficient in the soil analysis (Table 2). Four replicates were used in both locations.

Plots of 3 x 2 m were used with perimeter bunds. In addition to perimeter 30 cm bunds, 25 cm deep and 25 cm wide trenches were made around the beds to minimize border effects and to prevent contamination from adjoining beds. The experimental layout was repeated for four seasons in two consecutive years, without mixing soil among treatments.

Field experiments at both sites had a balanced nutrient (optimum) treatment identified as "Treatment 1" with optimum levels of all the nutrients based on soil analysis and fixation studies (Kirthisinghe, 2006). Plant nutrients, which were deficient in soil, were included when formulating the optimum fertilizer treatment. In addition, six other treatments with low or zero levels of N, P and K were included to test the effect of N, P and K. In addition, fertiliser recommendation of Department of Agriculture (DOA) for cauliflower was included in both sites (Treatment 8). A control treatment (Treatment 9) without fertiliser was included in both experimental sites (Tables 1 and 2).

Table 1. Treatment combinations for the field experiment at CIC seed farm, Pelwehera.

Treatment	Nutrients supplemented (kg/ha)		
	N	P	K
T1 Optimum	200	180	400
T2 Optimum with 50% N	100	180	400
T3 Optimum with 50% P	200	90	400
T4 Optimum with 0% P	200	0	400
T5 Optimum with 50% K	200	180	200
T6 Optimum with 0% K	200	180	0
T7 Optimum with 50% P,K	200	90	200
T8 DOA* recommendation	180	45	75
T9 Control	0	0	0

* Department of Agriculture

Table 2. Treatment combinations for the field experiment at University experimental farm, Dodangolla.

Treatment	Nutrients supplemented (kg/ha)						
	N	P	K	Ca	S	B	Mn
T1 Optimum	200	150	400	200	160	1	5
T2 Optimum with 50% N	100	150	400	200	160	1	5
T3 Optimum with 50% P	200	75	400	200	160	1	5
T4 Optimum with 0% P	200	0	400	200	160	1	5
T5 Optimum with 50% K	200	150	200	200	160	1	5
T6 Optimum with 0% K	200	150	0	200	160	1	5
T7 Optimum with 50% P,K	200	75	200	200	160	1	5
T8 DOA* recommendation	180	45	75	0	0	0	0
T9 Control	0	0	0	0	0	0	0
T10 Optimum–no Ca,S,B,Mn,	200	150	400	0	0	0	0

* Department of Agriculture

Urea, Triple Super Phosphate (TSP) and Muriate of Potash (MOP) were used to supply N, P and K, respectively. Calcium carbonate (lime) was used to supplement Ca. Sulphur was applied in the form of Sulphur dust, while B was applied as borax. Mn was supplemented as $MnSO_4$. Analytical grade chemicals were used for B and Mn as the requirement was in small amounts. These chemicals were applied in soluble form dissolved in water.

The land was ploughed and harrowed to a fine tilth without mixing the soil among treatments at both sites. Seedlings of cauliflower variety Fuji were transplanted in the field according to the DOA recommended spacing of 50 cm x 50 cm (DOA, 1990) at a planting density of 24 plants per plot (4 plants m^{-2}). Uniform seedlings were selected from the

nursery and were planted in the middle of the planting hole. After planting, the seedlings were covered with gliricidia leaves to reduce evapotranspiration to prevent drying.
All the DOA recommended cultural practices were adopted except organic manure application. Organic manure was not included although recommended, as most farmers in the dry and the intermediate zones do not apply manure due to unavailability. The other reason was to observe the effect of micro nutrients added as inorganic fertilisers. The plots were irrigated with water frequently except on rainy days to keep the soil moisture between 70-100% of field capacity during the entire growing period. Water was applied separately to each plot using a rubber hose and necessary precautions were taken to avoid mixing of water among treatments.

During the vegetative stage, plant characters viz. plant height (the highest point of the plant above the soil surface) at one week after transplanting and 50% flowering, number of leaves at 50% flowering, Leaf Area Index (LAI) at 50% flowering, number of days to flower, time period for curd maturity were recorded for each treatment. LAI was measured using a potable leaf area meter (model LICOR, LI 3000C).

Harvesting was done when the curd was mature at commercial maturity stage, (Cauliflower curd is well formed, firm and compact with a very close texture and white or cream in colour) which was the best harvesting stage to obtain the highest quality of the curd (Kirthisinghe, 2006). The curd weight of each plant was recorded soon after harvest. Fresh and dry weights of plant and curd yield, total yield per plot, market value measurements *viz*. average size (diameter) of the curd and diameter of the florets were recorded. Diameter of the curd was measured in a straight line from two direction of the curd, which passes through the centre of the curd, and the mean was taken. The firmness was measured using a hand held penetrometer (model Bishop, Fruit pressure tester FT011). The colour and compactness of the curd were assessed visually and the measurements were recorded using a visual quality rating (VQR) scale (Tables 3 and 4) which was developed for the present study according to the Sri Lankan market value for cauliflower curd.

Table 3. Visual quality rating (VQR) scale used to assess the colour of the curd in field trials

Score	Visual characters of the curd	Market grade
9	No visible lesions and the curd is pure white/cream	Extra class
7	Few lesions and the curd is pure white/cream	Class 1
5	No visible lesions and the curd is yellow	Class 2
3	Lesions and/or the curd is off colour	Class 3
1	Not edible	Off grade

Source: Kirthisinghe (2006)

Assessment of keeping quality of the curd was done by randomly selected eight curds from each of the fertiliser treatments stored separately. Among these eight curds,

1. Two curds were kept open and stored at the temperatures of 4±2 ºC in a refrigerator
2. Two curds were kept open and exposed to room temperature 28±2 ºC
3. Two curds were stored in 150 gauge low density polythene bags with a relative humidity of 93±3% and stored at the temperatures of 4±2 ºC in a refrigerator

4. Two curds were stored in 150 gauge low density polythene bags with a relative humidity of 93±3% and exposed to room temperature 28±2 ºC

The weight loss of curd during storage was measured. The storage life was measured as a quality parameter by counting the number of days to show the symptoms of rotting, decaying or the change in colour. Curds stored at 28±2 ºC in open environmental condition started to decay after 6 days. Therefore, the percentage of weight loss was measured at 3, 4, 5 and 6 days of storage.

Table 4. Rating scale used to assess the compactness of the curd in field trials

Score	Visual characters of the curd
9	Fully compacted
5	Loosely compacted
1	Riciness or elongation of the stems of the flower clusters

Source: Kirthisinghe (2006)

An economic analysis was done using the prices of fertiliser in Kandy, Sri Lanka on September 2006, the yield, and the wholesale price of a curd obtained from Manning market, Colombo, Sri Lanka in October 2006. Benefit Cost Ratio (BCR) or the profitability index for each treatment for each trial was calculated. Gross return above fertilizer cost (GFC) was calculated using the mean yield of four seasons at Pelwehera and Dodangolla. The mean yield to total fertilizer cost (YFC) ratio was calculated using the following equation (Wang *et al*., 2001) as an economic indicator.

$$\text{YFC} = \frac{\text{Mean yield of individual treatment}}{\text{Total fertilizer cost of individual treatment}}$$

The data were analysed with the Statistical Analytical Software (SAS, 1998) package using General Linear (GLM) and Log Linear Models. Analysis of Variance (ANOVA) with Duncan Multiple Range Test (DMRT) was conducted for normally distributed data. Data recorded using indices *viz*. the colour and compactness of the curd were analysed using Kruskal Wallis Test, the non-parametric test in MINITAB computer package (MINITAB, 1999).

RESULTS AND DISCUSSION

The average curd yield of cauliflower under Sri Lankan conditions is 6 t/ha (DOA, 1993). The average curd yield for the four seasons in Pelwehera and Dodangolla soils with the optimum treatment (Treatment 1) were 10.2 and 7.9 t/ha, respectively (Table 5).

Cauliflower requires a high amount of N, P and K to produce a profitable curd yield (Sparks, 1988). The lowest yields of 6.06 and 5.19 t/ha were recorded in no fertilizer (control) treatments at Pelwehera and Dodangolla soils, respectively. The optimum treatment (Treatment 1) in both locations gave the highest curd yield increments of 35-40% over the control treatment. The results indicate that inadequate supply of K has a more pronounced effect on the curd yield at both sites than inadequate supply of any other single nutrient, with the exception of nitrogen, which was not tested with a zero N treatment in this experiment. Wenqiang *et al*. (2004) reported that potassium (K) was the main yield-limiting factor for cauliflower. Sparks (1988) reported that potassium increases crop resistance to several diseases, support strong root and stem development, and help to tolerate lodging of plants. These findings were confirmed by the present study with a higher yield loss of 22% and 24% in the zero potassium treatment (Table 5) at Pelwehera and Dodangolla respectively, compared to nitrogen and phosphorous treatments.

Table 5. Mean curd yield (t/ha) and percentage of yield loss of cauliflower at Pelwehera and Dodangolla for different nutrient combinations

Treatments		Pelwehera		Dodangolla	
		Mean of 4 seasons	Yield loss (%)	Mean of 4 seasons	Yield loss (%)
T1	Optimum	10.16 ^{a}	0.0	7.99 ^{a}	0.0
T2	Optimum with 50 % N	8.62 ^{b}	15.2	6.73 ^{b}	15.8
T3	Optimum with 50 % P	9.39 ^{ab}	7.6	7.56 ^{ab}	5.4
T4	Optimum with 0 % P	8.59 ^{b}	15.5	6.47 ^{b}	19.0
T5	Optimum with 50 % K	8.34 ^{b}	17.9	7.04 ^{ab}	11.9
T6	Optimum with 0 % K	7.91 ^{bc}	22.1	6.04 ^{bc}	24.4
T7	Optimum with 50 % P,K	8.38 ^{b}	17.5	6.34 ^{b}	20.7
T8	DOA recommendation	7.41 ^{bc}	27.1	5.79 ^{bc}	27.5
T9	Control	6.06 ^{c}	40.4	5.19 ^{c}	35.0
T10	Opt without Ca,S,B,Mn,			6.00 ^{bc}	24.9

Means with same letters were not significantly different within each column ($p \leq 0.05$) using DNMRT

At Dodangolla, treatments with no secondary and micronutrients (Treatment 10) gave significantly lower yields ($p \leq 0.05$) than the optimum treatment (Treatment 1), indicating the importance of supplying secondary and micronutrients when deficient in soils. Wenqiang *et al*. (2004) have previously reported significantly higher cauliflower yields with proper levels of magnesium (Mg).

The yields with the DOA treatment were 7.41 and 5.79 t/ha with a lower yield of 27.1% and 27.5% compared to the optimum treatments at Pelwehera and Dodangolla, respectively. The reasons for the lower yields could be the low rates of N (approximately 90% of the optimum N level) with low P and K rates (25% and 18% of the respective optimum levels) of the DOA recommendation (Tables 1 and 2) and organic manure was not included even though recommended.

The mean curd yields at Pelwehera and Dodangolla soils with the optimum treatment (Treatment 1) were 10.2 and 8.0 t/ha respectively. The total curd weight varied among the treatments due to the growth pattern of the crop. Even though the same variety was grown at both experimental locations, the curd yields varied with the locations even with the same optimum fertiliser recommendation (Table 5). This may be due to the climatic and soil variations in the two experimental locations. No significant interaction was observed between the seasons and the fertilizer treatments.

Curd dry weight

Dry weight of the curd was taken as an indication of dry matter production in relation to fertilizer treatments. A significant difference was observed in dry weights among the fertiliser treatments (Table 6). The highest dry weight was obtained in the optimum treatment while the lowest was given by the control treatment in both locations.

Table 6. Mean dry weight (g) of cauliflower curd per plant in four consecutive seasons at CIC seed farm, Pelwehera and Dodangolla for different nutrient combinations

Treatments		Mean of 4 seasons (g)	
		Pelwehera	Dodangolla
T1	Optimum (Opt)	49.8 [a]	38.5 [a]
T2	Opt with 50% N	44.5 [b]	33.0 [b]
T3	Opt with 50% P	46.5 [ab]	36.5 [ab]
T4	Opt with 0% P	41.8 [bc]	31.8 [b]
T5	Opt with 50% K	41.0 [bc]	33.8 [ab]
T6	Opt with 0% K	39.3 [bc]	29.3 [bc]
T7	Opt with 50% P,K	45.8 [ab]	31.3 [b]
T8	DOA	36.8 [c]	29.3 [bc]
T9	Control	31.5 [d]	26.5 [c]
T10	No trace		29.8 [bc]

Means with same letters were not significantly different ($P \leq 0.05$)

The number and the percentage of market grade curds per treatment

There was no significant difference ($p \leq 0.05$) observed among the fertiliser treatments on number of marketable curds (class 2 and better) per plot or per treatment in both locations. Even though there were 24 plants in each plot in all seasons at both locations, some plants did not produce a marketable curd due to insect attack or diseases. Therefore, the mean number of marketable curds per plot ranged from 20 to 23.

Percentage of market grade based on the Visual Quality Rating (VQR) of curd colour did not show significant difference ($p \leq 0.05$) among different fertilizer treatments. Thus, curd colour appears to be more affected by environmental factors, than soil fertility status. At high temperatures (>25 ºC) curds may become discoloured (Tindall, 1983) and hot weather encourages the production of small hard curds (Wurr *et al*., 1993), which was observed with most curds at both sites.

Higher numbers of Class I and Class 2 market grade curds than the Extra class were obtained at both sites, due to unavoidable climatic variations such as rainfall and temperature, during the experimental period. As a result the percentage of market grade curd was low at Dodangolla site than at Pelwehera sites. However, in both experimental locations the optimum treatment (Treatment 1) had the highest marketable curd percentage.

Average diameter of the curd

The optimum fertiliser treatment gave a significantly higher ($p \leq 0.05$) mean curd diameter than most of the other treatments at both locations (Table 7). The mean curd diameter of the optimum treatment was 16.5 cm with a range of 12.4 – 21.3 cm, while the mean curd diameter in the control treatment was the lowest with 8.5 cm with a range of 6.1 - 15.2 cm.

Wenqiang *et al.* (2004) reported that potassium application increases curd weight and diameter, as observed in the present study. No significant difference was observed between treatment 1 and 50% K treatment (Treatment 5) on increase of curd diameter (Table 7), but a significant difference was observed between optimum (Treatment 1) and 0% K treatment (Treatment 6).

Table 7. Mean curd diameter at the experimental locations

Treatments		Mean Curd Diameter (cm)	
		Pelwehera	Dodangolla
T1	Optimum (Opt)	16.5 [a]	14.6 [a]
T2	Opt with 50% N	11.5 [bc]	11.6 [bc]
T3	Opt with 50% P	15.5 [ab]	14.5 [a]
T4	Opt with 0% P	13.5 [b]	14.2 [ab]
T5	Opt with 50% K	15.0 [ab]	14.5 [a]
T6	Opt with 0% K	13.5 [b]	14.0 [ab]
T7	Opt with 50% P,K	11.5 [bc]	11.5 [bc]
T8	DOA	12.3 [b]	12.5 [b]
T9	Control	8.5 [c]	7.7 [c]
T10	No trace		12.7 [b]

Means with same letters were not significantly different ($P \leq 0.05$)

The firmness and compactness of the curd

Firmness, which indicates the compactness of the curd, showed no significant differences ($p \leq 0.05$) among fertiliser treatments in the present field trials. All treatments in both locations showed a curd riciness ranging from 4-7% with loose compactness and with small flower buds on the surface.

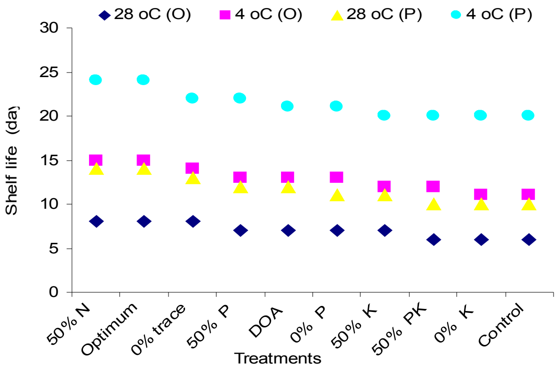
Shelf life of curd

No significant differences were observed ($p \leq 0.05$) among the experimental locations and also among the fertiliser treatments on the shelf life of cauliflower curd during storage under the same conditions, but significant differences were observed between different storage conditions. Curds from low nitrogen fertiliser treatment (Treatment 2) stored at low temperatures (4 ºC) and high relative humidity conditions (in polythene bags) had the highest storage life (Figure 1). The control treatment (Treatment 9) had the lowest storage life in all environmental conditions.

Curds from the low nitrogen fertiliser treatment (Treatment 2) stored at 4 ± 2 ºC in polythene bags with a relative humidity of 93 ± 3% started to decay after 24 days while the curds of the same treatment stored at 28 ± 2 ºC in polythene bags with a relative humidity of 93 ± 3% showed decaying after 14 days. Curds from the control treatment (Treatment 9) stored at 4 ± 2 ºC and at 28 ± 2 ºC with a relative humidity of 93 ± 3% in polythene bags started to decay after 20 and 10 days, respectively (Figure 1).

Curds from the low nitrogen fertiliser treatment (Treatment 2) stored at 4±2 ºC and at 28±2 ºC in open environmental condition started to decay after 15 and 8 days, respectively. Curds from the control treatment stored at 4±2 ºC and at 28±2 ºC in open environmental condition started to decay after 11 and 6 days respectively.

The results of the present study revealed that the curds stored at 4±2 ºC in polythene bags with a relative humidity of 93±3% had the highest storage life of 24 days, when compared among treatments (Figure 1). Curds stored at 4±2 ºC in polythene bags may decreased in respiration rate due to low oxygen levels and low temperature and gave the highest storage life compared to other environmental conditions. Even though there were no significant differences among the fertiliser treatments on the shelf life, the additional 4 days of storage life in the optimum treatment over control treatment confers a considerable economic advantage.



28 ºC (O) = 28 ºC in open — 4 ºC (O) = 4 ºC in open

28 ºC (P) = 28 ºC in polythene bags — 4 ºC (P) = 4 ºC in polythene bags

Figure 1. Storage life of Curds stored at 28 ºC and 4 ºC in open and in polythene bags.

Although it has been reported that with application of B, or Mg fertilizers, the storage time increased from 1-4 days with substantially reduced moisture loss (Kirthisinghe, 2006), the present study did not show this effect.

Weight loss of the curd during storage

A significant difference at 5% probability level on the weight loss was observed between curds kept under open conditions and curds kept in 150 gauge low density polythene bags, but no significant differences were observed among the fertiliser treatments on the weight loss of cauliflower curd during storage (Table 8). The effect of modified atmosphere packaging (MAP) on reducing weight loss may be due to the limitation of water vapour pressure inside the polythene packages.

Table 8. Percentage of weight loss of cauliflower curd at 6 days of storage

Treatments		Mean weight loss at 6 days of storage (%)			
		28 ºC in open	4 ºC in open	28 ºC in polythene bags	4 ºC in polythene bags
T1	Optimum (Opt)	14	12	6	6
T2	Opt with 50% N	13	11	6	6
T3	Opt with 50% P	14	12	8	6
T4	Opt with 0% P	11	10	6	6
T5	Opt with 50% K	10	9	7	6
T6	Opt with 0% K	12	12	6	6
T7	Opt with 50% P,K	12	10	7	5
T8	DOA	14	10	7	6
T9	Control	11	12	6	6
T10	No trace	14	12	6	6
	Mean	12.5	11.0	6.5	5.9
	Probability value	0.14	0.11	0.07	0.07

If, P>0.05, there is no significant difference between treatments

Significant differences at 5% probability level on the percentage of weight loss were observed among the days of storage (Table 9).

Table 9. Percentage of weight loss of cauliflower curd during storage for 6 days

Treatments	Mean weight loss (%)				
	3 days	4 days	5 days	6 days	Probability value
28 ºC in open	2.5	4.2	7.5	12.5	0.017
4 ºC in open	2.0	4.1	7.2	11.0	0.013
28 ºC in polythene bags	1.5	2.6	4.0	6.5	0.011
4 ºC in polythene bags	1.5	2.5	3.8	5.9	0.012

If, P>0.05, there is no significant difference between treatments

Benefit cost ratio

The highest total fertilizer cost (TFC) was recorded from the optimum treatment (Treatment 1) and the lowest TFC was from the control treatment (Treatment 9). The yield response to optimum treatment was high, compared to the other fertiliser treatments. Therefore, gross returns (mean yield) above fertilizer cost (GRF) too were high for the optimum fertiliser treatment (Table10).

Table10. Total fertilizer cost and gross return above fertilizer cost for each treatment at Pelwehera and Dodangolla.

Trt No	Pelwehera			Dodangolla		
	Total Income (Rs/ha)	**TFC** (Rs/ha)	**GRF** (Rs/ha)	**Total Income** (Rs/ha)	**TFC** (Rs/ha)	**GRF** (Rs/ha)
T1	1016400	113382	903018	799200	197109	602091
T2	862000	104686	757314	673200	188413	484787
T3	938800	98654	840146	756000	184836	571164
T4	858800	83927	774873	647200	172564	474636
T5	834000	98982	735018	704000	182709	521291
T6	791200	84582	706618	604000	168309	435691
T7	938400	84254	854146	634000	170436	463564
T8	741200	28416	712784	579200	28416	550784
T9	606400	0	606400	519200	0	519200
T10	0	0	0	600000	70737	529263

TFC = total fertilizer cost (Rs/ha)
GRF = gross return above fertilizer cost (Rs/ha)

CONCLUSIONS

The dry matter curd yields in treatments with deficient nutrient levels were lower when compared with the optimum treatment in the experiment. The average curd yield of the optimum treatment was higher in all seasons, in the field experiments at both locations. The optimum treatments in both locations gave the highest curd yield increment of 35-40% over the control treatment. Therefore, the results of field experiments indicate the importance of diagnosing nutrient problems in soils prior to cultivation and site-specific fertilizer management for cauliflower.

The results of this study confirm that the site-specific fertilizer recommendation is an effective and reliable method to evaluate soil fertility status and nutrient limiting factors to recommend fertilizers and to refine the presently used recommendations for cauliflower in Sri Lanka

No significant differences were observed among the treatments on number of marketable curds per plot, percentage of market grade curds based on the Visual Quality Rating (VQR), the firmness and compactness of the curd and the weight loss of the curd during storage. High nitrogen contents with a deficit of other nutrients may be a reason for shorter storage life of cauliflower.

Even though there was no significant differences between the storage conditions, the low nitrogen fertiliser treatment curds stored at different storage conditions started to decay later than the other treatments. Therefore further studies are needed before making conclusive statements about reducing the recommended nitrogen fertiliser to increase storage life.

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