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Evaluation of Site-Specific Fertilizer Recommendation for Cauliflower (*Brassica oleracea* L.) in two Locations in Sri Lanka

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ABSTRACT. *Inadequate and unbalanced supply of mineral nutrients may be one reason for the lower yields of vegetables in Sri Lanka. Site-specific fertilizer management is a modern approach that could increase the fertilizer use efficiency with minimum environmental impacts. This research was conducted to evaluate the potential of using a systematic approach of diagnosing soil nutrient problems in improving the present fertilizer recommendation for cauliflower. Soils collected from the two experimental sites at Dodangolla and Pelwehera, Sri Lanka were analysed for available nutrients using a three-step extraction method. Nutrient contents were compared with the established optimum values to identify deficiencies. Fixation studies conducted for P, K, Cu, Zn, Fe, Mn, S and B were used to adjust the amount of fertilizer to be supplemented. An optimum fertilizer recommendation formulated for each soil was tested in the greenhouse using a modified missing element technique using sorghum (Sorghum vulgare Pers), and in the field using cauliflower (Brassica oleracea L.) as the test crop. Field experiments were conducted for four consecutive seasons comparing the optimum treatment with other treatments including the Department of Agriculture (DOA) recommendation, and treatments with 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, Mo at Dodangolla. The optimum treatment gave the highest dry matter yield in the greenhouse while the minus treatments of N, P, and K gave significantly lower yields, confirming the deficiencies predicted by soil testing. The average cauliflower curd yield in the field varied between 129.8 - 263.7 g/plant (5.19 - 10.55 mt/ha) with the optimum treatment, which was significantly higher than the other corresponding fertilizer treatments. The results of field experiments with cauliflower at both Pelwehera and Dodangolla, for four consecutive seasons indicated the superiority of the optimum treatment over other fertilizer combinations in obtaining higher yields. Benefit cost ratio analysis confirmed that the optimum fertiliser treatment is more profitable as it gave the highest gross return above fertilizer cost (GRF) than the DOA or any other fertiliser treatment.*

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INTRODUCTION

Site-specific fertilizer management is a modern approach used with the intention of increasing the fertilizer use efficiency, maximizing profitability, and minimizing negative environmental impacts. The commonly used general fertilizer recommendations for vegetable crops in Sri Lanka are based on crop response experiments, and are often limited to the supply of N, P, and K. The soil-test based fertilizer recommendation introduced by the Department of Agriculture (DOA) does not include secondary and micronutrients.

Several researchers have investigated the availability and behaviour of micronutrients and alleviation of micronutrient deficiencies and toxicities in soils (Kumaragamage and Indraratne, 2002; Deb, 1992). Kumaragamage and Indraratne (2002) have 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. Deficiencies of micronutrients in soil may be another reason for lower crop yield (Deb, 1992). Nutrient imbalance in soil produces low fertiliser use efficiency (Bandara and Silva, 2000), reduced farmer profit (Fairhurst and Doberman, 2002) and further depletion of nutrients in the soil. When a nutrient content of soil is reduced to a limiting level, yield falls dramatically even when large amounts of other nutrients are applied (Anon, 2000).

Site-specific fertilizer application involves identification of nutrient problems by soil analysis and formulating a fertilizer recommendation based on this analysis. A systematic procedure of formulating site-specific fertilizer recommendation based on laboratory analysis combined with sorption studies are used in many countries including Asian countries such as China and India (Wu and Liu, 2002). In this approach, fertilisers are recommended based on available N, P, K, S, Ca, Mg and micronutrients and sorption capacity of nutrients in the soil. Such a technique will immensely benefit the present fertiliser recommendation program, and will help in increasing the yields of vegetable crops.

In the above context, the objectives of the present study were to formulate and test a site-specific fertilizer recommendation for cauliflower (hybrid variety ‘Fuji’) in two experimental sites and to determine the cost effectiveness of new fertiliser formula.

MATERIALS AND METHODS

Soil analysis

The experimental sites were located in the Dry zone at Pelwehera (Reddish Brown Earth; Alfisols) and in the Intermediate zone at Dodangolla (Immature Brown Loams; Inceptisol), in Sri Lanka. Soils were analysed for texture, pH, cation exchange capacity (CEC), organic matter content, electrical conductivity and active acidity. Particle size was determined using the pipette method (Green, 1981). Soil pH was measured using a glass electrode/pH meter in a 1:2.5 soil: deionised water suspension. Cation exchange capacity was measured using NH_4OAc buffered at pH 7.0 (Rhoades, 1982). Soil organic matter content was determined using Walkley and Black method (Hatfield, 1984). Electrical conductivity was measured in a 1:5 soil water suspension (Rhoades, 1996). Active acidity was determined by titrating 1 M KCl extract of soil (1:10 soil: extractant) with 0.1M NaOH using phenolphthalein as the indicator.

Determination of available nutrients

Available nutrient contents in soils were analysed using a three-step extraction method; extracting with ASI solution (0.25 M $NaHCO_3$+ 0.01 M EDTA+0.01 M NH_4F) for P, K, Cu, Fe, Mn and Zn, extracting with 1 M KCl for Ca, Mg and Na, and extracting with 0.08 M $CaH_2(H_2PO_4)_2.H_2O$ for B and S contents (Portch and Hunter, 2002).

The extractable K, Cu, Fe, Mn, Zn, Ca and Mg were determined with an atomic absorption spectrophotometer (Buck Scientific Model 210 VGP). The extractable phosphorus (P) was determined by the molybdenum blue method (Murphy and Riley, 1962) and measuring the absorbance using a UV visible spectrophotometer at 882 nm wavelength. Sulphur in the extract was determined by a turbidimetric method and Boron (B) was determined by colorimetric method at 555 nm after treating with curcumin using a spectrophotometer (Portch and Hunter, 2002). Molybdenum (Mo) in soils was not analyzed even though it is an essential plant nutrient, since a method of analysis providing sufficient confidence in predicting its status had not been reported (Portch and Hunter, 2002). Since availability of Mo is pH dependent, Mo was supplemented when the soil pH is less than 6.5. CEC values in both soils were greater than 5 cmol/kg. Nutrient contents of both soils were compared with the optimum values established by Portch and Hunter (2002) to identify deficiencies (Table 2).

Fixation study

Fixation studies were conducted for P, K, Cu, Zn, Fe, Mn, S and B to determine the fixation capacity of the soil for these nutrients. Six concentration levels of each nutrient were used with two replicates. Nutrient solutions were added to the soils and incubated for 72 hours. Soils were extracted using the same extractants to determine the available status of these nutrients. The amounts of nutrients to be applied to the soil were calculated using the curves generated by plotting the amount of nutrient extracted against the nutrient added to the soil.

Greenhouse experiment

An optimum fertilizer recommendation was formulated for each soil and was tested in the greenhouse using a modified missing element technique (Portch and Hunter, 2002) using Sorghum as the indicator plant for nutrient deficiencies and because of its rapid germination and vegetative growth.

The greenhouse experiment was conducted using 14 treatments including an optimum and 13 individual treatments for each nutrient and lime. Optimum treatment had all nutrients at optimum level, with all deficient nutrients supplemented at the rates calculated based on soil analysis and fixation data while the individual treatments were either plus or minus treatments. When a nutrient is deficient, it was added to the optimum, but not to the treatment evaluating its status (minus treatments), which was used to examine the effect of not supplying the nutrient on plant growth when all other nutrients are supplied at the same rates as the optimum treatment. When a nutrient was sufficient, is was not added to the optimum, but added only to the treatment evaluating its status (plus treatments), to examine the effect of supplying the particular nutrient on plant growth even though soil analysis indicated supplementing is not required (Portch and Hunter, 2002). Accordingly, the treatments in this study for Pelwehera soil were optimum (OPT), minus treatments (-

treatment) each for N, P, K, Mo (-N, -P, -K,-Mo), plus treatments (+ treatment) for lime, Ca, Mg, S, Fe Zn, Mn, Cu and B (+$CaCO_3$, +Ca, +Mg, +S, +Fe, +Zn, +Mn, + Cu, +B) with four replications. Treatments for Dodangolla soil were optimum (OPT), -treatments each for N, P, K, Ca, S, B, Mn and Mo (-N, -P, -K,-Ca, -S, -Mn, -Mo), and +treatments for lime, Mg, Fe Zn, Cu and B (+$CaCO_3$, +Mg, +Fe, +Zn, + Cu, +B).

A capillary irrigation system was practiced throughout the growth period. Six weeks after planting, plants in each pot were cut at the ground level and oven dried at 60ºC to a constant dry weight. Relative dry matter yield percentage of each treatment was calculated by the following formula;

$$\text{Relative dry matter yield} = \frac{\text{Mean dry matter yield of individual treatment}}{\text{Mean dry matter yield of optimum treatment}} \times 100$$

Field experiments

An optimum fertilizer recommendation formulated for each soil was tested in the field using cauliflower (*B. oleracea*) as the test crop and because of an expensive vegetable in Sri Lanka. The field experiments were conducted in both locations for four consecutive seasons from *Maha* 2003 to *Yala* 2005. The experimental design was a Randomised Complete Block Design (RCBD) with nine treatments at Pelwehera and ten treatments at Dodangolla (Table 1) with four replicates. 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 between adjoining beds. Same experimental layout was repeated for four seasons in two consecutive years, without mixing soil among treatments.

The DOA recommended cultural practices were adopted. Organic manure was not included even though recommended, as most farmers in the dry zone and the intermediate zones do not apply manure due to unavailability. The plots were irrigated with water frequently to keep the soil moisture between 70 - 100% at field capacity during the entire growing period except on rainy days. Weeding was done once a week manually. Earthing up was done ten days after transplanting to keep the plants vertical and was continued when it is necessary up to the flower initiation stage. Blanching was done after the curd was initiated by covering the curd, using the outer leaves. Pest and disease attacks were monitored and recorded by visual observation. Light traps were fixed to control plant hopper attacks only at Dodangolla experimental location. Harvesting was done when the cauliflower curd is well formed, firm and compact with a very close texture and white or cream in colour. An economic analysis was done using the prices of fertiliser in Kandy, Sri Lanka on September 2006 and the yield and the price of a curd obtained from Manning market, Colombo, Sri Lanka on October 2006.

Statistical analysis

Data were statistically analyzed using analysis of variance (ANOVA) with Duncan multiple range test (DMRT) with the Statistical Analytical Software (SAS, 1998) package using General Liner Model (GLM). The fertiliser treatment means were compared by DMRT at $p = 0.05$.

Table 1. **Treatment combinations for the field experiment at CIC seed farm, Pelwehera and University experimental farm, Dodangolla.**

Treatment No	Nutrients supplemented (kg/ ha)												
	Pelwehera					Dodangolla							
	N	**P**	**K**	**Mg**	**Mo**	**N**	**P**	**K**	**Ca**	**S**	**B**	**Mn**	**Mo**
T1 Optimum	200	180	400	0	2	200	150	400	200	160	1	5	2
T2 Optimum with 50% N	100	180	400	0	2	100	150	400	200	160	1	5	2
T3 Optimum with 50% P	200	90	400	0	2	200	75	400	200	160	1	5	2
T4 Optimum with 0% P	200	0	400	0	2	200	0	400	200	160	1	5	2
T5 Optimum with 50% K	200	180	200	0	2	200	150	200	200	160	1	5	2
T6 Optimum with 0% K	200	180	0	0	2	200	150	0	200	160	1	5	2
T7 Optimum with 50% P,K	200	90	200	0	2	200	75	200	200	160	1	5	2
T8 DOA recommendation*	180	45	75	0	0	180	45	75	0	0	0	0	0
T9 Control	0	0	0	0	0	0	0	0	0	0	0	0	0
T10 Optimum–no Ca,S,B,Mn,Mo						200	150	400	0	0	0	0	0

Note: Department of Agriculture recommendation for cauliflower.

RESULTS AND DISCUSSION

Soil analysis and fixation data

Soils from both Pelwehera and Dodangolla sites were acidic in reaction with pH values of 5.7 and 6.3, and active acidities of 0.1 and 0.3, respectively. Pelwehera and Dodangolla soils had organic matter content of 1.20% and 1.55% and cation exchange capacity values of 8 and 12 of cmol/kg respectively. Both soils were of sandy clay loam textural class.

Table 2. Available nutrient contents in the soil, their optimum levels and the status at experimental locations.

Nutrient	Optimum level* mg/kg	Pelwehera		Dodangolla	
		Amount mg/kg	Status**	Amount mg/kg	Status**
Ca	1202	1232	S	1191	D
Mg	304	425	S	345	S
K	196	162	D	98	D
Ca/Mg	4	3	D	3.5	D
Mg/K	1.5	3.5	S	3.5	S
P	48	28	D	20	D
S	40	46	S	30	D
B	0.8	1	S	0.5	D
Cu	3	3.6	S	3.4	S
Fe	30	114	S	98	S
Zn	4	14	S	6	S
Mn	12	48	S	9	D
Mo	2	1.4	D	1.8	D

Note: * Source: Portch and Hunter (2002), ** S: sufficient; D: deficient.

The initial soil analysis indicated deficient levels of P and K in both locations and deficient levels of Ca, S, B, Mn, Mo at Dodangolla site (Table 2). Available P content in experimental locations ranged between 20 - 28 mg/kg (Table 2) and was less than the optimum value of 48 mg/kg. Amount of available K in the soils were 162 and 98 mg/kg in Pelwehera and Dodangolla soils, respectively, and were in the deficient range compared to the optimum level (Table 2).

The optimum recommendation formulated for each soil consisted of the deficient nutrients at rates adjusted based on the fixation capacities for nutrients. The fixation curves were used to calculate the amount of P that should be added to 1 kg of soil to increase the P level to the optimum level of 48 mg/kg. Accordingly, to supply P to increase the extractable P level to 48 mg of P/kg, 90.1 and 75.0 mg of P has to be added/kg of soil for Pelwehera and Dodangolla soils, respectively. To increase the K levels to reach the optimum level of 196 mg/kg 202 and 198 mg of K needs to be added/kg of soil for Pelwehera and Dodangolla, respectively. The results indicate high K fixation in both soils. In Dodangolla soil, to increase the S levels to reach the optimum level of 40 mg/kg, 80 mg of S has to be added/kg of soil, while to increase the B and Mn levels to reach the optimum levels, the respective amounts of B and Mn needed were 0.5 and 2.5 mg/kg of soil.

Table 3. Mean dry matter yields of Sorghum and the relative yields based on optimum treatment of the greenhouse experiments.

	Pelwehera			Dodangolla		
Treatment	+/-	**Mean* (g/pot)**	**Yield (%)**	+/-	**Mean* (g/pot)**	**Yield (%)**
Optimum		4.57 a	100.0		5.12 a	100.0
S	+	4.54 a	99.3	-	4.20 b	82.4
Cu	+	4.51 a	98.7	+	5.02 a	98.0
$CaCO_3$	+	4.23 ab	92.6	+	5.02 a	98.0
B	+	4.20 ab	91.9	-	4.20 b	82.0
Ca	+	4.14 ab	90.6	-	4.30 b	84.0
Mg	+	4.10 b	89.7	+	4.66 ab	91.0
Mo	-	4.10 b	89.7	-	4.62 ab	90.2
Fe	+	4.09 b	89.5	+	4.22 b	82.4
Mn	+	4.05 b	88.6	-	4.23 b	82.6
Zn	+	4.04 b	88.4	+	4.23 b	82.6
P	-	2.87 c	62.8	-	2.84 c	55.5
K	-	2.76 c	60.4	-	2.35 c	45.9
N	-	1.04 d	22.8	-	0.95 d	18.6

Note: *Means with the same letters were not significantly different P = 0.05.
**The symbol + indicates plus treatments with nutrient supplemented where as the symbol – indicates minus treatments where nutrient is not added.

Greenhouse study

The optimum treatment gave the highest dry matter yield while the reduction in yields with minus N, minus P, and minus K treatments was highly significant ($p \leq 0.05$) in both soils (Table 3), thus confirming the deficiencies predicted by soil analysis. With soils from Pelwehera site, a significant ($p \leq 0.05$) yield reduction was observed with minus Mo, as well as plus treatments with Mg, Fe, Mn and Zn. Therefore, the results indicate that excess application of Mg and micronutrients such as Fe, Mn and Zn, when they are sufficient in soils, may lead to a lower yield, possibly due to nutrient imbalances and toxicities as reported by Bandara and Silva (2000). With soils from Dodangolla site, a significant reduction in dry matter yield was observed with minus treatments of S, Ca, Mn and B, thus confirming the deficiencies predicted with soil analysis. The yield reduction with minus Mo treatment was lower than the yield of the optimum treatment, but the difference however, was not statistically significant ($p \leq 0.05$). Excess application of Fe and Zn, significantly reduced the dry matter yield in Dodangolla soil where as the yield decrease with excess application of Cu and Mg was not statistically significant. Thus, the results of the greenhouse study, in general, confirmed the deficiencies predicted through soil analysis in both soils, indicating that the optimum values used were appropriate for these soils.

Table 4. **Mean yield (mt/ha) of cauliflower in four consecutive seasons at Pelwehera.**

Treatment		Season 1	Season 2	Season 3	Season 4	Mean of 4 seasons
T1	Optimum	12.4^{ab}	11.1^{a}	7.00^{a}	10.2^{a}	10.2^{a}
T2	Optimum with 50% N	10.6^{abc}	10.2^{ab}	5.88^{ab}	9.32^{a}	8.62^{b}
T3	Optimum with 50% P	10.7^{abc}	10.9^{a}	6.36^{ab}	9.60^{a}	9.39^{ab}
T4	Optimum with 0% P	10.4^{bc}	9.92^{abc}	5.96^{ab}	8.08^{b}	8.59^{b}
T5	Optimum with 50% K	10.0^{bc}	9.68^{abc}	5.60^{ab}	8.04^{b}	8.34^{b}
T6	Optimum with 0% K	9.88^{c}	9.12^{bcd}	4.96^{bc}	7.72^{b}	7.91^{bc}
T7	Optimum with 50% P,K	12.8^{a}	9.88^{abc}	6.12^{ab}	8.76^{ab}	9.38^{ab}
T8	DOA recommendation	10.3^{bc}	7.72^{de}	5.04^{bc}	8.48^{ab}	7.41^{bc}
T9	Control	8.80^{c}	6.64^{e}	2.72^{d}	6.08^{c}	6.06^{c}

Note: Mean yield was calculated from replicates. Means with same letters were not significantly different within each column ($p \leq 0.05$) using DNMRT.

Field experiment

The average yield of cauliflower under Sri Lankan conditions is 6 mt/ha (Anon, 1993). The average yield for the four seasons in Pelwehera and Dodangolla soils with the same optimum treatment (treatment 1) were 10.2 and 7.99 mt/ha, respectively (Tables 4 and 5). Even though the same variety was grown at all experimental locations, the yields varied with the locations even with the optimum fertiliser recommendation. This may be due to the climatic variations such as rainfall and temperature in the experimental locations. No significant interaction was observed between the season and the fertilizer treatment.

Table 5. **Mean yield (mt/ha) of cauliflower in four consecutive seasons at Dodangolla.**

Treatment		Season 1	Season 2	Season 3	Season 4	Mean of 4 seasons
T1	Optimum	6.64^{a}	8.40^{a}	8.28^{a}	8.64^{a}	7.99^{a}
T2	Optimum with 50% N	5.28^{bc}	7.16^{bc}	7.08^{b}	7.40^{b}	6.73^{b}
T3	Optimum with 50% P	6.44^{a}	7.92^{ab}	7.64^{abc}	8.24^{ab}	7.56^{ab}
T4	Optimum with 0% P	5.28^{bc}	6.96^{bc}	6.52^{bc}	7.12^{b}	6.47^{b}
T5	Optimum with 50% K	5.56^{b}	7.48^{b}	7.44^{abc}	7.68^{b}	7.04^{ab}
T6	Optimum with 0% K	4.88^{bc}	6.40^{c}	6.16^{c}	6.72^{bc}	6.04^{bc}
T7	Optimum with 50% P,K	5.00^{bc}	6.44^{c}	6.80^{bc}	7.12^{b}	6.34^{b}
T8	DOA recommendation	4.80^{c}	6.12^{c}	5.76^{c}	6.48^{c}	5.79^{bc}
T9	Control	4.72^{c}	5.40^{d}	4.72^{d}	5.92^{d}	5.19^{c}
T10	Opt without Ca,S,B,Mn, Mo	4.84^{c}	6.36^{c}	6.12^{c}	6.68^{bc}	6.00^{bc}

Note: Mean yield was calculated from replicates. Means with same letters were not significantly different within each column ($p \leq 0.05$) using DNMRT.

The average curd yield of the optimum treatment (treatment 1) was higher (10.2 mt/ha) than the other treatments in all seasons at both locations (Tables 4 and 5). Cauliflower requires high amount of N, P and K to produce a profitable yield (Anon, 1999). The lowest yields of 6.06 and 5.19 mt/ha were recorded from the control treatment with no fertilizer application at Pelwehera and Dodangolla soils, respectively. The optimum treatments (treatment 1) in both locations gave the highest yield increments of 35-42% over the control treatment. The results indicate that inadequate supply of K has a more pronounced effect on the curd yield at all 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) had earlier 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, stem development, and help to tolerate lodging of plants.
The highest total fertilizer cost (TFC) was recorded from the optimum treatment (treatment 1) and the lowest TFC was from control treatment (Treatment 10). 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 (Table 6).

Table 6. Total fertilizer cost and gross return above fertilizer cost for each treatment at Pelwehera and Dodangolla.

	Pelwehera			Dodangolla		
Treatment No.	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	602,091
T2	862000	104686	757314	673200	188413	484,787
T3	938800	98654	840146	756000	184836	571,164
T4	858800	83927	774873	647200	172564	474,636
T5	834000	98982	735018	704000	182709	521,291
T6	791200	84582	706618	604000	168309	435,691
T7	938400	84254	854146	634000	170436	463,564
T8	741200	28416	712784	579200	28416	550,784
T9	606400	0	606400	519200	0	519,200
T10	0	0	0	600000	70737	529,263

Note: TFC: total fertilizer cost (Rs/ha). GRF: gross return above fertilizer cost (Rs/ha).

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) and molybdenum (Mo).

The fertilizer recommendation by the Department of Agriculture (DOA) provides approximately 90% N, 25% P and 18% K of that of the optimum treatment (treatment 1), both at Pelwehera and Dodangolla. The yields with the DOA treatment recorded 7.41 and 5.79 mt/ha with a yield loss of 27.0% and 27.5% compared to the optimum treatments at Pelwehera and Dodangolla, respectively. The reason for the lower yields could be the low rate of N (approximately 90% of the optimum N level) with low P and K rates (25% and 18% of the respective optimum levels) associated with DOA recommendation. Therefore, the results of field experiments indicate the importance of diagnosing of nutrient problems in soils prior to cultivation and site-specific fertilizer management for cauliflower.

CONCLUSIONS

The dry matter yields, in treatments with deficient nutrient levels were lower when compared with the optimum treatment in the greenhouse experiment. The average curd yield of the optimum treatment was higher in all seasons, in the field experiments at both locations.

The results of this study confirm that the systematic approach for 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.

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