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# Determination of Site Specific Fertilizer Requirement of Sugarcane and Intercrops in Sugarcane-based Cropping Systems

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**Abstract:** The site-specific nutrient requirement of sugarcane (*Saccharum officinarum*) and companion crops, viz. onion (*Allium cipa*) and lentil (*Lens culinaris*) in sugarcane based cropping systems field experiments was determined under two Agro-ecological zones (AEZ), namely High Barind Tract (AEZ 26) and Tista Meander Floodplain soils (AEZ 3). The application of fertilizers for sugarcane and intercrops, onion and lentil as per soil test basis followed by dhaincha (*Sesbania aculeata*) significantly increased cane yield to the extent of 19 % at AEZ 26 and 45 % at AEZ 3 over the sole cane crop. Maximum cane yield (119 t $ha^{-1}$) with highest BCR of Tk.4.37 was found in High Barind Tract with the application of $N_{190}$ + $P_{44}$ + $K_{65}$ + $S_{25}$ + $Zn_{3.5}$ kg $ha^{-1}$ to sugarcane and $N_{55}$ + $P_{18}$ + $K_{25}$ + $S_{8}$ kg $ha^{-1}$ to potato. In Tista Meander Floodplain soils, application of $N_{120}$ + $P_{40}$ + $K_{75}$ + $S_{20}$ + $Zn_{2}$ + $Mg_{15}$ kg $ha^{-1}$ and $N_{15}$ + $P_{5}$ + $K_{6}$ + $S_{3}$ kg $ha^{-1}$ to sugarcane and lentil, respectively produced the highest yield of 117 t $ha^{-1}$ with BCR of Tk.4.25. Green manure *Sesbania aculeata* increased cane yields about 2 to 9 per cent and contributed 56 - 66 kg N $ha^{-1}$.

**Key words:** Determination, fertilizer requirement, sugarcane, intercrop, cropping systems

## Introduction

Intercropping in sugarcane with pulses, oilseeds and vegetable is quite a common practice in cane growing countries. Intercropping has been recognized as a potential system for augmenting the productivity over space and time in subsistence farming situations. An intercropping partly meets the N requirement of the companion crop due to the transfer of the symbiotically fixed N from the legume to the non- legume (Ledgard *et al.*, 1985). An intercropping with cereal crop may also provide 50 kg N to the following crop (Waghmare and Singh, 1984). Sugarcane is a long duration and widely spaced crop and up to 90 days the canopy does not cover the vacant space in between the rows, as such there is apple scope to grow short- duration intercrops. Singh *et al.* (1997) found that 1 row of green manure as intercrop in sugarcane gave yield similar to the sugarcane sole crop, which also gave the highest net return. Due to complementary effect of different crops when grown together, making better use of resources ultimately helps in productivity of sugarcane. Researchers have been reported that if legumes could be more widely used in cropping system, it positively contributes in terms of nitrogen nutrition to sugarcane, amelioration of yield decline and direct cash return. So, careful management and the selection of right species and end use (grain or green manure) for the local climatic condition is important for maximizing benefits. In Bangladesh, sugarcane is mainly cultivated in South-western part of the country and its cultivation is mostly concentrated within 12 Agro-ecological zones. The production of intercrop in sugarcane in Bangladesh is localized depending on the soil, environment and market. However, information regarding raising intercrops with green manure crop as a second intercrop in sugarcane is scanty. Due to continuous monocropping and imbalance use of inorganic fertilizers the cultivated lands are fastly becoming unfertile. Hence, experiments were undertaken with the following objectives:

a) to find the nutrient requirement of sugarcane and two intercrops, onion and lentil.
b) to determine the beneficial effects of intercropping to sugarcane productivity and
c) to observe potential of growing two intercrops, onion and lentil as cash crop in supplementing extra income to cane growers

## Materials and Methods

The field trials were conducted in the farmer's field during the cropping season 1999-2000 under High Barind Tract (AEZ 26) and Tista Meander Floodplain (AEZ 3) soils at Rajshahi and Jaipurhat sites, respectively. Each of the treatment was replicated thrice in RCB design. The experimental plot was 8x6 $m^2$. Initial soils at the depth of 0-15 cm were collected and analyzed following standard procedure. The soil of experimental sites was neutral in reaction and deficient in organic matter, available nitrogen, potassium and zinc. Sulphur was near to critical level. Thirty-five days old two-budded soil bed sugarcane settlings (var. lsd 16) were used as test crop. Sugarcane settlings were transplanted during mid November at a row spacing of 1m with interplant spacing of 0.5m. Sugarcane crop was harvested 13 months after planting. Three rows of lentil (var. BARI 4) and four rows of onion (local) were planted on the vacant space in between two rows. As green manure crop Dhaincha (*Sesbania aculeata*) was grown after harvesting of 1st intercrop in April. The GM crop was ploughed down *in situ* on 50 days of sowing seeds by way of earthing up with spade. All the other cultural management practices were followed when required. Full dose of P, S, Zn and Mg were applied in trenches and thoroughly mixed with soils by spade prior to transplanting of sugarcane settlings. Half of the quantities of N and K were top-dressed after 20-30 days of settling transplanting. The rest of N and K fertilizers were applied at peak tillering stage. Half dose of N and all other fertilizers of intercrops were applied at the vacant space of two cane rows and mixed thoroughly with soils and remaining N was applied as top dressing. The incorporated green manure dhaincha contained 1.65 % N. Necessary data were recorded and analyzed using the Least Significant Differences Test (LSD) at $P$= 0.05. Economics of different treatments were calculated on the basis prevailing market prices during the study period. Table 1 shows the amount of fertilizers used at different locations.

Table 1: Amount of fertilizers (kg ha$^{-1}$) used at the experimental sites

| Treatments | Crops | Locations | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Rajshahi | | | | | Jaipurhat | | | | | |
| | | N | P | K | S | Zn | N | P | K | S | Zn | Mg |
| $T_1$ | Sugarcane | 130 | 35 | 60 | 20 | 3 | 120 | 40 | 75 | 20 | 2 | 15 |
| $T_2$ | Sugarcane | 130 | 35 | 60 | 20 | 3 | 120 | 40 | 75 | 20 | 2 | 15 |
| $T_3$ | Sugarcane | 130 | 35 | 60 | 20 | 3 | 120 | 40 | 75 | 20 | 2 | 15 |
| | Onion | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| $T_4$ | Sugarcane | 130 | 35 | 60 | 20 | 3 | 120 | 40 | 75 | 20 | 2 | 15 |
| | Onion | 50 | 20 | 30 | 10 | 0 | 50 | 20 | 30 | 15 | 0 | |
| $T_5$ | Sugarcane | 190 | 44 | 65 | 25 | 3.5 | 196 | 53 | 144 | 23 | 3.5 | 30 |
| | Onion | 55 | 18 | 25 | 6 | 0 | 33 | 15 | 25 | 11 | 0 | 0 |
| $T_6$ | Sugarcane | 130 | 35 | 60 | 20 | 3 | 120 | 40 | 75 | 20 | 2 | 15 |
| | lentil | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| $T_7$ | Sugarcane | 130 | 35 | 60 | 20 | 3 | 120 | 40 | 75 | 20 | 2 | 15 |
| | lentil | 5 | 5 | 0 | 0 | 0 | 15 | 5 | 6 | 3 | 0 | 0 |
| $T_8$ | Sugarcane | 190 | 44 | 65 | 25 | 3.5 | 196 | 53 | 144 | 23 | 3.5 | 30 |
| | lentil | 10 | 5 | 6 | 4 | 0 | 10 | 12 | 10 | 8 | 0 | 0 |

Details of treatment are given in materials and methods Under lined figures indicates the amount of nutrients added in the intercrops

Table 2: Initial and final soil status of the experimental sites of different fertilizer management packages

| Sites | Treatments | Analytical value | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | pH | OM (%) | N (%) | P (ppm) | K (meq/100g soil) | S (ppm) | Zn (ppm) |
| Rajshahi | Initial | 7.2 | 1.14 | 0.08 | 12.0 | 0.18 | 17.0 | 0.90 |
| | Final | | | | | | | |
| | $T_1$ | 7.1 | 1.10 | 0.07 | 11.0 | 17.0 | 16.0 | 0.90 |
| | $T_2$ | 7.2 | 1.08 | 0.07 | 11.5 | 17.0 | 15.0 | 0.95 |
| | $T_3$ | 7.3 | 1.09 | 0.065 | 12.0 | 16.0 | 16.0 | 1.0 |
| | $T_4$ | 7.2 | 1.09 | 0.07 | 11.0 | 0.165 | 16.0 | 0.98 |
| | $T_5$ | 7.2 | 1.12 | 0.065 | 12.0 | 0.17 | 15.0 | 0.90 |
| | $T_6$ | 7.3 | 1.08 | 0.065 | 12.5 | 0.16 | 16.0 | 0.98 |
| | $T_7$ | 7.2 | 1.11 | 0.07 | 11.0 | 0.17 | 15.0 | 0.90 |
| | $T_8$ | 7.2 | 1.13 | 0.07 | 12.0 | 0.17 | 15.0 | 0.90 |
| Jaipurhat | Initial | 6.2 | 0.88 | 0.07 | 17.0 | 0.17 | 19.0 | 1.20 |
| | Final | | | | | | | |
| | $T_1$ | 6.2 | 0.85 | 0.065 | 15.0 | 0.16 | 20.0 | 1.0 |
| | $T_2$ | 6.3 | 0.78 | 0.07 | 15.5 | 0.16 | 20.0 | 1.00 |
| | $T_3$ | 6.4 | 0.82 | 0.07 | 17.0 | 0.17 | 19.0 | 1.12 |
| | $T_4$ | 6.3 | 0.83 | 0.06 | 16.0 | 0.16 | 21.0 | 1.15 |
| | $T_5$ | 6.5 | 0.80 | 0.07 | 15.0 | 0.17 | 22.0 | 1.20 |
| | $T_6$ | 6.3 | 0.85 | 0.075 | 16.5 | 0.17 | 20.0 | 1.20 |
| | $T_7$ | 6.4 | 0.84 | 0.07 | 16.0 | 0.16 | 19.0 | 1.15 |
| | $T_8$ | 6.4 | 0.85 | 0.065 | 17.0 | 0.16 | 20.0 | 1.18 |

Table 3a: Yield of cane and intercrops and yield contributing parameters of sugarcane as influenced by different fertilizer management packages under sugarcane based cropping system at Rajshahi

| Treatments | Tillers (x10$^3$ ha$^{-1}$) | Millable cane stalks (x10$^3$ ha$^{-1}$) | Yield of cane (t ha$^{-1}$) | Yield of onion (t ha$^{-1}$) | Brix (%) | Yield of lentil (t ha$^{-1}$) | Dry matter of GM (t ha$^{-1}$) |
|---|---|---|---|---|---|---|---|
| $T_1$ | 189.44 | 121.93 | 83.75 | 17.50 | - | - | - |
| $T_2$ | 195.55 | 124.92 | 91.78 | 17.08 | - | - | 2.5 |
| $T_3$ | 166.67 | 132.48 | 93.57 | 17.17 | 8.20 | - | 2.38 |
| $T_4$ | 189.28 | 128.52 | 104.60 | 16.83 | 9.92 | - | 2.67 |
| $T_5$ | 183.32 | 136.82 | 118.97 | 17.83 | 8.96 | - | 2.64 |
| $T_6$ | 168.34 | 135.95 | 114.19 | 17.33 | - | 0.92 | 2.31 |
| $T_7$ | 166.98 | 135.12 | 117.55 | 17.86 | - | 1.09 | 2.41 |
| $T_8$ | 195.7 | 141.72 | 121.55 | 16.83 | - | 1.05 | 2.75 |
| LSD | NS | 4.05 | 3.95 | NS | NS | 0.036 | - |

Details of treatment are given in materials and methods NS = Non significant

Table 3b: Yield of cane and intercrops and yield contributing parameters of sugarcane as influenced by different fertilizer management packages under sugarcane based cropping system at Jaipurhat

| Treatments | Tillers (x10$^3$ ha$^{-1}$) | Millable cane stalks (x10$^3$ ha$^{-1}$) | Yield of cane (t ha$^{-1}$) | Brix (%) | Yield of onion (t ha$^{-1}$) | Yield of lentil (t ha$^{-1}$) | Dry matter of GM (t ha$^{-1}$) |
|---|---|---|---|---|---|---|---|
| $T_1$ | 231.43 | 108.98 | 105.8 | 20.5 | - | - | - |
| $T_2$ | 257.24 | 113.58 | 108.0 | 21.0 | - | - | 2.5 |
| $T_3$ | 263.55 | 116.99 | 110.5 | 19.5 | 4.43 | | 2.6 |
| $T_4$ | 273.95 | 119.59 | 111.7 | 19.8 | 8.36 | - | 2.7 |
| $T_5$ | 261.26 | 128.59 | 122.1 | 19.0 | 9.36 | - | 2.7 |
| $T_6$ | 232.91 | 131.58 | 111.6 | 19.5 | - | 0.85 | 2.7 |
| $T_7$ | 232.09 | 128.39 | 119.3 | 19.0 | - | 1.00 | 2.5 |
| $T_8$ | 285.24 | 133.09 | 126.1 | 19.3 | - | 0.97 | 2.8 |
| LSD | NS | NS | 10.65 | NS | NS | 0.036 | - |

Table 4a: Economic analysis of different fertilizer management packages under sugarcane based cropping system at Rajshahi

| Treatments | Yield ( t ha$^{-1}$) | | | Cost of production (Tk. ha$^{-1}$) | | Total variable cost (TK. ha$^{-1}$) | Return TK. ha$^{-1}$ (cane+ trash + intercrop | Net profit (TK. ha$^{-1}$) | Benefit cost ratio (BCR) |
|---|---|---|---|---|---|---|---|---|---|
| | Cane | Trash | Inter crop | Cane | Inter crop | | | | |
| $T_1$ | 83.75 | 8.37 | - | 34,900 | - | 34,900 | 85,760 | 51,260 | 2.48 |
| $T_2$ | 91.78 | 9.17 | - | 34,900 | - | 34,900 | 93,983 | 59,083 | 2.69 |
| $T_3$ | 93.57 | 9.36 | 8.20 | 34,900 | 12,000 | 46,900 | 1,77,816 | 1,30,916 | 3.79 |
| $T_4$ | 104.60 | 10.5 | 9.92 | 34,900 | 14,750 | 46,650 | 2,06,310 | 1,56,660 | 4.15 |
| $T_5$ | 118.97 | 11.9 | 8.96 | 33,900 | 14,500 | 48,400 | 2,11,425 | 1,63,025 | 4.37 |
| $T_6$ | 114.19 | 11.4 | 0.92 | 34,900 | 1,600 | 36,500 | 1,39,930 | 1,03,430 | 3.83 |
| $T_7$ | 117.55 | 11.7 | 1.09 | 34,900 | 2,000 | 36,900 | 1,47,620 | 1,10,720 | 4.00 |
| $T_8$ | 121.55 | 12.2 | 1.05 | 33,900 | 2,250 | 36,150 | 1,56,862 | 1,20,712 | 4.34 |

Table 4b: Economic analysis of different fertilizer management packages under sugarcane based cropping system at Jaipurhat

| Treatments | Yield (t ha$^{-1}$) | | | Cost of production (Tk. ha$^{-1}$) | | Total variable cost (TK. ha$^{-1}$) | Return TK. ha$^{-1}$ (cane+ trash + intercrop | Net profit (TK. ha$^{-1}$) | Benefit cost ratio (BCR) |
|---|---|---|---|---|---|---|---|---|---|
| | Cane | Trash | Inter crop | Cane | Inter crop | | | | |
| $T_1$ | 105.79 | 10.58 | - | 31,950 | - | 31,950 | 1,08,329 | 76,379 | 3.39 |
| $T_2$ | 107.99 | 10.80 | - | 32,300 | - | 32,300 | 1,10,581 | 78,281 | 3.42 |
| $T_3$ | 110.48 | 11.05 | 4.43 | 32,300 | 12,000 | 44,300 | 1,57,431 | 1,13,131 | 3.55 |
| $T_4$ | 111.69 | 11.17 | 8.36 | 32,300 | 14,850 | 47,150 | 1,97,970 | 1,50,820 | 4.20 |
| $T_5$ | 122.09 | 12.21 | 9.36 | 38,183 | 14,100 | 52,283 | 2,18,620 | 1,66,337 | 4.18 |
| $T_6$ | 111.59 | 11.16 | 0.85 | 32,300 | 1,600 | 33,900 | 1,35,518 | 1,01,618 | 3.99 |
| $T_7$ | 119.29 | 11.93 | 1.00 | 32,300 | 2,300 | 34,600 | 1,47,153 | 1,12,553 | 4.25 |
| $T_8$ | 126.08 | 12.61 | 0.97 | 38,183 | 2,889 | 40,072 | 1,53,359 | 1,13,287 | 3.82 |

Price of input and output and labour wages was considered on local market

The treatments applied are as follows:

$T_1$ : Sole sugarcane crop (Fer. for MYG as per FRG'97)
$T_2$: Sugarcane (Fer. for MYG as per FRG'97) + GM
$T_3$ : Sugarcane (Fer. for MYG as per FRG'97) + Onion (control)+ GM
$T_4$ : Sugarcane (Fer. for MYG as per FRG'97) + Onion (Fer. for MYG as per FRG'97) + GM
$T_5$ : Sugarcane (STB) + Onion (STB) + GM
$T_6$ : Sugarcane (Fer. for MYG as per FRG'97) + Lentil (control) + GM
$T_7$ : Sugarcane (Fer. for MYG as per FRG'97) + Lentil (Fer. for MYG as per FRG'97) + GM
$T_8$ : Sugarcane (STB) + Lentil (STB) + GM

Where
FRG = Fertilizer Recommendation Guide, (1997), MYG = Moderate Yield Goal (80 ± 10 t ha$^{-1}$); HYG = High Yield Goal I (100 ± 10 tha$^{-1}$); STB = Soil Test Basis and GM = Green manure

## Results and Discussion

### Yield attributes and yield

**Location - High Barind Tract (AEZ 26):** Data on number of tillers, millable cane stalks, cane yield, brix and yield of intercrops have been provided in Table 3a. The number of tillers and brix under different treatments showed no significant variation. The highest number of tillers was found (195.7x10$^3$ ha$^{-1}$) at $T_8$ treatment, which was similar to $T_2$ (195.5 x 10$^3$ ha$^{-1}$) and $T_1$ (189.4 x10$^3$ ha$^{-1}$). Significant differences were observed for millable cane stalks and yield of sugarcane among different treatments. The highest number of millable cane stalks were found for $T_8$ treatment (141.7x10$^3$ ha$^{-1}$) followed by $T_5$ (136.8 x 10$^3$ ha$^{-1}$) and $T_6$ (135.9 x 10$^3$ ha$^{-1}$). The highest yield of 121.6 t ha$^{-1}$ was found at $T_8$ and it was at par with $T_5$ and $T_7$. The cane yield increase was 24.9, 42.1, 40.1 and 45.1 per cent at $T_4$, $T_5$, $T_7$ and $T_8$, respectively, where intercrops were raised over sole cane ($T_1$). This study indicates that cultivation of intercrops viz. onion (in $T_3$, $T_4$ and $T_5$) and lentil (in $T_6$, $T_7$ and $T_8$) caused no adverse effects on cane yield rather significantly increased compared to sole cane crop ($T_1$). It is assumed that residual effect of applied fertilizers as well as additional cultural management for intercrops i.e. beneficial association of intercropping with sugarcane crops resulting more yields. This finding is in close conformity with Majid *et al.* (1998) and Imam *et al.* (1990). Fertilizer application to sugarcane and lentil intercrop on the basis of soil test i.e. $T_8$ treatment produced maximum cane yield of 121.6 t ha$^{-1}$ with second highest lentil yield of 1.09 t ha$^{-1}$. In sugarcane + onion intercropping system, $T_5$ treatment (the crops received highest rate of fertilizers following soil test value) 13.7 % higher cane yield over $T_4$ (the crops received fertilizers for MYG following FRG'97). On the contrary, in sugarcane + lentil intercropping system, $T_8$ treatment (the crops received highest rate of fertilizers following soil test value) produced 6.4 % more cane yield than that of $T_7$ treatment (the crops received fertilizers for MYG following FER'97). Hence, it is revealed that higher rate of fertilizers is required for obtaining higher cane yield than that of present recommended dose or the fertilizer is applied for MYG. The intercrops, onion and lentil produced maximum yield of 9.92 and 1.09 t ha$^{-1}$, respectively where moderate rate of fertilizers were applied. It is assumed that there is no need of higher dose of fertilizer both for onion and lentil under the present soil condition. Green manuring increased cane yields about 9 % and contributed 56-66 kg N ha$^{-1}$. Uddin *et al.* (1996) and Ahmed *et al.* (1998) observed that cane yield was increased with addition of biomass from sunhemp and dhaincha.

**Location - Tista Meander Floodplain soil (AEZ 3):** The influence of different fertilizer management practices on the production of tillers, millable cane stalks, yield of cane and intercrops (onion and lentil), brix per cent and dry matter production of green manure have been provided in Table 3b. The data on tillers and millable cane stalks production although did not vary significantly among the treatments but an increasing trend was observed. The maximum number of tillers (285.2 x 10$^3$ ha$^{-1}$) and millable cane stalks (133.1 x 10$^3$ ha$^{-1}$) were obtained from the $T_8$ treatment while the lowest number of tillers of 231.4 x 10$^3$ ha$^{-1}$ and millable cane stalks of 108 x 10$^3$ ha$^{-1}$ from the $T_0$ (sole sugarcane crop for MYG as per FRG'97) treatment. Raising of intercrops influenced cane yield significantly. Application of fertilizers both for cane and lentil intercrop on soil test basis followed by green manure significantly increased yield of 126.1 t ha$^{-1}$ followed by $T_5$, $T_7$, $T_4$ and $T_8$ and those produced 122.1, 119.3, 111.7 and 111.6 t ha$^{-1}$, respectively. The highest yield of cane recorded by the treatment $T_5$, $T_7$, $T_4$ and $T_6$ perhaps might be due to growing of intercrops and application of fertilizer on soil test basis might have facilitated residual effects of plant nutrients in cane crop and enhanced the cane yield compared to sole cane. In sugarcane-onion intercropping system highest yield of onion (9.36 t h$^{-1}$) was found in $T_5$ treatment while the lowest yield (4.43 t ha$^{-1}$) was from $T_3$ treatment. In sugarcane-lentil intercropping system, yield of lentil

differed significantly with maximum yield of 1.00 t $h^{-1}$ and it was at par with $T_8$ treatment. From the study it was observed that onion intercrop and lentil had produced maximum yield following the fertilizer rate as FRG'97 which indicates that the present soil condition is in a position to harvest better yield. There were no significant differences among those treatments on brix per cent of sugarcane. The dry matter production of green manure Dhaincha ranged from 2.5 to 2.8 t $ha^{-1}$ and it supplemented 41 to 46 kg N $ha^{-1}$.

**Soil fertility status:** The status of soil pH, organic carbon, total N, available P, K, S and Zn in initial soil as well as post harvest soil are presented in Table 2. There were considerable decreases in organic matter in soils. Little changes were observed on soil pH at Jaipurhat site. The change in total N, available P, K, S and Zn were not conspicuous due to one year of cropping using different fertilizers.

**Economics of fertilizer use:** Farmers of our country are continuously facing multifarious problems in crop production and strongly considered the economics of fertilizer use by which they can be benefited. Hence, economic analyses of different fertilizer management packages under sugarcane based intercropping systems were computed and have been provided in Tables 4a & 4b. Analysis of different fertilizer packages was done considering the total variable cost and return where all other costs were involved remains constant for all the treatments. At different sites the highest net benefit and BCR was varied, as it was associated with the yield production as well as fertilizer requirement of the treatments. At Rajshahi, the highest BCR of Tk. 4.37 was obtained in $T_5$ treatment followed by Tk. 4.34 of $T_8$ treatment (Tk is a unit of Bangladesh currency and one US$ ≈ Tk. 56). At Jaipurhat the highest net benefit and BCR of Tk. 4.25 was found in $T_7$ treatment followed by Tk. 4.20 of $T_4$ and Tk. 4.18 of $T_5$.

Application of $N_{190}$ + $P_{44}$ + $K_{65}$ + $S_{25}$ + $Zn_{3.5}$ kg $ha^{-1}$to sugarcane and $N_{55}$ + $P_{18}$ + $K_{25}$ + $S_6$ kg $ha^{-1}$to potato and $N_{120}$ + $P_{40}$ + $K_{75}$ + $S_{20}$ + $Zn_2$ + $Mg_{15}$ kg $ha^{-1}$to sugarcane and $N_{15}$ + $P_5$ + $K_6$ + $S_3$ kg $ha^{-1}$to lentil in High Barind Tract and Tista Meander Floodplain soils, respectively are found profitable for sustainable sugarcane production.

A beneficial effect of raising intercrops with sugarcane enhances cane yield over sole cane and also provides interim economic benefits to the cane growers.

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