Effect of Urea and Cocoly® Fertilizers on Production of Sugarcane (*Saccharum officianarum* L.), Kenana Sugar Scheme, White Nile State, Sudan

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Received:- 05 July 2025/ Revised:- 14 July 2025/ Accepted:- 22 July 2025/ Published: 31-07-2025

Abstract— *Sugarcane (Saccharum officianarum L.) is one of the most important economic crops in the world. The climatic conditions and soil types in the Sudan are suitable for the production of the crop, especially in the central clay plains. The aim of this study was to investigate the effect of different levels of Urea and Cocoly® fertilizers on yield and yield components of sugarcane (variety Co997) in the heavy clay soils. The experiment was conducted at the Research and Development Farm, Kenana Sugar Scheme (Sudan), during the season-(2021/2022). The treatments consisted of three levels of Urea fertilizer (0, 238 and 375 kg/ha) and four levels of Cocoly® fertilizer (0, 48, 95 and 143 kg/ha). The treatments were arranged in split plot design with four replications. Urea fertilizer was assigned as the main plots and Cocoly® fertilizer as the subplots. The results showed that increasing Urea fertilizer, significantly increased cane height, cane thickness, cane internodes and cane yield. Whereas increasing Cocoly® fertilizer, significantly increased plant height, stalk population, stalk weight and cane yield. The highest cane yield (199.9 t/ha) was obtained when the crop fertilized with 143 kg Cocoly®/ha and 375kg/ha Urea. Depending on the results of this study, to obtain high cane yield from Sugarcane, it could be recommended that the crop should be fertilized with 143 kg/ha of Cocoly® and 375 kg/ha of Urea.*

***Keywords*— *Cocoly® fertilizer, Sugarcane yield, Urea fertilizer, Heavy clay soils, Kenana Sugar Scheme*.**

I. INTRODUCTION

Sugarcane (*Saccharum officianarum* L.) is a tropical giant perennial grass belongs to the family poaceae that includes cereal crops such as maize, wheat, rice, sorghum and many forage crops (Jannoo *et al.*, 2007). It is cultivated for the production of sugar and as a source of bio-energy due to its phenomenal dry matter production. Demand for sugar and bio-energy is increasing day by day but its present production is not enough to meet the increasing demand. The average production is much lower than the achievable potential of the existing sugarcane varieties (Ayoub *et al.*, 1999).

Sugarcane is one of the most important economic crops and the largest sugar crop in the world. The main sugarcane growing countries include: India, Brazil, Cuba, Australia and Mexico (Morais *et al*., 2015). According to the estimates of the Food and Agriculture Organization of the United Nations, the crop was cultivated on about 23.8 million hectares, in more than 90 countries, with a worldwide harvest of 1.69 billion tons (FAO 2010). Sudan is the third-largest producer of sugar in Africa (Hassan, 2008). The country’s estimated production is about 800 000 t, which is equivalent to 7.5 % of the African continent (Hassan, 2008). In Sudan, sugarcane is grown in two seasons, summer and winter (Ibrahim, 1978).

Sugarcane has been recognized as a crop with high potential that can successfully meet future sugar requirements (Hamid and Dagash, 2014). The soaring world’s sugar prices in the late 1950 motivated the Government of Sudan to plan establishment of sugar industry to ease pressure on its foreign exchange reserves and create jobs and employment within a new industrial environment (Ali, 1986). El Guneid Sugar Factory was commissioned in 1962 and the New Halfa Sugar Factory in 1964, each with a sugar production capacity of 60,000 tons per annum. The two projects were established to meet the domestic demand levels that were estimated at 120,000 tons per annum. In the early seventies the Sudanese Government designed a new plan to meet the growing demand for sugar. Therefore, Three major sugar plantations were successfully constructed, Assalaya, North West Sennar and Kenana (Ali, 1986). The Sudanese sugar industry started in the early 1960s. Currently, the production capacity, designed for the existing five sugar factories, is 755,000 tons (Hussein, 2013).

Kenana Sugar Company (KSC) was established in 1979 as a private (integrated) company and started production activity in 1984 (El Nazir and Desai, 2014). While the remaining four sugar plantations were administered by the Sudanese Sugar Company (SSC), a publicly owned enterprise(Ibrahim 2020). Sugarcane production in Kenana Sugar Scheme was supported by establishment of the research and development station in order to increasing the productivity of sugarcane through the effectively fertilization programs. The soil at Kenana scheme is a heavy clay soil “vertisols” (Ali, 1986). Besides, the clay contents in these soils which range between 60 and 70% (Blokhuis, 1993), these soil are classified under Dinder series (Abdulla *et al*., 1985).

Sustainable nutrient management is considered an integral part of sugarcane production (Schroeder *et al*., 2005). Use of fertilizers play an important role in increasing sugarcane yield (Nazir *et al*., 2013).

Proper fertilization is an important management function in sugarcane production (Hasan *et al*., 2021). Balanced application of different nutrient levels produced thicker cane, longer height and higher millable canes and high cane yield (Junejo *et al*., 2014). The increasing of cane yield production found followed the trend: millable cane, cane height and cane thickness (Chohan *et al*., 2013).

The primary nutrients Nitrogen, Phosphor and Potassium are those that plant need in large quantities and are necessary for all living cells and essential for the formation of chlorophyll (Ali and Hamid, 2012). Cocoly® NPK fertilizer, contribute to the increase in sugarcane yields by providing direct nutritional value and improving the use efficiency of other essential nutrients (El Hag *et al*., 2006). The most important fertilizers used in Kenana Sugar Scheme, are nitrogenous fertilizers Urea and Ammonium Sulphate. and phosphorus fertilizers, Di Ammonium Phosphate (Hamid and Dagash, 2014).

1.1 Objectives of the study:

Main objective is to study the effect of Urea and Cocoly® fertilizers on sugarcane production in the heavy Clay soils of Kenana sugar scheme.

Specific objective is to determine the optimum dose of applied Urea and Cocoly® fertilizers which gives the optimum cane and sugar yield in Kenana Sugar scheme.

II. LITERATURE REVIEW

2.1 Sugarcane Origin and Distribution:

Sugarcane (*Saccharum officinarum* L.) is believed to have originated in New Guinea or the Indo-Myanmar region (Alexander, 1973; Heinz, 2015). It is now cultivated globally, particularly in tropical and subtropical regions (Daniels et al., 1975).

2.2 Soil and Climatic Requirements:

Sugarcane thrives in diverse soils, from sandy loams to heavy clays, but optimal growth occurs in deep, well-aerated soils with adequate organic matter (Savant et al., 1999; Hunsigi, 2012). It requires high solar radiation (C4 photosynthesis), temperatures between 18–33°C, and moderate rainfall (300–2500 mm annually) (Ali, 1998; Marin et al., 2013).

2.3 Sugarcane Propagation and Sugar Yield:

Sugarcane is vegetatively propagated via stalk cuttings, with harvest cycles ranging from 12–24 months (Hamid et al., 2014). Juice extraction yields 9–18% sucrose, contributing to ~70% of global sugar production (Ming et al., 2010). Sudan’s Kenana Sugar Company produces 56% of the country’s sugar (Elzebair et al., 2015).

2.4 Role of NPK Fertilization:

Nitrogen (N), phosphorus (P), and potassium (K) are critical for sugarcane growth and yield (Estrada-Bonilla et al., 2021). Nitrogen enhances vegetative growth, P supports root development and energy metabolism, while K improves sugar translocation and stress resistance (Meyer, 2013; Chohan et al., 2013). Balanced NPK application increases cane height, thickness, and yield (Junejo et al., 2014).

2.5 Cocoly® Fertilizer and Its Components:

Cocoly® is a water-soluble NPK fertilizer enriched with fulvic acids (FAs) and polymeric acid substances (PAS) (Shandong Co, 2013). FAs improve nutrient uptake and stress tolerance (Pettit, 2004), while PAS enhances soil structure and root nutrient retention (Cocoly, 2013). Studies show Cocoly® significantly boosts sugarcane yield when combined with urea (El Hag et al., 2006).

2.6 Fertilizer Uptake and Management:

Sugarcane is a heavy feeder, requiring optimized NPK application to prevent soil depletion (Dotaniya et al., 2016). Excessive nitrogen reduces sucrose content, while deficiencies limit growth (Soomro et al., 2021). Integrated nutrient management, including Cocoly®, improves yield and sugar recovery (Khan et al., 2005).

III. MATERIAL AND METHODS

3.1 The Experimental Site:

An experiment was conducted at the Research and Development Farm of Kenana Sugar Scheme, Sudan, during season -2021/2022. Kenana is located between White Nile and Blue Nile, at the intersection of longitude 33˚ E, latitude 13˚ N and is 410m above the sea level. Kenana is located about 330km south of Khartoum, and 30km South East of Rabak Town (Elzaki, 2003). The climate is tropical aridic with a summer rainy season of four months, (June to September) with a peak in August. The average annual rainfall is 397 mm. This average fluctuates greatly from year to year. The soil is brown as heavy clay and classified as true vertisols (Ali, 1998). The 60 cm of the soil profile is cracking clay with 40 to 60% clay content (Ali 1986). The dominant clay mineral is montmorillonite (Pecini and Avena, 2013). The soil pH range from7.50 to 8.50 (Jensen, 2010). Above 90% of the upper horizon has an electrical conductivity less than 3 mS/cm^3. The Extractable Sodium Percentage (ESP) is within a range of 510 and 770 ppm (Ali, 1998).

3.2 Experimental Design and Treatment:

The treatments consisted of three Urea fertilizer levels (0, 238, 375 kg/ha) and four Cocoly® fertilizer levels (0, 48, 95, 143 kg/ha). The treatments were arranged in split plot design with four replications, Urea levels were assigned to the main plots and the Cocoly® application to the subplots. The subplot area was 4rows ×8m × 1.50m (48m^2).

3.3 Cultural Practices:

3.3.1 Land Preparation:

Land preparation was done according to the standard practice followed at Kenana estate. This consists of deep ploughing at 60 cm (uproot), a second cross deep ploughing at 30 cm, harrowing, leveling and ridging at 1.5 m between ridges.

3.3.2 Fertilizers and Application:

Urea and Cocoly® fertilizers are applied by placement uniformly in the ridges as one dose in the time of planting.

Cocoly® fertilizer is the granular water-soluble fertilizer, produced by Shandong Cocoly Fertilizer Company, China. Cocoly® is a fertilizer with adequate nutrition and has a complete formula, consist of NPK 14:11:10, Fulvic Acid (FA) 0.5% and Polymeric Acid Substance (PAS) 3%.

3.3.3 Variety:

The variety used in the experiment was Co997. Is an Indian promising variety which is agronomical characterized by good germinability, moderate growth rate, shy flowering, considerable resistance to the parasitic weeds, intermediate resistance to the smut disease, trashy with tightly attached leaf sheath and high cane and sugar yields. The variety occupies about 20.0% of the commercial sugarcane fields at Kenana Sugar Scheme.

3.3.4 Planting Date and Methods:

The crop was planted with stem cutting (setts), obtained from 9 months old seed cane, each set, with three buds. The sets were planted by hand in an end to end arrangement and covered with a thin layer of soil. Planting was done on the twenty-fourth of February 2021.

3.3.5 Irrigation:

Irrigation was carried out immediately after planting and subsequently every 10 days throughout the growing season.

3.3.6 Weeds and Insects Control:

Soil was treated by Regent insecticide and Pendimethalin herbicide to control insects and weeds, respectively. The crop received three hand weeding until full canopy was reached and it was treated by 2.4.D twice to control striga infestation.

3.3.7 On Barring:

At the age of three months after planting split-ridging was done.

3.4 Data Collection:

3.4.1 Germination (%):

After sowing, the number of seedlings emerged in each plot were counted.

3.4.2 Cane Height (cm):

Ten stalks were taken randomly from 2-inner rows in each plot for stalk height measurements. Stalk height was measured from the soil surface to the tip of the flag leaf, top-visible-dewlap leaf (TVD) by a measuring tape and the heights were recorded in centimeters.

3.4.3 Cane Girth (mm):

Stalk diameter was measured by (Vernier caliper) at 30 cm above the soil surface from bottom, mid and top portion and averages of three data were used for statistical analysis and the stalk diameters were recorded in millimeters.

3.4.4 Internodes Number:

At harvest, internodes of 25 randomly selected canes from each treatment were counted thereafter, their average was taken.

3.4.5 Stalk Population (1000 plant/ha:

Millable cane stalks in the 2-inner rows of each plot were counted.

3.4.6 Final Yield (ton/ha):

The crop was harvested in March 2022 when the crop is 13-month old. All millable cane in 2-inner rows of each plot were cut manually and arranged in bundles for weighting. The weight of the harvested millable stalks was recorded using portable spring balance and computed to tons per hectare.

3.4.7 Data Statistical Analysis:

Standard analysis of variance of the split plot design using MSTATC statistical computer programs was used to analyze data, Duncan's Multiple Range Test (DMRT) was used to separate significant means (Gomez and Gomez, 1976).

IV. Results and Discussion

4.1 Effect of Urea and Cocoly® fertilizers and their interaction on cane height (cm):

Effect of Urea fertilizer and Cocoly® fertilizer levels and their interaction on cane height (Table1) showed that, Urea fertilizer had significant effect on cane height. The tallest cane was observed when cane fertilized with 375kg/ha of Urea with a mean cane height of (244.3cm). While, the shortest cane was observed when cane without fertilized of Urea with a mean cane height of (214.4cm). These results agree with (Zeng *et al*., 2020) who obtained that Urea application levels had significant effect on plant height and stalk diameter of sugarcane. Moreover, with the increase of Urea levels, the stalk length and stalk diameter increased.

Table (1) showed that, Cocoly® fertilizer had significant effect on cane height. Moreover, increasing Cocoly® fertilizer levels significantly increased the cane height. The tallest cane was observed when cane fertilized with 143kg/ha of Cocoly® with a mean cane height of (236.8cm). while the shortest cane was observed when cane without fertilized of Cocoly® with a mean cane height of (219.8cm). These result was obtained by (Bokhtiar *et al*., 2002) who found that the cane height and cane thickness increased progressively with application of Cocoly® NPK fertilizer. Besides, Majeedano *et al*., (2003) and (Mahboob *et al*., 2000) who stated that significant maximum cane height was obtained with the balanced Cocoly® NPK application.

The interaction effect of Urea and Cocoly® fertilizer levels on cane height was significant. The tallest cane (252.8cm) was observed when cane fertilized with 375kg/ha of Urea and 143kg/ha of Cocoly®, followed by (252.5cm) was observed when cane fertilized with 375kg/ha of Urea and 95kg/ha of Cocoly®. While, the shortest cane (206.4cm) was observed without Urea and Cocoly® fertilizer application.

TABLE 1
EFFECT OF UREA AND COCOLY® FERTILIZERS AND THEIR INTERACTION ON CANE HEIGHT (cm).

Urea (kg/ha)	Cocoly® (kg/ha)				Mean
	0	48	95	143	
0	206.4 d	214.5 cd	218.6 bcd	218.1 bcd	214.4 B
238	217.6 bcd	228.8 bcd	228.9 bcd	239.5 ab	228.7 AB
375	235.3 abc	236.9 abc	252.5 a	252.8 a	244.3 A
Mean	219.8 B	226.7 AB	233.3 A	236.8 A	
SE ± for Urea		7.87**			
SE ± for Cocoly®		4.17**			
SE ± for Interaction		7.22**			
CV(%)		6.3			

Means followed by the same letter (s) are not significantly different according to Duncan's Multiple Range Test (DMRT).

4.2 Effect of Urea and Cocoly® fertilizers and their interaction on internodes number:

Table (2) shows that the effect of Urea and Cocoly® fertilizer levels and their interaction on internodes number of sugarcane. The results showed that Urea fertilizer had a significant effect on internodes number. The highest internodes number were obtained when cane fertilized 375kg/ha of Urea with a mean of (25) internodes. While the lowest internodes number were obtained without Urea fertilizer with a mean of (21) internodes. These results were in line with the finding of (Ali *et al*., 2000) who stated that increasing Urea fertilizer significantly increased internodes cane number. On the other hand, Cocoly® fertilizer levels had a non-significant effect on internodes number.

The interaction between Urea and Cocoly® fertilizer levels had a significant effect on internodes number. The high internodes number (25) were obtained when cane fertilized with 375kg/ha of Urea with 143, 95 and 48kg/ha of Cocoly® was used respectively. The higher internodes number may be attributed to, genetically controlled characters.

TABLE 1
EFFECT OF UREA AND COCOLY® FERTILIZERS AND THEIR INTERACTION ON INTERNODES NUMBER.

Urea (kg/ha)	Cocoly® (kg/ha)				Mean
	0	48	95	143	
0	21 b	21 b	21 b	23 ab	21 B
238	21 b	23 ab	23 ab	24 ab	23 B
375	24 ab	25 a	25 a	25a	25 A
Mean	22	23	23	24	
SE ± for Urea		0.39**			
SE ± for Cocoly®		0.50			
SE ± for Interaction		0.89**			
CV(%)		8.2			

Means followed by the same letter (s) are not significantly different according to Duncan's Multiple Range Test (DMRT).

4.3 Effect of Urea and Cocoly® fertilizers and their interaction on cane girth (mm):

The effect of Urea and Cocoly® fertilizer levels and their interaction on cane girth is shown in (Table 3). The results showed that, Urea fertilizer had a significant effect on mean cane girth. The largest cane girth was observed when cane fertilized with 375kg/ha of Urea with a mean cane girth (22cm). while the smallest cane girth was observed when cane without fertilization with Urea with a mean cane girth (20.8cm). These results agreed with the finding of (Zeng *et al*., 2020) who reported that Urea application levels had significant effect on stalk diameter and plant height of sugarcane. In addition to, Urea fertilizer improved the stalk diameter, tillering rate, plant height, stalk weight, millable stalks/ha and cane yield.

Cocoly® fertilizer levels had no significant effect on mean cane girth. These results was contrary to that obtained by (Bangar *et al*., 1994), (Sharma and Gupta, 1991), (Mahboob *et al*., 2000) and (Shafshak *et al*., 2001) who reported that the maximum cane girth obtained when applied higher doses of Cocoly® NPK fertilizer. Moreover, Bokhtiar *et al*., (2002) found that cane thickness and cane height increased progressively with the application of Cocoly® NPK fertilizer. Besides, Majeedano *et al*., (2003) stated that significantly maximum cane thickness and cane height was obtained with the balanced Cocoly® NPK application.

The interaction effect of Urea and Cocoly® fertilizer levels on cane girth was significant. The highest cane girth 23.65 was obtained when cane fertilized with 143kg/ha of Cocoly® and 238kg/ha of Urea.

TABLE 1
EFFECT OF UREA AND COCOLY® FERTILIZERS AND THEIR INTERACTION ON CANE GIRTH (mm).

Urea (kg/ha)	Cocoly® (kg/ha)				Mean
	0	48	95	143	
0	21.27 ab	19.83 b	20.77 ab	21.40 ab	20.82 B
238	22.02 ab	20.65 ab	21.02 ab	23.65 a	21.84 A
375	22.25 ab	22.10 ab	21.48 ab	22.00 ab	21.96 A
Mean	21.85	20.86	21.09	22.35	
SE ± for Urea		0.23**			
SE ± for Cocoly®		0.55**			
SE ± for Interaction		0.95			
CV (%)		8.9			

Means followed by the same letter (s) are not significantly different according to Duncan's Multiple Range Test (DMRT).

4.4 Effect of Urea and Cocoly® fertilizers and their interaction on stalk population (1000 plant/ha):

Table (4) shows that the effect of Urea and Cocoly® fertilizer levels and their interaction on cane population. The results showed that application of Urea fertilizer has a non-significant effect on stalk population. These results are contrary to that obtained by (Borden 1945) who reported that higher amounts of Urea produced dense stalk population. In addition to that, (Afzal *et al*., 2003) and (Sinha *et al*., 2005) reported that increasing the dose of Urea increased number of millable cane per unit area.

Cocoly® fertilizer levels had significant effect on stalk population. Thus, increasing Cocoly® fertilizer increased stalk population. The higher stalk population with a mean of (145) was obtained when sugarcane fertilized with 95kg/ha of Cocoly®. While lower stalk population with a mean of (135) was obtained when sugarcane without treated by Cocoly®. These results were supported by finding of (Asif *et al*., 2002). Who reported that cane millable stalks, increased progressively with increased application of Cocoly® NPK fertilizer.

The interaction effect of Urea and Cocoly® fertilizer levels on plant population was significant. The highest stalk number (154) was obtained when 375kg/ha of Urea and 143kg/ha of Cocoly® were applied.

TABLE 1
EFFECT OF UREA AND COCOLY® FERTILIZERS AND THEIR INTERACTION ON STALK POPULATION (1000 plant/ha)

Urea (kg/ha)	Cocoly® (kg/ha)				Mean
	0	48	95	143	
0	133 b	134 b	141 ab	138 b	136
238	137 b	148 ab	146 ab	138 ab	142
375	136 b	145 ab	148 ab	154 a	146
Mean	135 B	142 AB	145 A	143 AB	
SE ± for Urea		2006.1			
SE ± for Cocoly®		1186.3**			
SE ± for Interaction		2054.8**			
CV(%)		6.9			

Means followed by the same letter (s) are not significantly different according to Duncan's Multiple Range Test (DMRT).

4.5 Effect of Urea and Cocoly® fertilizers and their interaction on stalk weight (kg):

The effect of Urea an Cocoly® fertilizer levels and their interaction on stalk weight is shown in (Table 5). The results showed that, Urea fertilizer had a non-significant effect on mean stalk weight. These results disagreed with the results of (Zeng *et al*., 2020) who reported that Urea fertilizer had significant effect on the stalk weight, stalk diameter, tillering rate, plant height, millable stalks/ha and cane yield.

Cocoly® fertilizer had a significant effect on stalk weight. The highest stalk weight was obtained when sugarcane fertilized with 143kg/ha of Cocoly® with a mean of 1.23kg. While the lowest stalk weight was obtained when Cocoly® fertilizer untreated with a mean of 1.08kg, followed by 1.08kg was obtained when cane fertilized with 48kg/ha of Cocoly®. These results were in line with the findings of (Faqir and Shahid 2000) who obtained that maximum stalk weight, number of millable cane per meter square, and cane yield at the rate of Cocoly® NPK fertilizer 150 kg/ha.

The interaction between Urea and Cocoly® fertilizer levels had a significant effect on mean stalk weight (kg). The highest value of stalk weight (1.3kg) was obtained when sugarcane fertilized with 375kg/ha of Urea and 143kg/ha of Cocoly®. While the lowest value of stalk weight (1.0kg) was obtained when sugarcane fertilized with 238kg/ha of Urea and 48kg/ha of Cocoly®.

TABLE 1
EFFECT OF UREA AND COCOLY® FERTILIZERS AND THEIR INTERACTION ON STALK WEIGHT (kg).

Urea (kg/ha)	Cocoly® (kg/ha)				Mean
	0	48	95	143	
0	1.100 ab	1.175 ab	1.100 ab	1.175 ab	1.138
238	1.050 ab	1.000 b	1.050 ab	1.200 ab	1.075
375	1.100 ab	1.075 ab	1.225 ab	1.300 a	1.175
Mean	1.083 B	1.083 B	1.125 AB	1.225 A	
SE ± for Urea		0.15			
SE ± for Cocoly®		0.04**			
SE ± for Interaction		0.08**			
CV(%)		13.5			

Means followed by the same letter (s) are not significantly different according to Duncan's Multiple Range Test (DMRT).

4.6 Effect of Urea and Cocoly® fertilizers and their interaction on cane yield (ton/ha):

Urea fertilizer had a significant effect on cane yield as shown in (Table 6). These results agreed with (Ibrahim, 1979) who reported that Urea application generally increased the yields of both cane and sugar. Furthermore, increase in cane tonnage due to increase in Urea fertilizer application has been reported by (Samuels *et al*., 1952), (Parashar *et al*., 1980), (Silva *et al.*, 2019) and (Zeng *et al.*, 2020). Similarly, Yang *et al*., (2019) reported that larger Urea supplies increased yield by increasing cane weight and height.

Cocoly® fertilizer levels had a significant effect on cane yield. The result is indicated that, cane yield increased with increasing Cocoly® fertilizer levels. These results agreed with (Faqir and Shahid, 2000) who reported that cane yield was significantly increased with Cocoly® fertilizer application. Khan *et al*., (2005) reported that sugarcane yield increased with the increase in balanced nutrients levels. Yadava, (1993) stated that being a long duration crop an adequate and balanced supply of all these nutrients is required for obtaining sustainable crop yield. Asif *et al*., (2002), (Nasir *et al*., 1994) and (Ayoub *et al*., 1999) reported that Cocoly® NPK application was important for maximum cane yield. Chaudhry and Chattha, (2000) reported that, maximum cane yield was obtained when using Cocoly® NPK fertilizer.

The significant positive relationship between cane yield and different Cocoly® levels were observed by (Bokhtiar *et al*., 2002) and (Gurmani and Khan, 2003).

The cane yield parameters i.e. cane height, number of tillers, millable cane stalks, yield of cane and sugar increased significantly with application of Cocoly® NPK levels as reported by (Asif *et al*., 2002).

Interaction between Urea and Cocoly® fertilizer levels had a significant effect on cane yield. The highest cane yield (199.9 t/ha) was obtained when sugarcane fertilized with 375kg/ha of Urea and 143kg/ha of Cocoly®. While the lowest yield (138.3 t/ha) was obtained without Urea and Cocoly® fertilizers application.

TABLE 1
EFFECT OF UREA AND COCOLY® FERTILIZERS AND THEIR INTERACTION ON CANE YIELD (ton/ha).

Urea (kg/ha)	Cocoly® (kg/ha)				Mean
	0	48	95	143	
0	138.3 c	147.1 bc	149.5 bc	152.0 bc	146.7 B
238	140.7 c	149.2 bc	151.2 bc	164.1 bc	151.3 B
375	152.2 bc	159.2 bc	178.7 ab	199.9 a	172.5 A
Mean	143.8 B	151.8 B	159.8 B	172.0 A	
SE ± for Urea		6.00**			
SE ± for Cocoly®		2.30**			
SE ± for Interaction		4.00**			
CV(%)		12.1			

Means followed by the same letter (s) are not significantly different according to Duncan's Multiple Range Test (DMRT).

V. CONCLUSIONS AND RECOMMENDATION

5.1 Conclusion

- Increasing Urea fertilizer levels significantly increased cane height, cane girth, cane internodes and cane yield.
- Increasing Cocoly® fertilizer levels significantly increased plant height, stalk population, stalk weight and cane yield.
- The highest cane yield (199.9 t/ha) was obtained when 375kg/ha of Urea and 143kg/ha of Cocoly® were applied.

5.2 Recommendation:

Based on the results of this study it could be recommended that to obtain high cane yield of Sugarcane (variety Co997), the crop should be fertilized by Urea at the rate of 375kg/ha and Cocoly® at the rate of 143 kg/ha.

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