SHORT NOTE

Response of sugarcane (*Saccharum* spp) ratoons to N rate applied in a single or a split dose under Guneid Sugar Scheme conditions

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Sugarcane in Sudan is grown in the central clay plain where the soils are mostly Vertisols. These soils are generally low in nitrogen (0.03 to 0.045%) and organic matter (<1.0%). Therefore, nitrogenous fertilizers are needed for sustainable production of sugarcane and other crops. It is known that an increase of N fertilizer is associated with an increase of each of the number of millable stalks, plant height, cane and sugar yields until an optimum rate is reached beyond which each of the above parameters is negatively affected (Dillewijn, 1952; Wiedenfeld, 1997). This is especially true for the quality parameters of the crop (Humbert, 1968). This was confirmed by Rattey and Hogarth (2001) who reported that commercial cane sugar was reduced as the rate of applied N increased. Urea (46% N) is the main N source for sugarcane and other crops in Sudan. Thus, determining the optimum rates of urea is necessary because of its increased price, high cost of transport, storage and application.

Generally, in the cultivation of sugarcane, ratoons comprise more than 75 % of the annually harvested crop. Unlike the plant cane crop, it has been reported that yield response of ratoons to N application was relatively higher (DuToit, 1959; Wiedenfeld, 1997). However, recommendations in Sudan ranged from 69 to 80 kg N /feddan (Mohamed, 1990; Ali, 2007) [one feddan (f) = 0.42 ha].

Split application of N has little advantage over the full dose (Barnes, 1974). This is because the sugarcane plant absorbs N during the first few months of age in amounts more than needed (luxury consumption) that will be stored in the plant and is used later during the "boom stage of growth" (Humbert, 1968). Moreover, the split application has the disadvantages of increased cost and the ill-effects of additional movement of machines in the field.

In comparison to the above statements, cane growers believe that the addition of more N always results in more cane yields, especially the farmers of Guneid Sugar Scheme. They attribute their recently obtained high cane yields to the extra dose of N which they apply beyond the official dose (92 kg N/f ≡219 kg N/ ha).

Thus, the objective of the present study was to compare a lower and a higher rate of N than the official dose and splitting the dose to simulate what is mostly done by Guneid Sugar Scheme farmers.

The present research was conducted at Guneid Sugarcane Research Center farm which lies in the intersection of latitude 14^0 52′ N and longitude 33^0 19′ E. The experiments were conducted during the seasons 2006-2009. N rates were 69 and 104 kg N/ f (164 and 246 kg N ha^{-1}) applied in the form of urea. Nitrogen was applied either in a single dose or a split dose. The splitting was done by the ratio 2:1. The full and the first part of splitting the dose (⅔rd) were added at 20 days from the first irrigation of the ratoon cane crop, and the remainder was given later when the cane age was three months. Urea was added at both sides of the row, just like machine application. Treatments were arranged in a

randomized complete block design with four replicates. The experimental plot consisted of 4 rows, 10 m long and 1.5 m apart. The sugarcane cultivar was Co 6806.

Yield and quality parameters were measured at harvest. All millable stalks in the two inner rows were manually harvested by cane knives, topped, counted and weighed. Stalk population and cane yield per feddan were calculated. From the same two inner rows, a sample of 10 mature cane stalks were randomly taken to determine the stalk height and quality parameters which consisted of brix% cane (total soluble solids), pol % cane (sucrose content of cane), fiber % cane, % of estimated recoverable sugar (ERS) and sugar yield. Quality parameters were analyzed according to the International Commission of Uniform Methods of Sugar Analysis (ICUMSA) (Schneider, 1979).

Results showed an insignificant increase in cane yield and a significant increase in number of millable stalks at the rate of 225 kg urea/ f over that of 150 kg urea/ f treatment in the first ratoon of season 2007/08 (Table 1). The data also showed an insignificant increase in cane yield at the rate of 225 kg urea/f in season 2008/09 (Table 2). However, the above differences became narrower in cane yield between the two rates in the second ratoon (Table 3). These results confirm the findings of Ali (2007) who recommended 150 kg urea/f for the sugarcane for the first and second sugarcane ratoons.

In contrast to cane yield, the data in Tables 1 and 2 showed a significant decrease in the quality parameters such as brix % cane, pol %cane, ERS %, with the increase of N rate from150 kg urea/ f to 225 kg urea/ f. It is known that N application after a certain limit has adverse effects on the quality of sugarcane (Humbert, 1968).

However, split application of N didn't affect either cane yield or the quality parameters (Tables 1, 2 and 3). This result was in conformity with that of Barnes (1974) who stated that split application of N to sugarcane had little advantage over the full dose.

It is thus seen that the insignificant increase in cane yield due to the application of the higher rate of N was outweighed by the significant decrease in the quality of cane which ended in lower sugar yield. Based on the results of this study, the rate of 150 kg urea /f, i.e., (69 kg N/ f ≡164 kg N ha^{-1}) in a single dose, is seen as a probable wise husbandry practice for the cane and sugar yields of the first and the second ratoon crops under Guneid Sugar Scheme conditions. N should be applied at 20 days from the first irrigation of the sugarcane ratoon at both sides of the cane row followed by onbarring which covers the fertilizer.

Table1. Effect of N rates, single or split dose, on cane yield and quality components of sugarcane, 1st ratoon, season 2007/08, (established in January 2007).

Parameters	Urea (kg/f)		Split dose	Full dose	S.E (±)	C.V. (%)
	150	225				
No. of millable stalks /f	65406.00	68381.00	67524.00	66264.00	721.00	4.31
Stalk height (cm)	299.00	292.60	299.10	292.40	2.74	3.70
Yield of cane (t /f)	67.14	70.26	69.18	68.22	1.15	6.67
Brix% cane	17.74	17.21	17.33	17.63	0.17	3.84
Pol% cane	15.43	14.86	14.93	15.37	0.18	4.62
Fiber% cane	17.19	17.38	17.39	17.18	0.39	9.08
ERS (%)	11.87	11.36	11.42	11.81	0.16	5.56
TS (ton /f)	7.98	7.98	7.89	8.07	0.17	8.52

Table 2. Effect of N rates, single or split dose, on cane yield and quality components of sugarcane, 1st ratoon, season 2008/09 (established December 2007).

Parameter	Urea (kg/f)		Split dose	Single dose	S.E (±)	C.V. (%)
	150	225				
No. of millable stalks	64980.00	63901.0(	64138.00	64744.00	1862.00	11.56
Stalk height (cm)	208.70	211.1(	210.30	209.50	6.31	12.02
Yield (t/f)	50.09	52.4:	50.95	51.56	1.72	13.42
Brix% cane	16.58	15.9:	16.29	16.22	0.072	1.77
Pol% cane	13.06	12.3:	12.69	12.72	0.14	4.41
Fiber% cane	15.12	15.1(	15.00	15.28	0.233	6.15
ERS(%)	10.06	9.2:	9.63	9.71	0.15	6.26
TS (ton/f)	5.03	4.87	4.90	5.00	0.191	15.41

Table 3. Effect of N rates, single or split dose, on cane yield and quality components of sugarcane, 2nd ratoon, season 2008/09 (established in February 2008).

Parameter	Urea (kg/f)		Split dose	Full dose	S.E (±)	C.V. (%)
	150	225				
No. of millable stalks	62251.00	60498.00	61084.00	61665.00	708.20	4.60
Stalk height (cm)	230.40	224.20	227.50	227.10	3.82	6.72
Yield (t/f)	57.33	57.98	58.68	56.63	1.16	8.04
Brix% cane	18.10	17.94	18.21	17.83	0.174	3.86
Pol% cane	14.31	14.04	14.26	14.09	0.105	2.97
Fiber% cane	16.31	16.40	16.42	16.30	0.235	5.76
ERS(%)	12.33	12.04	12.35	12.10	0.113	3.70
TS (ton/f)	7.08	6.98	7.20	6.87	0.174	9.90

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إستجابة خلف محصول قصب السكر للنيتروجين كجرعة واحدة أو جرعة مقسمة تحت ظروف مشروع سكرالجنيد

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الخلاصة

09/2007 فى مزرعة مركز بحوث قصب السكر الواقعة ضمن نطاق مشروع سكر الجنيد أجريت التجارب الحالية فى المواسم فى سهل السودان الطينى الأوسط. هدفت هذه الدراسة لبحث استجابة خلف محصول قصب السكر لجرعة عالية من النيتروجين (يوريا) مع جرعة مخفضة عنها مع مقارنة تقسيم كل جرعة بنسبة 1:2 مع إضافتها كاملة و ذلك لتكون مماثلة لممارسة المزارعين فى ذلك المشروع. الجرعتان الكاملتان لسماد اليوريا هما 150 و225 كجم للفدان (69 و104 كجم نيتروجين للفدان ≡ 164 و246 كجم نيتروجين للهكتار). كما أضيف الجزء الأول من كل جرعة مقسمة و الإضافة الكاملة بعد 20 يوما من الرية الأولى للخلفة و أضيف الباقى من الجرعة المقسمة عندما كان عمر القصب ثلاثة شهور. وضع هذا الترتيب العاملى فى تصميم القطاعات العشوائية الكاملة. أوضحت النتائج وجود زيادة قليلة غير معنوية فى إنتاجية القصب فى الخلفة الأولى فى موسمى 08/2007 و 09/2008 للجرعة 225 كجم يوريا للفدان على الجرعة 150 كجم للفدان. كما نتج عن ذلك زيادة معنوية فى عدد السيقان القابلة للطحن للجرعة الأعلى بالنسبة للخلفة الاولى فى موسم 08/2007. وتلاشت هذه الفروقات بالنسبة للخلفة الثانية (موسم 09/2008). وعلى عكس إنتاجية القصب ومكوناتها, انخفضت معنويا مكونات جودة السكر مثل نسبة المواد الصلبة الذائبة (brix) والسكريات (pol) و نسبة الإستخلاص (ERS) بزيادة جرعة اليوريا من 150 كجم للفدان إلى 225 كجم للفدان مما أعطى محصول سكر أقل نسبيا بالنسبة للجرعة الأعلى. لم تؤثر معاملة تقسيم جرعة اليوريا على أى من إنتاجية القصب و مكوناتها أو مكونات جودة القصب وكذلك بالنسبة لإنتاجية السكر. و عليه تعتبر الجرعة 150 كجم يوريا للفدان (164 كجم نيتروجين للهكتار), هى الجرعة الأنسب لإنتاجية القصب و السكر للخلفة الأولى والثانية تحت ظروف مشروع سكر الجنيد, مضافة كجرعة واحدة بدون تقسيم, على جانبى خط نباتات القصب متبوعة مباشرة بعملية العزيق والتى تعمل على تغطية السماد.