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Original Research Article

Evaluating the potential of incorporating sugarcane host-plant resistance into integrated nematode management strategies

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Alexander Kipkorir Chirchir[1, 2,*], John W. Kimenju[2], Emmanuel S. Ariga[2], George M. Kariuki[3] and Chrispine O. Omondi[4]

[1]Kenya Agricultural and Livestock Research Organization-Sugar Research Institute, P.O. Box 44-40100, Kisumu Kenya.
[2]Department of Plant Science and Crop Protection, University of Nairobi, P.O. Box 29053-00625, Nairobi, Kenya.
[3]Kenyatta University, Department of Agric Science and Technology, P.O. Box 43844-00100 Nairobi, Kenya.
[4]Kenya Agricultural and Livestock Research Organization-Coffee Research Institute, P.O. Box 4-00232, Ruiru, Kenya.

*Corresponding Author
E-mail: alkchirchir@yahoo.com
Tel.: +254 722 206921

Certain sugarcane cultivars have been shown to exhibit resistance against some parasitic nematode species. A field study was conducted to assess potential of integrating this property into nematode control packages to enhance sugarcane productivity. Three sugarcane cultivars were evaluated in a split-plot design under three rates of nematicide aldicarb and replicated thrice. Significant differences ($P \leq 0.05$; $P \leq 0.01$) were observed in girth, plant height, millable stalks number and yield among the different cultivars and nematicide rates. KEN83-737, N14 and Co 421 reduced nematode populations in treated plots by 67, 49 and 32% while supporting nematode population growth in untreated plots by 24, 33 and 92% respectively at 9 months after planting. Reduction in nematode numbers resulted in a mean increase in yield, girth, plant height, millable stalks number and pol % cane by 34, 18, 37, 53 and 6% respectively. This reduction was highest for resistant and lowest for susceptible cultivars, hence indicating the reduction was partly due to host-plant resistance status of the cultivars. This study established that use of resistant/ tolerant cultivars with aldicarb has an additive effect in reducing nematode numbers resulting in improvement of yield and quality of sugarcane.

Key words: Host-plant resistance status, nematodes, sugarcane cultivars, sugarcane productivity.

INTRODUCTION

Sugarcane (*Saccharrum* spp. hybrids) is a tall perennial crop globally important due to its day to day utilities of providing for up to 60 % of the global sugar needs while sugar beet provides the balance of 40 % (Onwueme and Sinha, 1999, Girei and Giroh, 2012). As a C_4 crop, sugarcane has the potential of utilizing solar energy to form sucrose during its four stages of growth and development, thus is normally globally cultivated mainly within the latitudes 36.7° N and 31.0° S of the equator and up to 1600 meters above sea level in the tropical and sub-tropical regions (Anon, 2013). Sugarcane production is mainly highest in five nations worldwide, namely: Brazil, Colombia, Philippines, India and South Africa (Anon., 2013). Globally sugarcane covers an area of 26 million hectares from which 1.83 billion tonnes is harvested annually (Anon, 2013). In Kenya, the sugar industry is responsible for sustaining 25 % of the households amongst the population with sugarcane production contributing over 10 % to the total agricultural gross domestic product (GDP). It provides a source of employment and revenue generation for most households in the sugarcane belt of western Kenyan (Kenya Sugar Board (KSB), 2010).

Despite the important contribution by the sugar industry to the economy, the cane yields have experienced a sharp

decline from 74 tons ha^{-1} to 55 tons ha^{-1} between 2004 and 2013 (KSB, 2013). The yield decline has been attributed to a number of factors among which is susceptibility of the crop to diseases (e.g. sugarcane smut, ratoon stunting disease and sugarcane mosaic) and pests which include termites, moles and plant parasitic nematodes (PPN) (KSB, 2013). Worldwide PPN have been known to cause annual yield losses of 15.3% on sugarcane (Sasser and Freckman, 1987), a crop grown largely as a monoculture with a single cycle lasting up to 60 months in the field. This practice usually leads to build up of certain pests and diseases. Populations of PPN build up significantly as sugarcane is grown continuously on the same piece of land over a long period under monoculture. Use of nematicides by small-scale sugarcane farmers has been found to be none cost-effective due to their high pricing in addition to having detrimental environmental effects. Declining soil fertility and inadequate fertilization by the farmer is likely to have resulted in reduction of sugarcane tolerance to nematode infestation. A number of nematodes among them *Pratylenchus* spp. and *Meloidogyne* spp. have been observed to parasitize sugarcane causing a yield reduction of 1.6 million tonnes cane per annum and reducing the lengths and weights of both sugarcane shoots and roots (Cadet and Spaull, 2005; Chirchir et al., 2011; Dinardo-Miranda, 2005; Barbosa et al., 2013). However, one way of managing nematodes would be by use of resistant cultivars. Resistant cultivars have several advantages over other methods of reducing nematode populations: their use requires little or no technology and is cost-effective; they allow rotations to be shortened and best use to be made of the land; and they do not leave toxic residues. They provide an effective and economical method for managing nematodes in both high- and low-cash value cropping systems. They are environmentally compatible and do not require specialized applications, as opposed to most chemicals and, apart from preference based on agronomic or horticultural desirability, do not require an additional cost input or deficit. In less developed countries and in low-cash crop systems, plant resistance is probably the most viable solution to nematode problems (Tridgill, 1991). Studies like that by Santos et al. (2012) have demonstrated the existence of resistance to *Pratylenchus* spp. among Brazilian sugarcane cultivars. This study was undertaken to evaluate the presence or otherwise of host-plant resistance against plant parasitic nematodes among sugarcane cultivars grown in Kenya and thereby assess the potential of incorporating it in integrated nematode management packages.

MATERIALS AND METHODS

Site description

This study was conducted at Kenya Agricultural and Livestock Research Organization - Sugar Research Institute (KALRO-SRI) farm at Kibos (34° 48'E - 0°4'S) with an elevation of 1184 meters above sea level. The site had a mean daily temperature of 23°C with long term mean rainfall of 1464 mm per annum with eutric cambisols.

Sugarcane cultivars

Three sugarcane cultivars were selected based on their known host resistance status to plant parasitic nematodes: KEN 83-737 as resistant, Co 421 susceptible and N14 tolerant. Seedcane was harvested at ten months and the stalks cut into 3-budded setts. Planting furrows were prepared each 5 m long and 1.2 m apart giving a net plot size of 30 m^2 (5 rows x 5 m x 1.2 m). 15 setts were planted per row.

Diammonium phosphate was applied at planting at the recommended rate of 100 kg ha^{-1} and urea was applied as top dressing at five months at the recommended rate of 200 kg ha^{-1}.

Treatments

Aldicarb (Temik® 10 G) was used for treatment in this trial and applied at two rates: recommended dose of 3 kg ha^{-1} and half the recommended dose at 1.5 kg ha^{-1}. Untreated plots served as control.

Experimental design

The trial was established as a split plot design and replicated three times over two blocks. Main plot received the nematicide treatment while subplot the cultivar.

Data collection

Nematode population numbers were determined at 0, 9 and 18 months after planting (MAP). Initial nematode population was determined on newly prepared seedbed just before planting. Soil samples were collected using a soil auger. Eight soil sub-samples were collected also at 9 and 18 MAP from the sugarcane rhizosphere at a depth of 5-20cm, mixed to form a composite sample and placed in a polythene bag and taken to the laboratory.

Germination was determined at 42 days after planting. At harvest, 10 stalks from each of the three central rows were selected at random to form the sample population of 30 stalks per plot. Using the sample, girth was determined by measuring the thickness at the mid-section of the stalk by use of veneer calipers; plant height was determined by measuring the stalk length by use of a metre rule; and, yield was determined by weighing the stalks using a tripod and weighing scale and the weight expressed as tonnes per hectare. The total plant population was determined by counting the total number of millable stalks in the three central rows using a tally counter. Nematode counts were determined at planting, nine months after planting (MAP) and at harvest. Field brix (brix % cane) was determined by use of hand refractometer. 15 stalks from each plot were taken for laboratory analysis to determine the juice quality parameters: Pol % cane, Fibre % cane, Pol % juice, Brix % juice, Purity % juice and Commercial Cane Sugar calculated.

Table 1. Effect of cultivar and nematicide application on girth, plant height, millable stalks number and yield of sugarcane

		Girth (mm)	Plant height (cm)	Millable stalk numbers (no.)	Yield (tonnes per ha)
Cultivar	Ken83_737	24.74	301.86 ^{a}	257.72 ^{a}	177.50
	N 14	23.82	279.14 ^{ab}	191.56 ^{b}	171.17
	Co 421	23.67	272.39 ^{b}	184.61 ^{b}	166.44
Nematicide Rate	Full Rate	26.62 ^{a}	336.69 ^{a}	263.44 ^{a}	200.44 ^{a}
	Half Rate	23.93 ^{b}	288.39 ^{b}	214.67 ^{b}	173.72 ^{b}
	Control	21.67 ^{C}	228.31 ^{c}	155.78 ^{c}	140.94 ^{c}
	Mean	24.07	284.46	211.30	171.70
	CV%	6.20	9.89	11.46	11.79
	H.S.D $_{(0.05)}$	0.82	22.75	19.58	16.37
f-values	Cultivar	2.71	5.42 **	49.97 **	1.35
	Nematicide Rate	49.68 **	67.00**	89.18 **	38.98**
	Cultivar*Nematicide Rate	0.72	2.94*	0.94	0.26

Means followed by different letters on the same column are significantly different at $P \leq 0.05$ (*) and at $P \leq 0.01$ (**).

Processing of nematodes

Nematodes were extracted from 200 cm^3 soil obtained from each of the plots using the modified Baermann funnel technique (Hooper, 1990). Nematodes from five gram root samples were extracted using the maceration/filtration technique described by Hooper (1990). The nematodes were killed using gentle heat in a water bath at 50–70°C and fixed using the method described by Hooper (1990). Using a high-resolution microscope nematodes were identified up to the genus level following the key by Mai and Lyon (1975) and the counts recorded. From the preserved nematodes suspension, two ml was drawn using a pipette, placed in a counting dish under a light microscope and nematodes counted thrice with the average recorded.

Data analysis

Data was subjected to analysis of variance (ANOVA) and means were separated by honestly significant difference (HSD) test at $P < 0.05$ and $P < 0.01$ using SAS ® Proprietary Software Release 9.2. Nematode counts were log transformed into Log x+1 to fit the assumptions of ANOVA but means reported are actual figures collected. Multiple regression analysis was performed using PROC REG to determine the predictors of yield and commercial cane sugar using variables in their respective regression models.

RESULTS

Plant parasitic nematodes extracted from the experimental site belonged to 17 genera namely *Pratylenchus, Meloidogyne, Helicotylenchus, Tylenchus, Rotylenchus, Scutellonema, Xiphinema, Trichodorus, Paratylenchus, Hirsmaniella, Ditylenchus, Hoplolaimus, Rotilenchulus, Criconema, Dolichodorus, Longidorus* and *Criconemoides.* The three most predominant nematodes were in the genera *Pratylenchus, Meloidogyne* and *Helicotylenchus* accounting for 68%, 22% and 5% of all the nematodes respectively. Members of each of the other genera accounted for less than one per cent.

Effect of nematicide application on sugarcane yield parameters

Different yield parameters exhibited significant differences ($P \leq 0.05$ and $P \leq 0.01$) for different cultivars under varied nematicide rates of application (Table 1). Both plant height and millable stalks number for KEN 83-737 were significantly higher compared to N14 and Co 421 cultivars ($P \leq 0.01$).

Application of the nematicide at either of the two rates significantly increased the girth, plant height, total number of stalks and the yield of sugarcane. However, the recommended rate had a significantly higher effect than the half rate ($P \leq 0.01$). There was a significant interaction between sugarcane cultivar and nematicide rate only in the improvement of the plant height.

Interaction between sugarcane cultivars and nematicide rates on yield parameters

Significant ($P \leq 0.05$) interactions between sugarcane cultivars and nematicide rates were observed on the yield and its parameters (Figure 1). Ken 83-737 and Co 421 had significantly thicker stems at the higher nematicide rate compared to the lower rate and control. Whereas the stem thickness was not significantly different for the two nematicide rates for N14, both were significantly thicker than for the control.

Nematicide application produced significantly ($P \leq 0.05$)

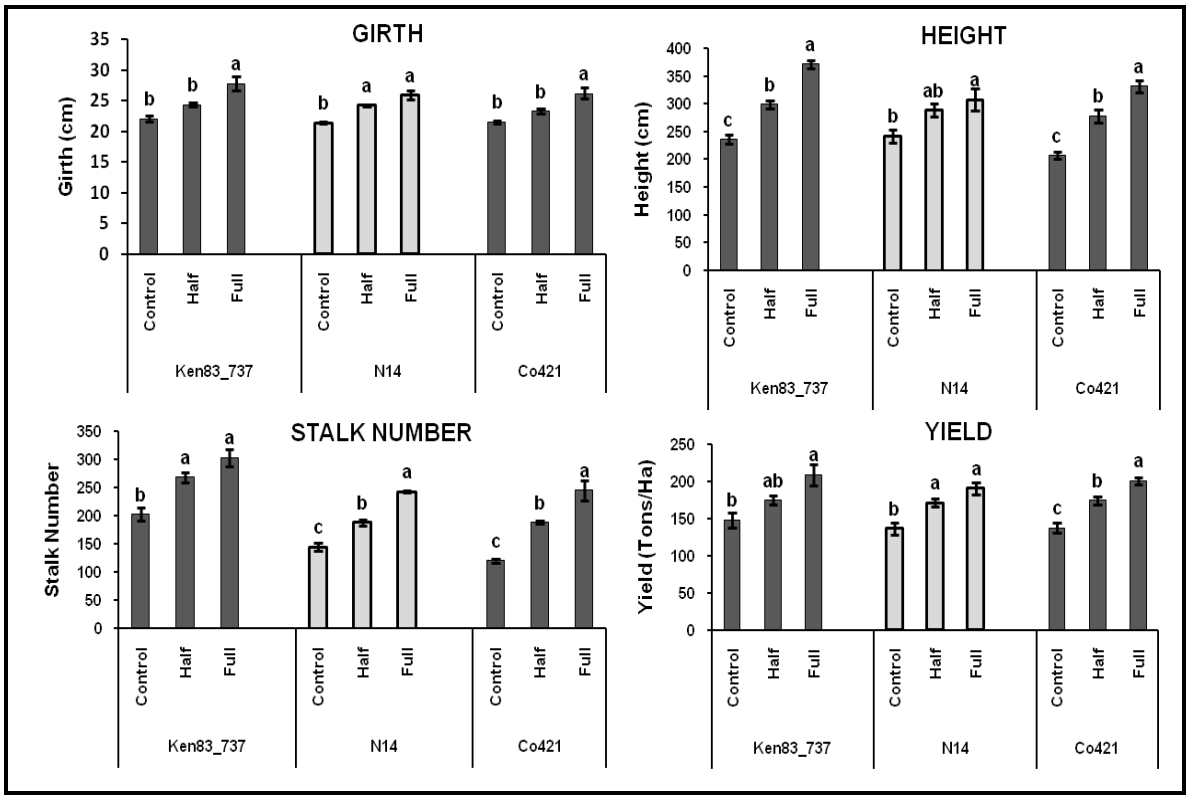

Figure 1: Effect of cultivar and nematicide application on girth, plant height, millable stalks number and yield of sugarcane. Means of bars having different letters over them are significantly different at $P \leq 0.05$.

taller plants for both KEN 83-737 and Co 421 compared to control. For N14 however the lower nematicide rate did not produce significantly longer stalks than the control. Millable stalks number for KEN 83-737 was comparatively higher than both N14 and Co 421 over the different rates of nematicide application. Whereas nematicide application did not produce significantly different stalks number over the two rates for KEN 83-737, both rates had significantly higher number of millable stalks than the control. KEN 83-737 yield was significantly higher under the recommended rate than the control. However, the half rate did not significantly differ with the control. Co 421 had significantly different yields for all treatments with highest yields in recommended rate and lowest in the control.

Effect of interaction between sugarcane cultivars and nematicide rates on nematode population

Interaction effects between the sugarcane cultivars and nematicide rates revealed significant ($P \leq 0.05$ and $P \leq 0.01$) differences in the numbers of plant parasitic nematodes present at different times of cane growth (Table 2). The nematode population in KEN 83-737 and N14 differed significantly in their numbers across nematicide rates only at 9 months after planting (MAP) but not at harvest. However, for Co 421 the nematode numbers differed significantly across the nematicide rates at both 9 MAP and at harvest. The control plots generally exhibited the highest number of nematodes compared to the nematicide applied plots for all the cultivars. Indeed, in Co 421 the average nematode counts was significantly higher in the control plots compared to both the half and full rate application treatments, while in N14 the numbers in the control plots were only significantly higher than those in the recommended rate treatment.

Nematode population trends during the cane growth period

The nematode numbers differed during the progressive growth of the cane crop across all the treatments (Figure 2). The control had the highest nematode count compared to the two nematicide treatments. A general nematode population decline was recorded in the nematicide treated plots while for the control there was an initial increase up to 9 months before decreasing by harvest time at 18 months.

Effect of different nematicide rates on cane quality components

The different nematicide rates significantly ($P \leq 0.05$; $p \leq 0.01$) affected cane quality components for different cane cultivars (Table 3). Significantly ($P \leq 0.05$) different pol % cane, pol % juice and brix juice were observed among the cultivars. Different nematicide rates and cultivars had

Table 2. Effect of cultivar and nematicide application on nematode population

		P_i	P_m	P_f	Average
Ken83-737	Full	1104.90	598.65 ab	116.02	732.87
	Half	855.98	54.71 b	188.01	570.08
	Control	1183.57	1469.50 a	1264.90	1392.61
	mean	1038.32	365.22	302.65	834.90
	CV %	6.99	20.64	24.76	6.58
	H.S.D *(0.05)*	0.42	1.11	1.30	0.39
	f-values	0.42	5.98 *	2.41	3.59
N14	Full	1027.95	258.30 b	262.50	618.71 b
	Half	1416.44	976.46 a	205.62	1067.84 a
	Control	1342.56	1779.11 a	1448.86	1575.90 a
	mean	1250.37	766.02	427.97	1013.61
	CV %	5.27	7.44	21.38	2.98
	H.S.D *(0.05)*	0.33	0.44	1.17	0.18
	f-values	0.76	13.17 **	2.12	17.48 **
Co 421	Full	1124.95	701.24 ab	151.25 b	828.53 b
	Half	1194.96	866.96 b	714.31 ab	1056.97 b
	Control	1238.22	2373.90 a	1909.43 a	1930.26 a
	mean	1185.12	1130.21	591.55	1191.29
	CV %	5.31	7.37	17.06	2.76
	H.S.D *(0.05)*	0.33	0.45	0.97	0.17
	f-values	0.06	5.37 *	4.45 *	16.95 **

Means followed by different letters on the same column are significantly different at $P \leq 0.05$ (*) and $P \leq 0.01$ (**). P_i, P_m and P_f are nematode population numbers at 0, 9 and 18 months after planting respectively.

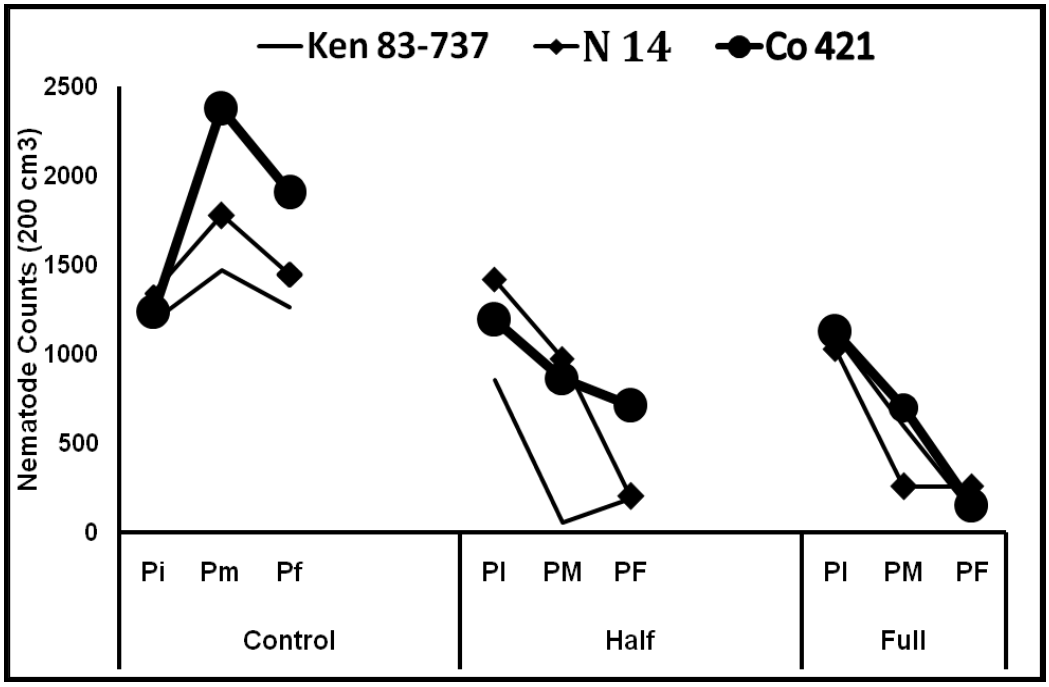

Figure 2: Effect of cultivar and nematicide application on nematode populations.
PI, PM and PF are nematode population numbers at 0, 9 and 18 months after planting respectively

significantly ($P \leq 0.01$) different fibre % cane and Pol % cane. No significant interaction effect was found between the cultivars and nematicide rates for the cane quality components. A significantly higher Pol % cane, Pol % juice

Table 3: Effect of cultivar and nematicide application on cane and juice quality components

		POL cane (%)	BRIX cane (%)	Fibre cane (%)	POL juice (%)	BRIX juice (%)	Purity juice (%)	CCS (%)
Sugarcane Cultivar	KEN 83-737	15.35 [a]	16.68	15.74 [a]	19.34 [a]	20.47 [a]	94.38	14.68
	N14	14.82 [ab]	16.23	15.34 [a]	18.67 [ab]	19.94 [ab]	93.51	14.34
	Co 421	14.62 [b]	16.54	13.23 [b]	18.36 [b]	19.75 [b]	92.96	14.25
Nematicide Rate	Full	15.31 [a]	16.38	14.82	18.83	19.98	94.19	14.58
	Half	15.05 [ab]	16.52	14.98	18.84	20.14	93.42	14.35
	Control	14.44 [b]	16.56	14.51	18.69	20.04	93.24	14.33
	H.S.D *(0.05)*	0.63	0.48	0.98	0.81	0.64	1.51	0.7
	C.V %	5.19	3.63	8.25	5.33	3.92	2	5.96
f - Value	Cultivar	4.3 *	2.69	22.04 **	4.44 *	4.16 *	2.62	1.27
	Nematicide Rate	5.91 **	0.46	0.7	0.12	0.21	1.29	0.48
	Cultivar*Nematicide Rate	1.58	1.3	0.78	0.72	0.96	0.55	1.03

Means followed by different letters on the same column are significantly different at $P \leq 0.05$ (*) and $P \leq 0.01$ (**).
CCS = commercial cane sugar.

Table 4. Effect of yield parameters and nematodes on yield and commercial cane sugar

Regression variables		Parameter estimate	*t*-value	*f*-value	R-Square
Yield Parameters Model	Girth (cm)	3.07	1.63	10.21**	0.6083
	Stalk length (cm)	0.22	2.42 *		
	Stalks number	0.05	0.5		
	P_i	6.15	0.29		
	P_m	2.04	0.32		
	P_f	0.16	0.03		
	Mean Nematodes	-30.72	-1.04		
CCS Model	Pol cane	0.01	0.17	58.96 **	0.8827
	Brix cane	-2.21	-6.82 **		
	Fibre cane	-0.60	-9.16 **		
	Pol juice	3.80	2.62 *		
	Brix juice	-1.06	-0.8		
	Purity juice	-0.54	-1.94		

Values followed by (*) and (**) are significantly different at $P \leq 0.05$ and $P \leq 0.01$ respectively. P_i, P_m and P_f are nematode population numbers at 0, 9 and 18 months after planting respectively. CCS = commercial cane sugar.

and brix juice was measured in KEN 83-737 cultivar compared to Co 421 cultivar while a significantly higher fibre % cane was measured in both KEN 83-737 and N14 cultivars compared to the Co 421. A significantly higher Pol % cane was measured under full nematicide rate (15.31 %) compared to the control (14.44 %).

Determination of the relationship between yield parameters and commercial cane sugar (CCS)

A significant ($P \leq 0.05$; $P \leq 0.01$) difference was determined among the different yield parameters and commercial cane sugar (CCS) when applied in their respective regression models. The variables associated with sugarcane yield explained 61% of the variation observed as compared to the variables associated with commercial cane sugar that accounted for 88 % of the variation (Table 4).

A significant ($P \leq 0.05$) relationship was determined between stalk length and yield. An increase in mean length by 0.22 cm would result in a mean yield increase of 1 tonne ha^{-1}. For commercial cane sugar model, significant ($P \leq 0.01$; $p \leq 0.05$) relationships were determined between brix % cane, fibre % cane and pol % juice. A mean reduction of 2.21 and 0.6 brix and fibre % cane would respectively lead to a reduction in CCS 1 %. However, a mean increase in pol juice of 3.8 % would to lead to an appreciation of CCS by 1%.

DISCUSSION

This study has revealed that nematicide application and use of resistant cultivars reduced nematode populations in the plots subsequently leading to improved sugarcane yield

and quality parameters. The significantly higher mean stalk lengths for resistant and tolerant cultivars compared to the susceptible cultivar indicates that Ken 83-737 and N 14 actually overcame the parasitic effects of nematodes present in their rhizosphere. This was confirmed by the significantly higher mean girth, stalk length, stalks number and yield measured for all cultivars when the nematicide was applied at the higher rate. Root nematodes are known to deprive the host crop of vital nutrient access and efficient utilization leading to nutrient deficiency. Consequently this result in patchy stunted growth, reduced root mass reduced foliar development and subsequent low yields (Coyne *et al.,* 2007). The phytoparasitic resistance capability was further demonstrated by measurements of higher means of growth parameters for the resistant and tolerant cultivars in nematicide-treated plots compared to the controls. Studies conducted by Showler and Reagan (1991) and Waraitch (1982) have shown that aldicarb do reduce nematode populations and other arthropod predators of sugarcane resulting in the improvement of sugarcane yields. This additive effect when aldicarb was applied in conjunction with use of resistant and tolerant cultivars was vital in realization of significantly higher growth parameters for Ken 83-737 and N 14 cultivars compared to the susceptible cultivar Co 421 which also showed improved performance with increasing aldicarb application rate. The rise in performance of Co 421 with increasing rate of nematicide indicates its higher level of sensitivity to varying numbers of parasitic nematodes compared to a resistant/tolerant cultivar.

Nematicides applied in the soil during crop production are meant to stem crop damage to root damaging nematodes. Sugarcane is no exception to the effect of such root parasites and earlier studies by Birchfield (1984), Ramirez (1981) and Cadet and Spaull (2005) have indicated that sugarcane roots are parasitized by atleast 14 phytoparasitc nematodes key among them *Pratylenchus*, *Meloidogyne*, *Trichodorus* and *Tylenchorhynchus* species. Mehta et al. (1992) reported the lesion, root-knot, sting and spiral nematodes as the major plant parasitic nematodes of sugarcane in India. In Kenya Chirchir et al. (2008) and Nzioki (2007) reported a significant presence of *Pratylenchus*, *Meloidogyne*, *Scutellonema* and *Trichodorus* species in the sugarcane growing zones. According to Mohan (2011) application of aldicarb and other suitable nematicides during sugarcane production averts the effect of these root parasites on sugarcane. In the current study the population of nematodes at 9 and 18 months after planting (MAP) had reduced from the initial nematode population at planting for the nematicide-treated plots. Conversely, control plots had significantly higher nematode populations compared to the nematicide-treated ones. Among the latter, plots treated with higher nematicide rate had lower nematode populations compared to those treated with lower nematicide rate at both 9 and 18 MAP. This demonstrates that the higher the nematicide levels in the soil the greater the mortality of nematodes and probably the more the reduction of the reproductive factor of the nematodes. Maqbool and Hashmi (1987) and Cadet and Spaull (1985) have similarly reported increased populations of *Pratylenchus zeae* in untreated plots of sugarcane till harvest and noted gradual decline in their numbers with increasing nematicide levels in treated pots. Qureshi et al. (2002) noted a significantly greater mortality rate in nematode populations when sugarcane fields were treated with nematicides furadan, miral and tenekil. This study confirms these observations as it is in line with the ability of aldicarb to prohibit reproduction of nematodes. The increased mortality under the presence of a nematicide could also explain why the nematode populations in the untreated plots in our study were recorded to have increased at mid-season (9 months) and decreased (though not significantly) at harvest as the active root growth at 9 months was taking place favouring reproduction and the effects of crop senescing impeded further nematode reproduction in the rhizosphere at 18 months. Quereshi et al. (2002) also observed the improvement of sugarcane's agronomic outputs such as plant height, stalk weight and yields when the crop was treated with the chemical nematicides as compared to the control. In this study, generally nematode populations in the nematicide-treated plots declined from the initial population at planting to harvest. In a few instances however there was a slight increase between 9 and 18 MAP probably due to wearing off of the nematicide toxicity with time. This confirms the finding by White (1984) who observed in similar studies that aldicarb reduced in toxicity for long-term control of plant parasitic nematodes. Similarly, Waraitch (1982), Elliott et al. (1984), Showier and Reagan (1991) and Showler et al. (1998) reported in their studies that aldicarb does in fact persist strongly in the soil only for 10 weeks when it consistently reduces plant parasitic nematodes.

This study has demonstrated that if any of the yield parameters (girth, height, millable stalk population) that are interacting together during sugarcane growth are measured accurately, one can determine with 61 % level of confidence the final yield that will be realized at harvest. If the mean stalk length increases by 0.22 cm, it will highly likely lead to an increase in yield of 1 kg ha^{-1}. Similarly, commercial cane sugar (CCS) can be predicted with an 88 % level of confidence using the sugarcane quality parameters that are measured during its growth (pol % cane and fibre % cane) and after harvest (pol % juice) all of which are interrelated in their determination. In particular, a 4 % increase in pol % juice will highly likely lead to an increase of CCS by 1 %. However, a 1 percent reduction in fibre % cane will highly likely lead to a 1 % increase in the CCS. These results have confirmed the observations made by Zorilla (2007) who reported that application of the nematicides Apache lOG (Cadusafos) and Furadan 3G (Carbofuran) reduced nematode populations and consequently increased cane yields and sugar yield and quality. In this study, the combined application of nematicides and the host resistance/tolerance status of the selected cane cultivars could possibly have caused the reduction in the nematode populations thereby minimizing their phytoparasitic effect on the cane. This consequently led to an increase in cane yields and quality and increased

sugar yield. Studies conducted by Qureshi et al. (2002), Reyees (1988) and Mehta and Sundararaj (1995) have also shown improvement of sugarcane agronomic parameters that in turn lead to realization of higher sugarcane yield and increased sucrose content when chemical nematicides are applied in soils during cane production. In this study, the resistant and tolerant varieties KEN 83-737 and N14 reduced the nematode populations between 0 - 9 months by an average of 67 % and 49 % respectively when combined with nematicide application, whereas the susceptible variety Co 421 reduced them by an average of 32 %. The nematode populations increased between 0 – 9 months in the control plots by 24 %, 33 % and 92 % for KEN 83-737, N14 and Co 421 respectively. The reduction in nematode population consequently resulted in an increase of cane yield, girth and stalk length, millable stalks number and pol % cane by an average of 34, 18, 37, 53 and 6 % respectively.

CONCLUSION

This study has demonstrated that sugarcane cultivars possessing host-plant resistance or tolerance to plant parasitic nematodes have an inherent ability to reduce the nematode population in the rhizosphere. This reduction most probably caused the improvement in cane yield of 34 % and cane quality of 6 %, while increasing the girth by 18 %, plant height 37 % and millable stalks number by 53 %. This study further revealed that the resistant cultivar restricted the growth of nematode populations. The nematode population in the control plots at 9 MAP had grown by 24 %, 49 % and 92 % for KEN 83-737, N14 and Co 421 respectively. Resistant and tolerant cultivars may therefore be incorporated in developing integrated nematode management practices to enhance sugarcane productivity.

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