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Erianthus arundinaceus as a trap crop for the sugarcane stem borer *Chilo sacchariphagus*: Field validation and disease risk assessment

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ABSTRACT

The sugarcane internode spotted stem borer *Chilo sacchariphagus* (Bojer, 1856) (Lepidoptera: Crambidae) is a major pest of sugarcane. In a previous work carried out in Reunion, we showed that *Erianthus arundinaceus* (Retz.) Jeswiet (Poales: Poaceae), accession 28NG7, can be used as trap crop to control *C. sacchariphagus*. The aim of this study was to determine the efficiency of using *E. arundinaceus* 28NG7 as a trap crop to control *C. sacchariphagus* in commercial field conditions and to assess the susceptibility of *E. arundinaceus* 28NG7 to the three main sugarcane diseases in Reunion: smut, leaf-scald and gumming.

Our results confirmed that *E. arundinaceus* 28NG7 effectively reduced *C. sacchariphagus* damage on sugarcane in large fields. The *E. arundinaceus* 28NG7 perimeter trap considerably reduced the mean number of bored internodes in the adjacent sugarcane fields, by a factor ranging from 2.8 to 4.4. Using on-station trials, we also showed that *E. arundinaceus* 28NG7 is tolerant or resistant to the three sugarcane diseases and is, therefore, unlikely to act as a disease reservoir and source of inoculum for contaminating sugarcane. The first step to encourage the use of *E. arundinaceus* 28NG7 borders in commercial fields described here was also successful in terms of growers' adoption. All ten growers involved in the experiment spontaneously increased the area of sugarcane protected by *E. arundinaceus* 28NG7 borders on their farm.

1. Introduction

The sugarcane internode spotted stem borer *Chilo sacchariphagus* (Bojer, 1856) (Lepidoptera: Crambidae) is a major sugarcane pest (Waterhouse, 1993). It reduces crop yield and the sugar content of susceptible cultivars (Goebel and Way, 2007; Rajabalee et al., 1990). It originated in Asia and has been described in most sugarcane growing countries, including China, Bangladesh, Singapore, Indonesia, Malaysia, Philippines, Taiwan, Sri Lanka, Thailand, Japan (Sallam and Allsopp, 2002), Vietnam (Duong et al., 2011) and Iran (Ghahari et al., 2009). *Chilo sacchariphagus* has spread to the islands in the South-West Indian Ocean, Mauritius, Reunion, Comoro and Madagascar (Sallam and Allsopp, 2002) and recently to Mozambique, in Africa (Way and Turner, 1999). It now represents a threat to the African and Australian sugar industry (Sallam, 2006; Way et al., 2012).

In a previous work (Nibouche et al., 2012), we have shown that *Erianthus arundinaceus* (Retz.) Jeswiet (Poales: Poaceae) could be used as trap crop to control *C. sacchariphagus*. In controlled conditions, we demonstrated that *C. sacchariphagus* females preferred to oviposit on *E. arundinaceus* 28NG7, rather than on the sugarcane cultivar R579. Despite this preference, we found that larvae survival and development was reduced on *E. arundinaceus* 28NG7 compared to sugarcane. In field conditions, we also demonstrated that in small plots (625 m^2) surrounded by a row of *E. arundinaceus* 28NG7, stalk borer damage was reduced by a factor ranging from 2 to 9. These preliminary results suggested that *E. arundinaceus* 28NG7 had potential for controlling *C. sacchariphagus* when used as part of a trap crop strategy (Hokkanen, 1991; Shelton and Badenes-Perez, 2006). However, these results were obtained in controlled conditions, involving small plots. Therefore, it was necessary to test the strategy under real commercial sugarcane cultivation conditions before encouraging a more extensive use of this technique.

Numerous diseases (Rott et al., 2000) affect sugarcane. They are primarily controlled using resistant cultivars (Walker, 1987; Hogarth et al., 1997). Cultivars grown in sugarcane producing areas throughout the world are bred for their resistance to several major diseases (Berding et al., 2004). Three of the main sugarcane diseases are smut, leaf scald and gumming. For these three diseases, the inoculum pressure in

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Reunion is low. In fact, all sugarcane cultivars grown in Reunion are resistant or tolerant to all three diseases and only a few alternative hosts have been reported in Reunion (Rott et al., 2000). Some pests and pathogens can adapt to a wide range of plants as alternative hosts/reservoirs. Therefore, the effectiveness of the strategy to control pests and diseases based on plant species diversity has its limitations (Ratnadass et al., 2012). Indeed, it is obviously important to avoid introducing plants in sugarcane growing areas that could act as alternative hosts for sugarcane diseases. Sugarcane cultivars grown worldwide are interspecific hybrids of *Saccharum officinarum* and *Saccharum spontaneum*. The *Erianthus* genera belong to the "*Saccharum* complex", a group of related taxa that are sugarcane's ancestors (Mukherjee, 1957). Therefore, they are potentially susceptible to some sugarcane diseases. Hence, before *E. arundinaceus* 28NG7 is used as a trap crop on a large scale, it is important to assess its susceptibility to diseases to ensure that: it does not act as an inoculum multiplier; and that it is not too susceptible to diseases that could hinder its cultivation. Some studies have already examined *Erianthus* spp.'s susceptibility to sugarcane diseases. Among *Erianthus* spp., several clones were shown to be susceptible to the *Sugarcane mosaic virus* (SCMV) (Grisham et al., 1992), the *Sorghum mosaic virus* (SrMV) (Li et al., 2013), the *Sugarcane streak mosaic virus* (SCSMV) (Putra et al., 2015), the *Sugarcane yellow leaf virus* (SCYLV) (Komor, 2011), leaf scald, caused by *Xanthomas albilineans* (Rott et al., 1997), Red Rot, caused by *Colletotrichum falcatum* (Ram et al., 2001; Hale et al., 2010) and smut, caused by *Sporisium scitaminea* (Burner et al., 1993). These studies conclude that *Erianthus* spp. are less susceptible overall to these diseases than other taxa belonging to the sugarcane complex. However, considering the high genetic diversity observed within the *E. arundinaceus* accessions (Besse et al., 1997; Cai et al., 2012), these results cannot be generalised. Consequently, the susceptibility of *E. arundinaceus* 28NG7 should be examined. In addition, as plant pathogens can exhibit geographical variations in terms of their pathogenicity, *Erianthus* susceptibility assessments should be tested locally, in Reunion.

Therefore, the aim of this study was to (1) confirm the efficiency of *E. arundinaceus* 28NG7 as a trap crop in controlling *C. sacchariphagus* in commercial fields, and (2) assess the susceptibility of *E. arundinaceus* 28NG7 to the three main sugarcane diseases in Reunion.

2. Material and methods

2.1. Field evaluation to determine the reduction in borer damage using *E. arundinaceus 28NG7*

The trial to determine the effectiveness of *E. arundinaceus* 28NG7 as a perimeter trap crop (PTC) for reducing *C. sacchariphagus* damage was conducted, by comparing fields protected by a PTC vs. control. The trial involved a multilocal pluri-annual design (Table 1).

The *E. arundinaceus* 28NG7 PTC was planted along two to four borders (depending on the field's geometry) in seven fields. All the fields were cultivated cane fields. The *E. arundinaceus* 28NG7 was planted simultaneously with the sugarcane, either in a row parallel to the sugarcane rows or in a clump at the end of each sugarcane row. The PTC was planted in seven fields, belonging to six growers. The seven fields were compared to six control fields, where only cane was planted. There were six replications of the PTC fields and the control fields. Each replication consisted of two fields (three in one instance) separated by a distance of 5–674 m (from border to border). Because sugarcane cultivars cultivated in Reunion may differ in their susceptibility to *C. sacchariphagus* (Nibouche and Tibère, 2009), the PTC field and the control were planted using the same sugarcane cultivar, either R579 or R585, within each replication (Table 1). However, the sugarcane cultivars might differ among replications. The *E. arundinaceus* 28NG7 PTC fields were planted from 2012 to 2015, depending on the replication. Borer damage assessments began 1 year after plantation and continued until 2016 (i.e. one to four annual assessments). The damage assessment involved the examination of 100 randomly chosen stalks in each field. The number of bored internodes was recorded for each stalk. The damage assessments were carried out at crop maturity, from July to October. In 2016, the borer feeding injuries were recorded on the stalks' terminal leaves, in addition to the internode damage assessments. The leaf damage was recorded for sugarcane and for the *E. arundinaceus* 28NG7 borders. Leaf feeding injuries are caused by young (first to third instar) *C. sacchariphagus* larvae and can be used as a proxy for the crop's attractiveness for female oviposition (Nibouche and Tibère, 2009).

Given the difficulties of finding control fields where a matching cultivar was being cultivated, three additional PTC fields were planted without a control. These fields were not considered in the analysis of damage reduction. However, the three growers concerned were included in the assessment of the technique's acceptability.

2.2. Evaluation of *E. arundinaceus 28NG7* susceptibility to diseases

The disease susceptibility of *E. arundinaceus* 28NG7 was assessed for three of the world's main sugarcane diseases: the fungal disease, smut, caused by *Sporisium scitaminea;* and two bacterial diseases, gumming, caused by *Xanthomonas axonopodis* pv. *vasculorum*, and leaf scald, caused by *Xanthomonas albilineans*. The evaluation was performed in three field trials planted in 2014 at the Bassin Martin station in Reunion (latitude: 21.309°S; longitude: 55.507°E; altitude: 300 m). In these trials, the susceptibility of *E. arundinaceus* 28NG7 was compared to reference sugarcane cultivars that exhibit contrasted susceptibility to each

Table 1
Characteristics of the fields in the experiment to determine the reduction in borer damage using *E. arundinaceus* 28NG7. PTC = presence of an *E. arundinaceus* 28NG7 perimeter trap crop along the borders of the sugarcane field. Control = sugarcane field without PTC.

Replication	Place	Year of trial establishment	Treatment	Distance between treatment and control field	Sugarcane cultivar	Latitude; longitude (centre of the field)	Field area (m^2)	Number of field borders occupied by *E. arundinaceus* 28NG7
A	Piton Saint-Leu	2012	PTC	650	R579	−21.216; 55.291	2.454	3
			control	–	R579	−21.223; 55.295	14.200	–
B	Jean Petit	2013	PTC	123	R585	−21.343; 55.634	4.486	4
			PTC	547	R585	−21.346; 55.636	2.148	4
			control	–	R585	−21.341; 55.633	6.769	–
C	Bagatelle	2013	PTC	5	R585	−20.959; 55.571	3.453	4
			control	–	R585	−20.959; 55.572	10.268	–
D	Beaumonds les Hauts	2013	PTC	674	R585	−20.948; 55.537	7.114	2
			control	–	R585	−20.941; 55.534	2.441	–
E	Bagatelle	2015	PTC	5	R579	−20.911; 55.599	3.191	4
			control	–	R579	−20.911; 55.598	4.573	–
F	Sainte-Marie	2015	PTC	104	R585	−20.922; 55.568	1.982	3
			control	–	R585	−20.921; 55.568	13.286	–

disease (Tables 4–6). The experimental designs involved complete block designs, with nine blocks for the leaf scald trial and seven for the smut and gumming trials. Elementary plots consisted of a single 5 m-long row of sugarcane, with a spacing of 1.5 m between the rows. For the gumming and smut trials, an elementary plot of a susceptible sugarcane cultivar was planted between two neighbouring elementary plots of the tested cultivars to act as disease spreader. The susceptible sugarcane cultivars used as spreaders were B34104 for the gumming and the leaf scald trials, and MQ7653 for the smut trial. Fertilisation, weeding and drip irrigation were carried out according to standard practices for sugarcane cropping in Reunion.

Artificial inoculations were conducted. This involved: the direct inoculation of the cultivars to be tested for leaf scald; the inoculation of the spreader cultivar for gumming; and the direct inoculation of the planted cuttings of the spreader and the tested cultivars for smut. The methodologies that our team has used for several years to screen elite sugarcane cultivars were applied. The trials were evaluated in planted cane in 2015 and then during the first ratoon in 2016. For the inoculation of leaf scald, the strain *Xanthomonas albilineans* Xa3P608, isolated at the La Mare experimental station in 2006, was grown for 48 h on a plate containing Wilbrink medium. Bacteria were suspended in 0.01 M Tris buffer (pH 7) to obtain a suspension of 10^9 bacteria.mL^{-1}. Inoculation was performed using the method described by Rott et al. (2011). Inoculation in the field involved pruning the top of the stalk of the cultivars to be tested using a pruner dipped in the bacterial suspension. After pruning, the cut was sprayed with the same suspension. The stalks were cut below the third ochrea. For the gumming inoculation, the strain *X. axonopodis* pv. *vasculorum* Xav3P509, isolated at La Mare in 2004, was grown for 24 h on a plate containing Wilbrink medium. Bacteria were suspended in 0.01 M Tris buffer (pH 7) to obtain a suspension of 10^9 bacteria.mL^{-1}. Field inoculation involved pruning the top of the infested variety using a pruner dipped in the bacterial suspension. The cut was then sprayed with the bacterial suspension. The stalks were cut below the second ochrea. The leaf scald and gumming symptoms were recorded on all stalks in each row, 6 months after inoculation, using a symptom severity scale, ranging from 0 to 5, where 0 = no symptoms, 1 = one chlorosis line; 2 = more than one chlorosis line, 3 = chlorosis of one or several leaves, 4 = leaf necrosis, 5 = dead stalk.

In the smut trial, the cultivars were inoculated at planting, by dipping the cuttings in a suspension of 5×10^6 spores.mL^{-1} for 30 min. Spores were isolated from whips collected in the fields, sieved and stored in a dry atmosphere. Spore germination rates were monitored prior to inoculation and were always greater than 80%. The number of whips that appeared on each elementary plot was recorded every 2 weeks during two crop cycles.

2.3. Statistical analysis

All statistical analyses were carried out using SAS software, version 9.3 of the SAS System for Windows (SAS Institute, 2010).

Borer stalk damage were analysed separately for each year. As replication A was the unique replication observed in 2013, the 2013 data were excluded from the analysis. The analysis was carried out with linear models, where treatment and replication were considered as fixed effects. The sugarcane cultivar effect was considered as confounded with the replication effect and was therefore not added to the model.

The number of bored internodes per stalk was analysed by fitting a generalised mixed marginal model with SAS/GLIMMIX (negative binomial distribution). In this model, each of the 100 stalks observed in each field was considered as a repeated observation within that field. The 100 observations from the same field were assumed to follow a compound symmetry (equicorrelation) model.

The proportions of stalks exhibiting borer leaf injuries were analysed with a generalised linear model (binomial distribution) with SAS/GENMOD.

The leaf scald and gumming trials were analysed with a mixed marginal model with SAS/MIXED software, where cultivars and blocks were fixed effects. The variable analysed was the mean severity among stalks, after a square root transformation in order to obtain a normal distribution for the residuals. In this model, the two severity assessments performed in two successive crop cycles were considered as longitudinal observations. Observations from the same elementary plot were assumed to follow an unstructured variance-covariance matrix.

Due to convergence issues, the smut trial was analysed in each crop cycle separately. The cumulated number of whips per plot was analysed with a generalised model with SAS/GLIMMIX, using a negative binomial distribution. Cultivars and blocks were considered as fixed effects.

3. Results

3.1. Field evaluation of the reduction of borer damage by E. arundinaceus 28NG7

The leaf damage (Table 2) in sugarcane PTC fields was significantly lower ($F_{1,5} = 15.73$; $P = 0.0107$) than on sugarcane control fields, by a factor of 2.6. In PTC fields, the leaf damage was significantly lower ($F_{1,5} = 238.04$; $P < 0.0001$) on sugarcane than on the *E. arundinaceus* 28NG7 perimeter trap crop, by a factor of 6.5.

During the 3 years of the assessment, the stalk damage (Table 3) was significantly lower in fields protected by an *E. arundinaceus* 28NG7 PTC than in control fields. Considering the number of bored internodes per stalk, the damage were reduced by a factor of 2.8 in 2014, 4.4 in 2015 and 3 in 2016. Considering the proportion of bored stalks, the damage was reduced by a factor of 1.6 in 2014 and 1.9 in 2015 and 2016.

The study involved ten producers, seven of whom were involved in the damage assessment experiment and three others for whom no damage assessment was carried out. During the study or from the 2016–2017 cropping season, the ten growers spontaneously increased the area of sugarcane fields protected by *E. arundinaceus* 28NG7 borders on their farms.

3.2. Evaluation of E. arundinaceus 28NG7 susceptibility to diseases

The results obtained comparing *E. arundinaceus* 28NG7 to a range of control varieties show that this accession is tolerant or resistant to three of the main diseases of sugarcane in Reunion. *E. arundinaceus* 28NG7 was totally resistant to smut and no whips were observed in the field (Table 4).

E. arundinaceus 28NG7 was also resistant to leaf scald (Table 5) and exhibited no symptoms. 28NG7 was significantly more resistant than the susceptible control cultivars. Compared to the two tolerant cultivars that occupy most of the sugarcane growing area in Reunion, *E. arundinaceus* 28NG7 was significantly less damaged than R570 and not significantly different from R579.

Regarding gumming (Table 6), *E. arundinaceus* 28NG7 was significantly less damaged than all the susceptible cultivars, except M37756; *E. arundinaceus* 28NG7 was not significantly different from the resistant cultivars, including R570 and R579.

Table 2
Mean (± SEM) of stalks with damaged leaves on sugarcane with perimeter trap crop (PTC), on sugarcane control plots or on *E. arundinaceus* 28NG7 perimeters, recorded in 2016.

	% stalks with damaged leaves
sugarcane with *E. arundinaceus* 28NG7 as perimeter trap crop	14.6 ± 2.0
sugarcane control	38.2 ± 7.8
E. arundinaceus 28NG7 perimeter (PTC)	95.0 ± 2.3

Table 3
Mean (± SEM) borer damage in fields with an *E. arundinaceus* 28NG7 perimeter trap crop (PTC) vs. control fields. Averaged values among four (2014 & 2015) or six replications (2016).

	2014		2015		2016	
	Bored internodes per stalk	% bored stalks	Bored internodes per stalk	% bored stalks	Bored internodes per stalk	% bored stalks
PTC	1.08 ± 0.06	55.2 ± 2.2	1.08 ± 0.06	55.2 ± 2.2	0.80 ± 0.04	43.7 ± 1.9
control	2.82 ± 0.12	82.5 ± 1.9	4.95 ± 0.14	99.3 ± 0.4	2.43 ± 0.07	83.0 ± 1.5
P	0.0013	0.0046	0.0016	<0.0001	<0.0001	0.0010
	$F_{1,4} = 64.60$	$F_{1,4} = 32.81$	$F_{1,4} = 57.89$	$F_{1,4} = 578.67$	$F_{1,6} = 85.95$	$F_{1,6} = 35.16$

Table 4
Susceptibility of *E. arundinaceus* 28NG7 to smut compared to resistant or tolerant ([R]) sugarcane cultivars (R570, R579, R580, B34104 and M3145) and susceptible ([S]) cultivars (MQ7653, M9948). Mean (±SEM) of the total number of whips per plot (7.5 m^2). Field trial with artificial inoculation. ***: rating of the cultivar is significantly different (P < 0.001) from 28NG7. #: the model could not estimate the difference with 28NG7.

Cultivars	2014/2015	2015/2016
28NG7	0.0 ± 0.0	0.0 ± 0.0
B34104[R]	2.7 ± 0.7 ***	0.0 ± 0.0 #
M3145[R]	0.0 ± 0.0 #	0.0 ± 0.0 #
M9948[S]	11.4 ± 3.2 ***	7.0 ± 1.5 ***
MQ7653[S]	20.4 ± 7.5 ***	27.7 ± 4.3 ***
R570[R]	0.3 ± 0.3 ***	0.9 ± 0.7 ***
R579[R]	0.0 ± 0.0 #	1.3 ± 1.1 ***
R580[R]	0.4 ± 0.4 #	0.6 ± 0.6 #
P	<0.0001	<0.0001
$F_{4,42}$	16.77	14.55

Table 5
Susceptibility of *E. arundinaceus* 28NG7 to leaf scald compared to resistant or tolerant ([R]) sugarcane cultivars (MQ 7653, R570 and R579) and susceptible ([S]) cultivars (B 34104, R580). Mean rating (±SEM) of leaf scald symptoms 6 months after inoculation over 2 years. Field trial under artificial inoculation. ***: rating of the cultivar is significantly different (P < 0.001) from 28NG7.

Cultivars	Mean leaf scald symptoms rating (±SEM)
28NG7	0.00 ± 0.00
B34104[S]	1.88 ± 0.24 ***
MQ7653[R]	0.04 ± 0.02
R570[R]	0.41 ± 0.12 ***
R579[R]	0.17 ± 0.06
R580[S]	2.06 ± 0.32 ***
P	<0.0001
$F_{5,40}$	46.39

Table 6
Susceptibility of *E. arundinaceus* 28NG7 to gumming compared to resistant or tolerant ([R]) sugarcane cultivars (R570, R573, R579) and susceptible ([S]) cultivars (B34104, R580, R397, M37756). Mean rating (±SEM) of gumming symptoms 6 months after inoculation over 2 years. Field trial under artificial inoculation. ***: rating of the cultivar is significantly different (P < 0.001) from 28NG7.

Cultivars	Mean gumming symptoms rating (±SEM)
28NG7	0.04 ± 0.03
B34104[S]	0.45 ± 0.13 ***
M37756[S]	0.18 ± 0.05
R397[S]	1.25 ± 0.26 ***
R570[R]	0.02 ± 0.02
R573[R]	0.07 ± 0.04
R579[R]	0.02 ± 0.01
R580[S]	0.34 ± 0.17 ***
P	<0.0001
$F_{7,42}$	21.16

4. Discussion

The results of the trial in larger commercial fields confirmed the efficiency of *E. arundinaceus* 28NG7 in reducing *C. sacchariphagus* damage on sugarcane, as previously demonstrated in smaller 25 m × 25 m plots (Nibouche et al., 2012). The proportion of stalks exhibiting leaf damage caused by early larval instars was 6.5 times higher on the *E. arundinaceus* 28NG7 borders than on the adjacent sugarcane. This is coherent with the fact that *E. arundinaceus* 28NG7 is more attractive to *C. sacchariphagus* females for oviposition, as has been demonstrated in controlled conditions (Nibouche et al., 2012). As a result, the *E. arundinaceus* 28NG7 perimeter trap considerably reduced the mean number of bored internodes in the adjacent sugarcane fields by a factor of 2.8–4.4.

The on-station trials have shown that the *E. arundinaceus* 28NG7 is tolerant or resistant to the three main sugarcane diseases present in Reunion: smut, leaf-scald and gumming. Therefore, it is unlikely to act as a disease reservoir and source of inoculum for contaminating sugarcane. Nevertheless, the sanitary status of *E. arundinaceus* 28NG7 should be continually monitored in future to facilitate the detection of the possible emergence of other diseases or pests when *E. arundinaceus* 28NG7 is planted on a larger area of land. A similar constraint has been observed in Kenya, for example, where the trap plant *Pennisetum purpureum* was used extensively to control the maize borer *Chilo partellus* as part of a push-pull strategy (Hassanali et al., 2008). However, it was attacked by the Napier stunt disease, caused by a phytoplasma (Obura et al., 2009), and by the Napier head smut, caused by the fungal pathogen *Ustilago kamerunensis* (Farrell et al., 2001). Moreover, the accidental introduction of new sugarcane pests or disease in Reunion, as illustrated by the recent introduction of the yellow sugarcane aphid *Sipha flava*, could also create new threats for *E. arundinaceus* 28NG7 that require surveillance.

One of the limitations of planting erianthus borders is that it reduces the area of land available for sugarcane. A simple calculation shows that in a square field measuring X m^2, the area occupied by the erianthus border (assumed to be the same width as a sugarcane row, i.e. 1.5 m) is $6.\sqrt{X}$. For a 2500 m^2, 5000 m^2 or 1 ha field, the area covered by the erianthus borders is, respectively, 12%, 8.4% or 6%. This represents a production loss that may exceed the yield increase resulting from the reduced borer damage, especially when borer damage is low. The yields were not measured during this study. Therefore, we were not able to estimate the trade-off between damage reduction and reduced yields as a result of a decrease in the area of sugarcane. When growers planted erianthus borders in other fields on their farm, they modified the initial design (i.e. an erianthus row along all borders of the field) to reduce the corresponding reduction in the area cultivated for sugarcane. Some growers planted discontinuous borders (i.e. one erianthus clump for every five sugarcane clumps) and some planted erianthus in uncultivated areas near their fields (swaths, on the edge of pathways and gulches, etc.). We did not assess the efficiency of these techniques; however there is probably a minimal erianthus/sugarcane area ratio that should be respected to keep the technique efficient. The determination of this minimal ratio requires additional research.

The second constraint relating to the *E. arundinaceus* 28NG7 borders is managing the erianthus biomass. *Erianthus arundinaceus* 28NG7 produces a large amount of biomass, at least equivalent to sugarcane. Erianthus contains no sucrose, which means the biomass cannot be harvested with sugarcane, otherwise it reduces the mean richness of the field. During this study, we observed that the decomposition of *E. arundinaceus* 28NG7 stalks was very slow when they were left intact on the soil surface after harvest. The growers involved in the study used two techniques to dispose of the erianthus biomass. Some used a mulcher to shred the erianthus stalks prior to the sugarcane harvest. Some harvested the erianthus every 6 months and used the green biomass as forage for livestock (mainly goats and some cattle).

The first step to encourage the more widespread use of *E. arundinaceus* 28NG7 borders in commercial fields described here was successful in terms of growers' adoption. All ten growers involved in the experiment spontaneously increased the area of sugarcane protected by *E. arundinaceus* 28NG7 borders on their farms. In addition, the growers rapidly set up an informal network to supply *E. arundinaceus* 28NG7 cuttings, which has led to the establishment of *E. arundinaceus* 28NG7 borders on several farms that were not part of our study. The Chamber of Agriculture's official extension service in Reunion has also been encouraging the more widespread use of the technique (demonstrations, training, distribution of *E. arundinaceus* 28NG7 cuttings) since 2017.

Despite the success of this technique in commercial field conditions and the demonstration that *E. arundinaceus* 28NG7 is attractive to *C. sacchariphagus* females in controlled conditions (Nibouche et al., 2012), we still know nothing about the mechanisms involved in this attraction. The most probable mechanism is the emission of attractive volatiles by *E. arundinaceus,* as hypothetized to explain the interaction between *Chilo partellus* vs. *Pennisetum purpureum* (Khan et al., 2000, 2010). Molecular ecology studies should be undertaken in the future to identify the volatiles involved in the *E. arundinaceus* 28NG7 and *C. sacchariphagus* interaction.

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