A Survey Report on Sugarcane Production in Guangxi Zhuang Autonomous Region in 2013

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Abstract In order to fully understand sugarcane production in Guangxi in 2013, the sample survey combined with data collection and field survey was carried out in sugarcane production areas in Nanning, Hechi, Liuzhou, Chongzuo, Baise and Laibin from May 28 to June 36 in 2013. It was found that the sugarcane growing area in Guangxi in 2013 declined compared with that in 2012; the rate of emergence remained the same as previous year, and as for the plant number of plant crop and ratoon crop per hectare, there was a decline of 4000 and 2000 seedlings respectively compared with the figure in 2012; borer damage rate declined on the whole while the incidence of sugarcane smut increased. Due to the growth in the cost of planting, the growers were less enthusiastic for management. According to the findings, the fertilization and sugarcane field management should be accelerated; borer prevention work was also required, so as to reduce borer damage and dieback rate; the planting structure of varieties had to be adjusted and the cultivated area of "Guitang" as a fine sugarcane variety should also be enlarged; meanwhile other active measures needed to be taken to prevent and control the outburst of pest attack in local areas.

Key words Sugarcane, Varieties, Growth of the seedlings, Plant crop, Ratoon cane

1 Introduction

Seedling growth of sugarcane is an important part of sugarcane production, and only when there are certain light and temperature conditions can the seedlings be even and healthy, thereby laying a solid foundation for the future high yield[1]. In recent years, the sugarcane growing areas in Guangxi have been frequently affected by the extreme weather. In 2008, most sugarcane growing areas in Guangxi suffered the freezing rain for a long time, and especially after getting warmer in March, the sugar content and juice purity rapidly declined, seriously affecting the supply of cane seed and emergence of ratoon cane[2-3]. Li Yangrui *et al.* [4] conduct a survey of sugarcane production in Laibin, Liuzhou and Hechi of Guangxi, and point out that it is necessary to accelerate the popularization and application of cold-resisting, high-yielding and high-sugar sugarcane varieties according to local conditions, and adopt some measures during the seedling growth stage such as using plastic film, covering with sugarcane leaf and applying warm organic manure. Duan Weixing *et al.* [5], Yang Cuifang *et al.* [6] conduct a survey of seedling number, plant height, smut rate and other indicators of sugarcane during the seedling emergence in the sugarcane growing areas of Guangxi, and believe that the survey is conducive to setting forth the recommendations for the current field management in a timely manner, and plays a positive role in promoting the late stage sugarcane production. Yan Juan *et al.* [7] make a survey of growing area, yield, fine variety coverage of sugarcane and application of new technologies in Yunnan, and analyze the correlation and differences between the sugarcane planting conditions and sugarcane yield in the sugarcane growing areas of Yunnan, in order to provide theoretical guidance for developing sugarcane development program. In order to grasp the growth of the seedlings and better understand the sugarcane production in the sugarcane growing areas of Guangxi in 2013, the survey team from Sugarcane Research Institute of Guangxi Academy of Agricultural Sciences and Guangxi University went to the sugarcane growing areas in Nanning, Hechi, Liuzhou, Chongzuo, Baise and Laibin from May 28 to June 3, 2013. Using a variety of ways such as consulting with local sugar production and management departments, interviewing local sugarcane growers and conducting a field survey, the team surveyed the growth of the sugarcane seedlings, in order to provide a theoretical basis for sugarcane production in the sugarcane growing areas of Guangxi in 2013.

2 Survey time, sites and methods

2.1 Survey time From May 28 to July 3, 2013.

2.2 Survey sites Nanning, Hechi, Liuzhou, Chongzuo, Baise, and Laibin.

2.3 Survey content and methods The sample survey, data collection and field survey are used. Sample survey includes vie-

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wing data, and listening with patience to the opinions of Science and Technology Bureau and Sugarcane Industry Bureau in the sugarcane growing areas on the sugarcane affected by disaster. Data collection includes collecting the statistics concerning the sugarcane growing areas in various counties, growing area of different varieties, and growth of different varieties. The field survey and analysis are performed on the sugarcane plant height, seedling number and borer damage. In each survey site, several representative plots of ratoon cane and plant crop are selected; in each plot, the spacing of five rows of sugarcane is surveyed, and the average spacing is calculated. The representative cane spacing of 30 m is selected to survey the total seedling number, blight seedling number, and sugarcane smut plant number, as well as seedling number per hectare, blight rate and sugarcane smut plant rate. In each plot, the plant height of 30 seedlings is measured and the average plant height is calculated while surveying the seedling number.

3 Results and analysis

3.1 Planting area of sugarcane and variety structure

3.1.1 Planting area of sugarcane and variety structure in the sugarcane growing areas of Nanning City. According to the data provided by Nanning Sugar Industry Development Bureau, the planting area of sugarcane in Nanning City was 161000 ha in 2012 (including 75900 ha of plant cane and 85100 ha of ratoon cane). In 2013, the planting area of sugarcane was 155200 ha, a decrease of 5700 ha over the previous year; the area of plant crop was 63000 ha, a decrease of 12900 ha; the area of ratoon cane was 92300 ha, an increase of 7200 ha. Due to the decrease in sugarcane prices and increase in production material and labor prices in 2012 and 2013, the sugarcane growers' planting benefits declined and resulting in decreased enthusiasm for planting in 2013. In 2013, the major sugarcane variety in Nanning City was still "ROC 22", but the planting areas declined from 116600 ha in 2012 to 109600 ha. The planting area of "Yuetang 94 – 128", with strong ratoon characteristics and low sugar content, was 7700 ha in 2013, an increase of 4500 ha over the previous year (see Table 1).

Table 1 Planting area of sugarcane and variety structure in Nanning City in 2013 Unit: ha

Sugar production year	Planting area of different types of sugarcane		Variety area					
	Plant crop	Ratoon cane	ROC 22	ROC 25	Taiyou	Yuetang 94/128	Yuetang 93/159	Yuetang 00/236
2012/13	7.59	8.51	11.66	1.06	0.86	0.32	1.07	0.22
2013/14	6.30	9.23	10.96	0.96	0.59	0.77	1.26	0.15
2013/14 2012/13	-1.29	0.72	-0.70	-0.10	-0.27	0.45	0.18	-0.07

Sugar production year	Variety area							The total planting area of sugarcane
	Other varieties	Yuetang 60	Guiliu 2(Liucheng03/1137)	Funong 39	Guitang 21	Yuanlin 9	ROC 28	
2012/13	–	–	–	0.11	0.07	–	0.72	16.10
2013/14	0.05	0.08	0.03	–	–	0.06	0.62	15.52
2013/142012/13	–	–	–	–	–	–	-0.10	-0.57

3.1.2 Planting area of sugarcane and variety structure in the sugarcane growing areas of Hechi City. The planting area of sugarcane in Hechi City was 83700 ha in 2012 (including 24400 ha of plant crop and 59300 ha of ratoon cane). In 2013, the major sugarcane variety structure in Hechi City was still "ROC 16" (including "Taiyou", so-called "ROC 25"), followed by "Guitang 21" and "ROC 22". However, various counties and cities have increased efforts to promote new varieties and the proportion of new varieties is increasing. According to the data provided by Yizhou Sugar Industry Bureau, Yizhou City promoted some new varieties such as "Guitang 29", "Guitang 30" ,"Guitang 31", "Guitang 32", "Guitang 35" and "Liucheng03/1137" ("Guiliu 2") and "Liucheng05/136", and the cumulative area reached 4000 ha, accounting for 53% of plant crop area.

3.2 Comparison of sugarcane growth between different sugarcane growing areas

3.2.1 The growth of the seedlings in different sugarcane growing areas. The survey results on the growth of seedlings in different sugarcane growing areas in Table 2 show that the emergence of plant crop is best in Chongzuo City, with average emergence of 129000 plants per hectare, followed by Baise City (116000 plants per hectare), and the emergence of plant crop in Hechi, Laibin, Liuzhou and Nanning is also more than 95000 plants per hectare. The emergence of ratoon cane is best in Hechi City (124000 plants per hectare), followed by Baise City (109000 plants per hectare), and the emergence of ratoon cane is poor in Laibin City and Nanning City (84000 and 91000 plants per hectare, respectively). The survey results on sugarcane plant height show that the average plant height of ratoon cane is 14 cm more than that of plant crop. The height of plant crop is best in Chongzuo City and Nanning City (61.31 cm and 47.6 cm, respectively), followed by Laibin City and Baise City (average height of 37.86 cm and 29.16 cm, respectively), and the height of plant crop is worst in Hechi City (average height of only 21.6 cm). The plant height of ratoon cane is best in Chongzuo City (80.79 cm), followed by Laibin City (58.45 cm). The height of plant crop and ratoon cane increases by 17.4 cm and 24.9 cm respectively over the previous year, which is mainly due to the abundant rainfall and high tem-

perature in early spring in Chongzuo and Nanning, conducive to the growth of sugarcane.

Table 2 Comparison of sugarcane growth between different sugarcane growing areas

Survey areas	Plant crop				Ratoon cane			
	Seedling number (10^3 plants/ ha)	Plant height cm	Blight rate of seedlings %	Smut plant rate %	Seedling number (10^3 plants/ ha)	Plant height cm	Blight rate of seedlings %	Smut plant rate %
Nanning City	102	47.6	4.88	0.11	91	48.1	11.08	2.33
Hechi City	100	21.6	1.96	0.00	124	36.3	3.99	0.79
Baise City	116	29.16	3.79	0.00	109	47.33	8.07	0.18
Chongzuo City	129	61.31	2.67	0.66	98	80.79	13.83	3.3
Liuzhou City	91	25.51	3.75	0.13	104	35.27	5.76	1.63
Laibin City	98	37.86	1.55	0.64	84	58.45	5.93	5.47
Average	106	37.17	3.1	0.25	102	51.04	8.11	2.28
Compared with the previous year	−4	+17.4	−0.11	+0.11	−2	+24.9	−1.17	−1.09

3.2.2 Plant diseases and insect pests in different sugarcane growing areas. Due to the expiration of the first generation borer damage period during this survey, the blight rate of seedlings is generally not high. However, the borer damage rate of plant crop in 2013 was indeed higher than in 2012, and the borer damage rate was highest in the southern Guangxi regions. In some sugarcane growing areas, the highest blight rate of plant crop reached more than 30%, while the blight rate of ratoon cane was slightly lower than in 2012. As can be seen from Table 2, the borer damage rate of ratoon cane was indeed higher than that of plant crop, and the blight rate of ratoon cane in Baise City reached 13.83%. The smut rate of plant crop in 2013 was 0.11% higher than in 2012, while the smut rate of ratoon cane in 2013 was 1.09% lower than in 2012. But the overall smut rate is low, because a lot of sugarcane growing areas have actively taken measures to remove the diseased plants and control sugarcane smut. The smut rate of ratoon cane in Laibin City is highest, reaching 5.47%.

3.3 The field survey results in different sugarcane growing areas

3.3.1 The field survey results in the sugarcane growing areas of Nanning City. As can be seen from Table 3, the number of plant crop and ratoon cane seedlings per hectare in the sugarcane growing areas of Nanning City in 2013 was less than in 2012. The greatest number of plant crop seedlings per hectare in the survey points in 2013 was 139000 (184000 in 2012), the smallest number was 58000 (128000 in 2012), and the average number of seedlings per hectare was 102000 (147000 in 2012), decreasing by 45000 compared with the same period in 2012. It was mainly due to the low temperature, low germination rate and reduced tillering from March to May 2013. The greatest number of ratoon cane seedlings per hectare in the survey points in 2013 was 140000 (180000 in 2012), the smallest number was 60000 (57000 in 2012), and the average number of seedlings per hectare was 91000 (107000 in 2012), decreasing by 16000 compared with the same period in 2012. It was mainly due to the increase in sugarcane yield during 2012/2013 milling season and rainy and warm winter in 2012. From the survey results on seedling number in different sugarcane growing areas of Nanning, the seedling number of plant crop per hectare in Wuming County was larger than in Hengxian County, and the seedling number of plant crop per hectare in rural sugarcane growing areas was larger than in sugarcane farms. The reason for this phenomenon is that the planting density in Wuming County is higher than in Hengxian County, and the row spacing in rural sugarcane growing areas is narrower than in sugarcane farms. In terms of the seedling height, the greatest plant height of ratoon cane in the sugarcane growing areas of Nanning was 68.1 cm in 2013 (53.2 cm in 2012), the smallest height of ratoon cane was 23.1 cm in 2013 (19.6 cm in 2012), and the average plant height was 48.1 cm (29.3 cm in 2012), 18.8 cm higher than that in 2012. As for the plant crop, the plant height of winter sugarcane planted in December reached 92.9 cm, while the greatest plant height of spring sugarcane was 51.8 cm (40.5 cm in 2012), the smallest plant height was 28.5 cm (21.6 cm in 2012), and the average plant height was 47.6 cm (30.9 cm in 2012), 16.7 cm higher than that in the same period in 2012. According to the characteristics of sugarcane growth over the years, the ten-day growth of ratoon cane in late May was usually more than 10 cm, and the ten-day growth of plant crop was also close to 10 cm. Taking into account the above factors, the sugarcane plant height in 2013 was slightly higher than in 2012, but the difference was not significant. By comparing the sugarcane growth between the sugarcane growing areas in Nanning, it is found that the growth in Wuming is slightly better than in Hengxian. In terms of blight rate due to borer damage, the highest blight rate of plant crop was 16.13% (18.35% in 2012), the lowest blight rate was 0.00% (0.55% in 2012), an average of 4.88% (5.23% in 2012); the highest blight rate of ratoon cane was 22.68% (also 22.68% in 2012), the lowest blight rate was 2.13% (5.18% in 2012), an average of 11.08% (13.11% in 2012). The blight rate of ratoon cane was significantly higher than that of plant crop, and the blight rate of ratoon cane in Liangqi Farm was highest, an average of 15.62%, 3.64% higher than that in 2012, which was mainly due to the late sugarcane harvest in 2012/13 milling season. In terms of smut plant rate, the smut plant rate in various sugarcane

growing areas of Nanning in 2013 was higher than in 2012. The highest smut plant rate of plant crop was 0.90%, and the lowest smut plant rate was 0.00%, an average of 0.11%. The highest smut plant rate of ratoon cane was 10.94%, and the lowest smut plant rate was 0.00%, an average of 2.33% (2.06% in 2012). The disease rate of ratoon cane was higher than that of plant crop, and the disease rate of "ROC 22", "Liucheng 03 - 1137" was higher than that of other varieties.

Table 3 The growth of sugarcane seedlings in Nanning City in 2013

Survey areas	Sugarcane plant types	Year	Items	Seedling number (10^3 plants/ha)	Plant height cm	Blight rate %	Smut plant rate %
The sugarcane	Plant crop	2013	Maximum	139	92.9	16.13	0.90
growing areas			Minimum	58	28.5	0.00	0.00
in Nanning City			Average	102	47.6	4.88	0.11
		Average in 2012	147	30.9	5.23	0.00	
		Comparison of average between 2013 and 2012		-45	+16.7	-0.35	+0.11
10.94	Ratoon cane	2013	Maximum		140	68.1	22.68
			Minimum	60	23.1	2.13	0.00
			Average	91	48.1	11.08	2.33
		Average in 2012	107	29.3	13.11	2.06	
		Comparison of average between 2013 and 2012	-16	+18.8	-2.30	+0.27	

3.3.2 The field survey results in the sugarcane growing areas in Hechi City. As can be seen from Table 4, the number of ratoon cane seedlings per hectare in the sugarcane growing areas of Hechi in 2013 was significantly higher than in 2012, while the number of plant crop seedlings per hectare in 2013 was slightly less than in 2012. The largest number of plant crop seedlings per hectare in 2013 reached 202000 (165000 in 2012), but the smallest number was only 47000 (50000 in 2012), an average of 100000 (104000 in 2012), decreasing by 4000 per hectare compared with the same period in 2012. The decrease in the number of plant crop seedlings was related to the low temperature from March to May 2013. In 2013, the largest number of ratoon cane seedlings per hectare in Hechi reached 310000 (191000 in 2012), and the smallest number was only 48000 (43000 in 2012), an average of 124000 (93000 in 2012), increasing by 31000 per hectare compared with the same period in 2012. The increase in the number of ratoon cane seedlings was related to the increased proportion of new sugarcane varieties with strong ratoon features in 2013. In terms of plant height of seedlings, the greatest height of plant crop in the sugarcane growing areas of Hechi was 33.3 cm in 2013 (25.1 cm in 2012), and the smallest height was only 12.7 cm (13.9 cm in 2012), an average of 21.6 cm (19.0 cm in 2012), only 2.6 cm higher than in 2012. If considering the delayed survey for two weeks, the actual height of plant crop seedlings in 2013 was shorter than in 2012, which was mainly due to the slow seedling growth under low temperature from March to May 2013. In 2013, the greatest plant height of ratoon cane reached 64.8 cm (41.6 cm in 2012), and the shortest height was 20.0 cm (18.1 cm in 2012), an average of 36.3 cm (25.4 cm in 2012), increasing by 10.9 cm compared with the same period in 2012. If considering the delayed survey for two weeks, the plant height of ratoon cane seedlings in 2013 was basically equivalent to that in 2012. From the general growth trend, the average level in 2013 was better than in 2012, and from the growth trend of varieties, "Guitang 29" and "Guitang 32" grew well in Hechi City. The blight rate due to borer damage in 2013 was lower than in 2012, and the blight rate in Hechi was also lower than in the southern sugarcane growing areas of Guangxi. The highest blight rate of plant crop was 11.69% (10.30% in 2012), and the lowest rate was 0.00%, an average of 1.96% (2.21% in 2012). The highest blight rate of ratoon cane was 17.07% (41.96% in 2012), and the lowest rate was 0.00%, an average of 3.99% (7.15% in 2012). In 2013, the disease rate in the sugarcane growing areas of Hechi was very low. There was almost no smut plant in plant crop, and the average smut rate of ratoon cane was only 0.79% (2.06% in 2012).

3.3.3 The growth of sugarcane seedlings in Laibin City. The survey results show that the average seedling number of plant crop in the sugarcane growing areas of Laibin was 104000 per hectare; the average plant height was 37.86 cm; the blight rate was 1.55%; the smut rate was 0.64%. Compared with the same period in 2012, the seedling number decreased by 6000 per hectare; the plant height increased by 18.76 cm; borer damage was reduced; the sugarcane blight rate decreased by 3.34%. From the survey results on ratoon cane, compared with the same period in 2012, the number of ratoon cane seedlings decreased by 1000 per hectare; the plant height increased by 33.3 cm; the borer damage increased by 0.46%. From the survey results on sugarcane smut disease, the incidence of ratoon cane smut was 6.82% in Wuxuan County, and it was the county seriously affected by smut disease in Laibin. From the overall results, the sugarcane grows well in Laibin (see Table 5).

Table 4 The growth of sugarcane seedlings in Hechi City in 2013

Survey areas	Sugarcane plant types	Year	Items	Seedling number (10^3 plants/ha)	Plant height//cm	Blight rate//%	Smut plant rate//%
The sugarcane growing areas in Hechi City	Plant crop	2013	Maximum	202	33.3	11.69	0.00
			Minimum	47	12.7	0.00	0.00
			Average	100	21.6	1.96	0.00
		Average in 2012	104	19.0	2.21	0.00	
		Comparison of average between 2013 and 2012	−4	2.6	−0.25	0	
	Ratoon cane	2013	Maximum	310	64.8	17.07	6.81
			Minimum	48	20.0	0.00	0.00
			Average	124	36.3	3.99	0.79
		Average in 2012	93	25.4	7.15	2.06	
		Comparison of average between 2013 and 2012	+31	+10.9	−3.16	+1.27	

Table 5 The survey results on the sugarcane growing areas in Laibin City in 2013

Sugarcane plant types	The sugarcane growing areas	2012				2013				Comparison between 2013 and 2012			
		Seedling number (10^3 plants/ha)	Plant height cm	Blight rate %	Smut plant rate//%	Seedling number (10^3 plants/ha)	Plant height cm	Blight rate %	Smut plant rate//%	Seedling number (10^3 plants/ha)	Plant height cm	Blight rate %	Smut plant rate//%
Plant crop	Xingbin District	106	19.5	5.35	1.01	104	32.9	1.4	0	−2	13.4	−3.95	−1.01
	Wuxuan County	102	18.7	4.44	0.14	93	42.9	1.7	1.28	−9	24.2	−2.74	1.14
	Average in the sugarcane growing areas of Laibin	104	19.1	4.89	0.57	98	37.9	1.55	0.64	−6	18.8	−3.34	0.07
Ratoon cane	Xingbin District	86	25	6.57	3.46	82	55.9	7.55	4.11	−4	30.9	0.98	0.65
	Wuxuan County	84	25.4	4.37	12.44	86	61.0	4.31	6.82	2	35.6	−0.06	−5.62
	Average in the sugarcane growing areas of Laibin	85	25.2	5.47	7.95	84	58.5	5.93	5.47	−1	+33.3	+0.46	−2.485

3.3.4 The growth of sugarcane seedlings in Liuzhou City. We carried out a field survey of Rongan County, Rongshui County and Liucheng County in Liuzhou City. The survey results (Table 6) show that the number of plant crop seedlings in Rongan County was the largest among the five counties (districts) surveyed, reaching 110000 per hectare, and the number of seedlings was basically the same as that in 2012. In terms of the entire sugarcane growing areas in Liuzhou, the average number of plant crop seedlings was 91000 per hectare, decreasing by 11000 per hectare when compared with the same period in 2012; the average number of ratoon cane seedlings was 104000 per hectare, increasing by 22000 per hectare; the average height of plant crop and ratoon cane was 25.5 cm and 35.3 cm, respectively, increasing by 10.8 cm and 15.8 cm, respectively. From the pest survey results, the borer damage in the sugarcane growing areas of Liuzhou increased when compared with the same period in 2012. The borer damage rate of plant crop and ratoon cane increased by 2.19% and 1.03%, respectively, and the sugarcane smut disease was reduced when compared with the same period in 2012.

Table 6 The survey results on the sugarcane growing areas in Liuzhou City in 2013

Sugarcane plant types	The sugarcane growing areas	2012				2013				Comparison between 2013 and 2012			
		Seedling number (10^3 plants/ha)	Plant height cm	Blight rate %	Smut plant rate//%	Seedling number (10^3 plants/ha)	Plant height cm	Blight rate %	Smut plant rate//%	Seedling number (10^3 plants/ha)	Plant height cm	Blight rate %	Smut plant rate//%
Plant crop	Rongan County	110	15.0	0.77	0.22	111	22.6	1.54	0.02	1	7.6	0.77	−0.2
	Rongshui County	101	15.8	1.49	0.19	78	25.5	7.39	0.05	−23	9.7	5.9	−0.14
	Liucheng County	95	13.3	2.44	0	84	28.4	2.32	0.31	−11	15.1	−0.12	0.31
	Average in the sugarcane growing areas of Liuzhou	102	14.7	1.56	0.14	91	25.5	3.75	0.13	−11	10.8	2.19	−0.01
Ratoon cane	Rongan County	90	18.5	2.44	1.02	105	33.3	5.65	0.75	15	14.8	3.21	−0.27
	Rongshui County	68	18.6	4.42	0.57	109	31.4	8.89	0.56	41	12.8	4.47	−0.01
	Liucheng County	87	21.4	7.32	4.51	97	41.1	2.75	3.58	10	19.7	−4.57	−0.93
	Average in the sugarcane growing areas of Liuzhou	82	19.5	4.73	2.03	104	35.3	5.76	1.63	+22	+15.8	+1.03	−0.4

3.3.5 The growth of sugarcane seedlings in Chongzuo City. The sugarcane planting and cutting occurred early in the sugarcane growing areas of Chongzuo, and the management was in place. The appropriate measures were taken to cope with the borer damage and sugarcane smut, and the growth of the seedlings was good. In the survey, it was also found that the growth of the plant crop seedlings in 2013 was in general better than in 2012, and the average seedling number was 129000 per hectare; the number of ratoon cane plants was less than in 2012, and the average seedling number was 98000 per hectare. The inadequate emergence may be related to the degeneration of local major variety "ROC 22". The sugarcane smut of ratoon cane was serious in basically all plots, but farmers removed the diseased plants (see Table 7).

Table 7 The growth of sugarcane seedlings in Chongzuo City from 2012 to 2013

Sugarcane plant types	The sugarcane growing areas	2012				2013				Comparison between 2013 and 2012			
		Seedling number (10^3 plants/ha)	Plant height cm	Blight rate %	Smut plant rate// %	Seedling number (10^3 plants/ha)	Plant height cm	Blight rate %	Smut plant rate// %	Seedling number (10^3 plants/ha)	Plant height cm	Blight rate %	Smut plant rate// %
Plant crop	Jiangzhou District	141	24.9	5.39	0	161	59.7	5.22	1.56	20	34.8	-0.17	1.56
	Fusui County	–	–	–	–	134	54.5	1.04	0.24	–	–	–	–
	Xianggui Sugar Industry	106	36.0	3.99	0.08	94	69.8	1.74	0.19	-12	33.8	-2.25	0.11
	Average in the sugarcane growing areas of Chongzuo	124	30.4	4.69	0.08	129	61.3	2.67	0.66	5	30.9	-2.02	0.58
Ratoon cane	Jiangzhou District	124	31.1	9.09	1.29	85	80.7	16.52	2.08	-39	49.6	7.43	0.79
	Fusui County	–	–	–	–	79	84.4	11.34	5.5	–	–	–	–
	Xianggui Sugar Industry	120	33.8	13.05	4.90	130	77.3	13.64	2.32	10	43.5	0.59	-2.58
	Average in the sugarcane growing areas of Chongzuo	122	32.4	11.07	3.09	98	80.8	13.83	3.3	-24	+48.4	+2.76	+0.21

3.3.6 The growth of sugarcane seedlings in Baise City. As can be seen from Table 8, the emergence of plant crop in Baise was very good. Due to adequate rainfall, the emergence of plant crop in 2013 was better than in 2012, and the average emergence was 116000 per hectare, increasing by 17000 per hectare. The emergence of ratoon cane was less than in 2012, but the average number of seedlings also reached 109000 per hectare. The overall seedling growth in 2013 was better than in previous years, and the average height of plant crop was 12.3 cm higher than in 2012, while the average height of ratoon cane was 22.6 cm higher than in 2012. Local areas mainly applied pesticides to prevent borer damage in Baise. The sugarcane smut was slight in 2013, and the black ear damage and borer damage were not as serious as in 2012.

Table 8 The growth of sugarcane seedlings in Baise City from 2012 to 2013

Sugarcane plant types	The sugarcane growing areas	2012				2013				Comparison between 2013 and 2012			
		Seedling number (10^3 plants/ha)	Plant height cm	Blight rate %	Smut plant rate// %	Seedling number (10^3 plants/ha)	Plant height cm	Blight rate %	Smut plant rate// %	Seedling number (10^3 plants/ha)	Plant height cm	Blight rate %	Smut plant rate// %
Plant crop	Youjiang District	102	20.3	1.38	0.00	108	37.9	3.78	0.00	6	17.6	2.4	0.00
	Tianyang County	–	–	–	–	101	34.6	2.50	0.00	–	–	–	–
	Tiandong County	97	13.5	6.47	0.00	139	15.0	5.10	0.00	42	1.5	-1.37	0.00
	Average in the sugarcane growing areas of Baise	99	16.9	3.92	0.00	116	29.2	3.79	0.00	17	12.3	-0.13	0.00
Ratoon cane	Youjiang District	163	22.4	19.73	0.61	113	48.6	3.26	0.28	-50	26.2	-16.47	-0.33
	Tianyang County	–	–	–	–	100	44.0	9.12	0.00	–	–	–	–
	Tiandong County	103	27.1	6.84	0.71	113	49.5	11.84	0.27	10	22.4	5.00	-0.44
	Average in the sugarcane growing areas of Baise	133	24.7	13.28	0.66	109	47.3	8.07	0.18	-24	+22.6	-5.21	-0.48

4 Survey summary

4.1 The planting area of sugarcane decreased During the 2012/2013 milling season, due to decline in sugarcane prices but rise in corresponding production material and labor prices, the sugarcane growers' planting efficiency was poor, and especially the major growers were mostly at a loss. The farmers' enthusiasm for growing sugarcane was reduced in 2013. Based on the actual situation in the sugarcane growing areas of Nanning City and Hechi City, the actual planting area of sugarcane in 2013 was nearly about 1333 ha less than in 2012. Due to low output value of sugar-

cane, most farmers tend to develop the cash crops of high output value. For example, Liucheng County in Liuzhou has vigorously developed the cultivation of citrus and other fruits in recent years, and a large area of sugarcane is replaced by citrus and other characteristic fruits; the planting area of sugarcane in Liucheng County decreased by nearly 4000 ha in two years.

4.2 The overall growth of seedlings in 2013 was similar to that in 2012 From the observed and surveyed data, it can be found that growth of the seedlings was similar to that in 2012. In terms of the seedling number per capita, the number of plant crop seedlings decreased by 4000 and the number of ratoon cane seedlings decreased by 2000 when compared with the same period in 2012. The number of plant crop seedlings in the sugarcane growing areas of Nanning was 2000 per hectare than in the sugarcane growing areas of Hechi, but the number of ratoon cane seedlings in the sugarcane growing areas of Hechi was 2000 per hectare than in the sugarcane growing areas of Laibin, possibly because in recent years, the sugarcane growing areas in Hechi have vigorously promoted the varieties with strong ratoon features such as "Guitang 29" and "Guitang 32". However, the plant height increased significantly compared with 2012, and the average height of plant crop in 2013 was 17.4 cm higher than in 2012 while the average height of ratoon cane in 2013 was 24.9 cm higher than in 2012.

4.3 The overall borer damage rate was lower than in 2012, but the borer damage rate was still high in some sugarcane growing areas The overall borer damage rate in 2013 was lower than in 2012, but the borer damage rate in some sugarcane growing areas was still high, which might be due to the prevention time and the degree of attention. The borer damage rate in some survey sites was still more than 10%. The borer damage rate was high in several survey sites in Liangqi Farm, and the highest blight rate of ratoon cane reached 22.68%, but the borer damage rate in adjacent Xinkai Sugar Industry was much lower than in Liangqi Farm. The difference between the two sugarcane growing areas was due to the fact that the harvest during the 2012/2013 milling season in Liangqi Farm was postponed to the date after April 20, and the growers had no time to prevent borers, while the harvest and milling occurred early in Xinkai Sugar Industry and sugarcane growers had time to prevent, so the borer damage rate was low.

4.4 There was a difference in sugarcane smut between north and south The major variety was still "ROC 22" highly prone to sugarcane smut, so the sugarcane smut rate of plant crop in 2013 was higher in 2012, while the sugarcane smut rate of ratoon cane was lower than in 2012. This is due to the fact that the farmers' awareness of control has been enhanced in recent years, and they choose the new sugarcane varieties that can not be easily affected by sugarcane smut. The sugarcane growing areas in Hechi have vigorously promoted disease - resistant varieties in recent years, and the area of "Guitang 21" easily prone to sugarcane smut declined significantly, so the sugarcane smut rate of plant crop in the sugarcane growing areas of Hechi was 0, and the sugarcane smut rate of ratoon cane was also significantly lower than in 2012. The smut plant rate of sugarcane in the southern regions of Guangxi was significantly higher than in the central and western regions of Guangxi.

4.5 The promotion of "Guitang" varieties was slightly effective The major variety in most sugarcane growing areas of Guangxi is still "ROC 22", but due to the serious degradation of "ROC 22" in recent years, coupled with frequent extreme weather, the harm caused by single varieties is becoming increasingly apparent. Over a decade, the sugarcane breeding units in Guangxi have always attached great importance to the breeding of fine varieties of sugarcane, and thanks to the strong support of the State and regions, a number of excellent new varieties of sugarcane have played a role in various sugarcane growing areas. Because of the high yield, antismut capacity and strong ratoon features of "Guitang 29", Hechi has promoted the cultivation of "Guitang 29" and "Guitang 40" ("Guitang 02 - 1156") presently. As of 2013, "Guitang 29" was grown in nearly 3333 ha of land; "Guitang 03 - 2287" is also very popular with farmers in Laibin; "Guitang 32" and "Guitang 31" also make good performance in Nanning.

4.6 The rising planting costs reduced growers' enthusiasm for management of sugarcane Due to decline in the sugarcane prices during the 2012/2013 milling season and decrease in the number of labor left behind in rural areas, the enthusiasm for sugarcane cultivation and management is significantly reduced, and some sugarcane growers can not find the workers even in the best period. In the sugarcane growing areas surveyed, the government subsidies for sugarcane cultivation are insufficient, the sugarcane planting costs are increased, and there is a shortage of labor forces. In addition, the backward cultivation techniques also greatly affect the production of sugarcane. It is found that only a small proportion of sugarcane growing areas adopt the film covering technology, and many farmers do not scarify land and perform subsoiling. Since there are insufficient labor forces in some sugarcane growing areas, the sugarcane growers' ratoon cane fertilization is relatively simple, and it is likely to cause fertilizer nutrient loss. Additionally, the extensive management also increases harm pests, and there is nearly a total crop failure in Rongshui County.

5 Recommendations

5.1 Accelerating the process of sugarcane fertilization and field management Currently, the ratoon cane and winter sugarcane have entered the jointing stage, but some sugarcane growers' fertilization management can not meet the sugarcane growth requirements. Therefore, it is necessary to take advantage of the current abundant rain to enhance the sugarcane fertilization and field management to ensure the adequate nutrient supply for sugarcane. On the basis of applying basal fertilizer to the stem of plant crop, it is recommended to apply 450 - 525 kg of urea and 375 - 450 kg of potassium chloride per hectare. For the ratoon cane without being fertilized, it is recommended to apply 1125 - 1500 kg of compound fertilizer with 45% of total NPK content or 1500 - 2250 kg of compound fertilizer with 25% - 30% of total NPK

content. For the weed – ridden sugarcane field, it is recommended to use 180 – 240 g of herbicides blended with 50 kg of water for directed spraying to educe weeds.

5.2 Strengthening the late borer prevention work to reduce borer damage and dieback rate The third generation borers will appear from late May to early July, leading to the sugarcane blight and dieback. It is necessary to strengthen the spraying control work to avoid the borer infestation, reduce borer damage rate and increase yield and sugar content[8]. It is recommended to use 20 – 30 mL of 20% Coragen or 20 mL of 30% Durivo mixed with 50 – 60 kg of water for spraying when there is powdered frass in the sugarcane leaf. In non – silkworm breeding areas, it is recommended to use 200 – 250 mL of 25% Bisultap plus 20 mL of 1.8% avermectin, or use 50 – 60 mL of 40% chlorpyrifos plus 20 mL of 1.8% avermectin, or use 100 – 125 g of 50% cartap plus 20 mL of 1.8% avermectin mixed with 50 – 60 kg of water for spraying.

5.3 Adjusting the variety planting structure and expanding the planting area of fine varieties of sugarcane At present, the variety structure is simple in the sugarcane growing areas, and in the arid areas, "ROC 22" and other varieties which are not droughttolerant, are still planted in a large area, which to some extent increases the adverse effects of drought on sugarcane producing areas in Guangxi. "Guitang" series varieties, as the local varieties, have strong adaptability, for example, "Guitang 21" has strong drought resistance[9]. In recent years, some new varieties bred by Sugarcane Research Institute of Guangxi Academy of Agricultural Sciences, such as "Guitang 29", "Guitang 31", "Guitang 32", "Guitang 35", "Guitang 37", "Guitang 38", "Guitang 39", "Guitang 40", "Guitang 42", "Guitang 03 – 2287" and "Guifu 98 – 296", have the features of precocity, high sugar content and drought toleration[10 – 12]. It is necessary to further strengthen publicity and promotion of "Guitang" varieties, and promote more sugarcane varieties that adapt to the climate in Guangxi to the sugarcane growing areas for largescale demonstration cultivation, in order to provide strong guarantee for the steady development of sugar industry in Guangxi[13 – 15].

5.4 Taking active measures to prevent and control outbreak of pests in some areas In recent years, due to the lack of rural labor and decline in farmers' enthusiasm for planting sugarcane, the sugarcane cultivation management is neglected, resulting in the occurrence of pests. The tumble bug hazards break out in nearly 200 ha of sugarcane field in Yongle Township of Rongshui County. In addition, the termites are rampant in Chongzuo and the local sugarcane growers hate deeply the pest outbreak but feel helpless. The sugarcane industry departments and sugarcane research departments should take active measures to reduce the loss of sugarcane, and ensure sustainable development.

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