QUALITY AND MATURITY PATTERN OF SUGARCANE CULTIVARS
FROM VARIOUS REGIONS OF THAILAND

By

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KEYWORDS: Maturity Pattern, Quality, Sugarcane.

Abstract

Sixteen cultivars developed at different breeding stations in Thailand were evaluated for various quality parameters at Mitr Phol Sugarcane Research Centre, to establish their maturity patterns. The field trial on clay soil was laid out in a RCBD of three replications. Plots were six rows. The quality parameters estimated were Brix, pol. percent, fibre percent and purity of juice. Stalk traits and cane yield were also measured. Maturity patterns were established by estimating all quality parameters from the eighth month until harvest. Cultivar LF82-2122 recorded the maximum CCS at harvest of 14.08, followed by LF00-1245 and Kps94-12-13. Cultivars Kps94-12-13, Kps92-2-3, LF82-2122, and LF00-1245 and the check cultivar K84-200 were early sucrose accumulators with high CCS during the 10th month. Cultivars UT94-2-483 and K88-92 were late maturing types. There was a decrease in night temperature between September and January, which had a positive effect on sucrose accumulation. We have seen the positive effect of low minimum temperature, coupled with genetic differences, on sucrose accumulation in all cultivars studied, but variation was in keeping with the manner in which certain cultivars accumulated sucrose, as given by their maturity trends. This information on maturity trends would help us to plan cultivar use (based on planting dates) to improve efficiency and sugar recoveries by altering planting and harvesting dates.

Introduction

In Thailand, sugarcane is harvested between October and April, and there are low recoveries in the mills in the first two months. The main objective of crop improvement in sugarcane is to improve profitability for farmers and millers.

Sugarcane quality is a measure of sucrose and is expressed as a net result of all physiological and metabolic pathways leading to the formation of sucrose. Study of natural maturity patterns of cultivars enables us to adjust harvesting and crushing schedules to obtain maximum recovery with minimum milling losses. The present study was undertaken to examine maturity patterns of different cultivars.

Material and methods

A field trial was conducted at Mitr Phol Sugarcane Research Centre, Phukieo, Thailand during 2002–2003. Sixteen cultivars contributed from various research institutes in Thailand were used. Field Crop Research Centre (KK), North Sugarcane Centre (LK), Kasetsart Project (Tby), Kasetsart University (Kps), Suphanburi Field Crop Research Centre (UT), Central Sugarcane Centre (K) and Mitr Phol Sugarcane Research Centre (LF) each contributed two cultivars and we included two checks K84-200 and K88-92.

We used a randomised complete block design (3 replications and each cultivar was planted in six rows of 6 metres having 1.3 metre inter row spacing). Normal agronomic practices were followed. The trial was planted on 17 January 2002.

Cane samples were collected from 8th month after planting until harvest and analysed for quality parameters viz., Brix, pol. percent, purity, fibre percent, and CCS were calculated (Bureau of Sugar Experimental Stations, 1991). Samples were prepared using a shredder, and shredded cane was squeezed to extract juice, which was analysed for Brix (refractometric) and pol. reading (polarimeter), and shredded fibre was washed to estimate fibre per cent in each sample. Stalk parameters like single stalk weight (kg), stalk length (cm), stalk diameter (cm), and number of nodes per stalk were recorded on the samples in addition to recording various agronomic traits. At harvest, yield and sugar yield were recorded.
Results and discussion

The results from the trials are discussed first for the natural maturity pattern of the cultivars followed by the estimation of yield and quality parameters at harvest.

Natural maturity pattern

Sucrose accumulation pattern

Data on quality parameters were estimated and the data on CCS are presented in Figure 1. We found a wide range of variation for the sucrose accumulation pattern among cultivars.

The data showed that there was an increase in sucrose from September to January. LF82-2122 and LF00-1245 are early maturing types along with Kps94-12-13, LK92-17 and Kps93-2-3 as well as check cultivar K84-200. Cultivars K88-92, UT94-2-483 and K95-84 were late maturing types with low CCS. The remaining cultivars fell into medium maturing types.

Cultivars Kps94-12-13, Kps92-2-3, LF82-2122, LF00-1245 and K84-200 were early sucrose accumulators with high CCS during the 10th month.

Night temperatures decreased from September to January, which has a positive effect on sucrose accumulation.

We have seen the positive effect of low minimum temperature on sucrose accumulation in all cultivars including the checks, but the variation is in keeping with the rate with which certain cultivars can accumulate sucrose, as given by their maturity trends which is genetic.

It is clear that physiological processes are involved in sucrose accumulation in these cultivars, as was seen by Moore (1995) and Nayamuth et al. (1999).

Yield and quality at harvest

The crop was harvested at 12 months and yield and quality data are presented in Table 1.

Fig. 1—Maturity pattern of different cultivars in the trial (DOP 17th January 2002).

Night temperatures decreased from September to January, which has a positive effect on sucrose accumulation.

We have seen the positive effect of low minimum temperature on sucrose accumulation in all cultivars including the checks, but the variation is in keeping with the rate with which certain cultivars can accumulate sucrose, as given by their maturity trends which is genetic.

It is clear that physiological processes are involved in sucrose accumulation in these cultivars, as was seen by Moore (1995) and Nayamuth et al. (1999).

Yield and quality at harvest

The crop was harvested at 12 months and yield and quality data are presented in Table 1.
**Table 1**—Yield and quality parameters at harvest in the trial (Maximum values shown in bold type).

<table>
<thead>
<tr>
<th>Cultivar</th>
<th>Brix (%)</th>
<th>Pol. (%)</th>
<th>Fibre (%)</th>
<th>CCS (%)</th>
<th>Purity (%)</th>
<th>Cane yield (t/ha)</th>
<th>Sugar yield (t/ha)</th>
</tr>
</thead>
<tbody>
<tr>
<td>KK94-2-200</td>
<td>20.67</td>
<td>17.68</td>
<td>14.74</td>
<td>12.79</td>
<td>85.51</td>
<td><strong>117.8</strong></td>
<td>15.1</td>
</tr>
<tr>
<td>KK94-2-206</td>
<td>20.32</td>
<td>17.13</td>
<td>12.35</td>
<td>12.62</td>
<td>84.22</td>
<td>108.6</td>
<td>13.7</td>
</tr>
<tr>
<td>LK92-11</td>
<td>20.19</td>
<td>17.16</td>
<td>13.68</td>
<td>12.52</td>
<td>84.99</td>
<td>83.8</td>
<td>10.5</td>
</tr>
<tr>
<td>LK92-17</td>
<td>21.61</td>
<td>18.98</td>
<td>15.43</td>
<td>13.86</td>
<td>87.74</td>
<td>94.3</td>
<td>13.1</td>
</tr>
<tr>
<td>Tby-2</td>
<td>19.79</td>
<td>16.81</td>
<td>10.28</td>
<td>12.78</td>
<td>84.89</td>
<td>88.6</td>
<td>11.3</td>
</tr>
<tr>
<td>UT94-2-483</td>
<td>19.53</td>
<td>16.38</td>
<td>15.30</td>
<td>11.60</td>
<td>83.87</td>
<td>116.1</td>
<td>13.5</td>
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<tr>
<td>Kps94-12-13</td>
<td>20.95</td>
<td>18.69</td>
<td>14.52</td>
<td>13.93</td>
<td><strong>89.15</strong></td>
<td><strong>114.1</strong></td>
<td><strong>15.9</strong></td>
</tr>
<tr>
<td>Tby-1</td>
<td>20.86</td>
<td>18.14</td>
<td><strong>15.64</strong></td>
<td>13.12</td>
<td>86.90</td>
<td>89.7</td>
<td>11.8</td>
</tr>
<tr>
<td>Kps92-2-3</td>
<td>20.65</td>
<td>18.05</td>
<td>14.17</td>
<td>13.33</td>
<td>87.35</td>
<td>92.7</td>
<td>12.4</td>
</tr>
<tr>
<td>UT95-2-156</td>
<td>19.75</td>
<td>16.98</td>
<td>14.61</td>
<td>12.33</td>
<td>85.94</td>
<td>87.9</td>
<td>10.8</td>
</tr>
<tr>
<td>K95-283</td>
<td>19.97</td>
<td>17.21</td>
<td>12.59</td>
<td>12.85</td>
<td>96.19</td>
<td>78.2</td>
<td></td>
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<tr>
<td>K95-84</td>
<td>19.35</td>
<td>16.57</td>
<td>13.72</td>
<td>12.14</td>
<td>85.62</td>
<td>107.1</td>
<td>13.0</td>
</tr>
<tr>
<td>LF82-2122</td>
<td>21.35</td>
<td>18.68</td>
<td>12.55</td>
<td><strong>14.08</strong></td>
<td>87.47</td>
<td>91.6</td>
<td>12.9</td>
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<tr>
<td>LF00-1245</td>
<td><strong>21.75</strong></td>
<td><strong>19.05</strong></td>
<td>14.36</td>
<td>14.03</td>
<td>87.52</td>
<td><strong>89.6</strong></td>
<td><strong>12.6</strong></td>
</tr>
<tr>
<td>K88-92(C)</td>
<td>18.36</td>
<td>15.60</td>
<td>11.79</td>
<td>11.67</td>
<td>84.93</td>
<td>112.0</td>
<td>13.1</td>
</tr>
<tr>
<td>K84-200(C)</td>
<td>21.07</td>
<td>17.33</td>
<td>13.88</td>
<td>12.33</td>
<td>82.34</td>
<td>81.1</td>
<td>10.0</td>
</tr>
<tr>
<td>Stat significance</td>
<td>**</td>
<td>**</td>
<td>**</td>
<td>**</td>
<td>*</td>
<td>*</td>
<td>ns</td>
</tr>
<tr>
<td>Lsd (5%)</td>
<td>1.48</td>
<td>1.72</td>
<td>2.48</td>
<td>2.18</td>
<td>3.96</td>
<td>3.99</td>
<td>3.83</td>
</tr>
</tbody>
</table>

**Quality**

At harvest, LF00-1245 had the highest Brix (21.75) and pol. percent (19.05), Kps94-12-13 the highest purity (89.15%) and Tby-1 the highest fibre content (15.64%).

Mitr Phol cultivars had higher CCS than other cultivars, with LF82-2122 and LF00-1245 recording maximum CCS of 14.08 and 14.04, respectively, while UT94-2-483 recorded the lowest CCS of 11.60.

**Yield**

There was significant variation for cane yield with KK94-2-200 recording the highest yield (117.8 t/ha) followed by UT94-2-483 (116.1 t/ha) and Kps94-12-13 (114.1 t/ha). K95-283 recorded the lowest yield of 78.2 t/ha. Kps94-12-13 recorded the maximum sugar yield of 15.9 t/ha followed by 15.1 t/ha by KK94-2-200.

**Stalk traits**

We found significant variation in stalk traits between early and late maturity types. Late maturing cultivars K88-92, UT94-2-483 and K95-84 had thicker and heavier stalks, and these cultivars recorded significantly higher yields.

K95-84 recorded single stalk weight of 2.05 kg, while UT94-2-483 had maximum stalk length. Early maturing LF00-1245 had maximum nodes apart from having higher internodal length.

We observed differential reaction of early and late maturing types to the stalk traits which is similar to the results of Nayamuth et al. (1999).

**Conclusion**

We have observed variation in maturity pattern and identified cultivars based on their maturity pattern (genetic potential), and seen the positive effect of low temperature.

This information would help us to use the cultivars to improve efficiency and sugar recoveries by altering planting (planting late-maturity, slow-growing types earlier in the season) and harvesting dates.

Late maturing cultivars (UT 94-2-483, K88-92 and K95-84) could be harvested during January or February to maximise profitability.

**Acknowledgements**

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PARAMETRES DE QUALITÉ ET MODES DE MATURITÉ DES VARIÉTÉS DE CANNE À SUCRE DE DIVERSES RÉGIONS DE LA THAILANDE
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MOTS CLÉS: Mode de Maturité, Qualité, Canne a Sucre.

Résumé

Seize variétés développées dans différentes stations de breeding en Thaïlande ont été évaluées à Mitr Phol Sugarcane Research Centre pour divers paramètres de qualité afin de déterminer leur mode de maturité. L'essai au champ a été établi dans un sol argileux, suivant un dispositif en blocs complètement aléatoires, avec trois répétitions dans des parcelles de six lignes. Les paramètres évalués étaient le Brix, le pourcentage de canne, la fibre et la pureté du jus. Les caractéristiques de la tige et le rendement ont aussi été mesurés. Des modes de maturité ont été établis en estimant tous les paramètres de qualité à partir du huitième mois jusqu'à la récolte. La valeur maximale de sucre commercial était obtenue à la récolte (14,08) a été enregistrée chez la variété LF82-2122, suivie des variétés LF00-1245 et Kps94-12-13. Chez les variétés Kps94-12-13, Kps92-2-3, LF82-2122, et LF00-1245, ainsi que dans la variété témoin K 84-200, le saccharose était accumulé tôt et une valeur élevée de sucre commercial était obtenue au dixième mois. Les variétés UT94-2-483 et K88-92 se sont révélées des variétés tardives. Une baisse de la température nocturne de septembre à janvier a eu un effet positif sur l'accumulation de saccharose. L'effet de ces chutes de températures, associées aux différences génétiques, a été observé chez toutes les variétés, toutefois une variation existait selon la manière dont certaines variétés accumulaient le saccharose, comme le démontrent leurs courbes de maturité. Ces informations sur les modes de maturité seront utiles pour planifier l'exploitation des variétés basée sur les dates de plantation - afin d'améliorer l'efficience et le rendement en sucre en programmant les dates de plantation et de récolte.

PATRONES DE CALIDAD Y MADURACIÓN DE CULTIVARES DE CAÑA DE ÁZUCAR DE VARIAS REGIONES DE TAILANDIA
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PALABRAS CLAVES: Patrones de Maduración, Calidad, Caña de Azúcar.

Resumen

Dieciséis cultivares desarrollados en diferentes estaciones de mejoramiento en Tailandia fueron evaluados para diferentes parámetros de calidad en el Centro de Investigación de la Caña de Azúcar de Mitr Phol, para establecer los patrones de maduración. La prueba de campo en un suelo arcilloso fue sembrada en un diseño de bloques completos al azar con tres repeticiones. Las parcelas tuvieron seis surcos. Los parámetros de calidad estimados fueron Brix, por ciento de caña, porcentaje de fibra y pureza del jugo. Los caracteres del tallo y la producción de caña también fueron medidos. Los patrones de maduración fueron establecidos mediante la estimación de todos los parámetros de calidad a partir del octavo mes hasta la cosecha. El cultivar LF82-2122 tuvo el máximo CCS a la cosecha que fue de 14,08, seguido por LF00-1245 y Kps94-12-13. Los cultivares Kps94-12-13, Kps92-2-3, LF82-2122, y LF00-1245 y el cultivar testigo K84-200 tuvieron una acumulación temprana de sacarosa con alto CCS, durante el 10° mes. Los cultivares UT94-2-483 y K88-92 tuvieron una maduración tardía. Entre septiembre y enero hubo una disminución de la temperatura nocturna que tuvo un efecto positivo en la acumulación de sacarosa. Se pudo apreciar el efecto positivo de las bajas temperaturas mínimas junto con las diferencias genéticas, en la acumulación de sacarosa en todos los cultivares estudiados, pero dicha variación estuvo de acuerdo con la manera de acumulación de sacarosa de algunos cultivares, según sus tendencias de maduración. La información sobre tendencias de maduración ayudará a planificar el uso del cultivar (basado en las fechas de siembra) para mejorar la recuperación y eficiencia de azúcar, cambiando las fechas de siembra y cosecha.