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SHORT COMMUNICATION

ENDOGENOUS GIBBERELLIN LEVEL IN THE SHOOT APICES OF FLOWERED AND NON-FLOWERED STALKS OF SUGARCANE VARIETIES

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Flowering in sugarcane is influenced by a number of plant and environmental factors. Among the plant factors, the growth hormones play a vital role in production of floral stimulus. The endogenous levels of gibberellins (GA_3) was analyzed in the shoot apices of flowered and non-flowered stalks of sugarcane varieties Bo 91,Co 86249,Co 1148 and Co C 671 at the end of the flowering season using HPLC. In sugarcane shoot apices, the gibberellic acid (GA) recorded a prominent peak at the retention time of 6.4 min. Data on endogenous gibberellin-like substances showed significant variations between the flowered and non-flowered stalks as well as varieties. The shoot apices of flowered stalks contained 25 to 45% higher endogenous GA level in the four varieties studied.

Key words: **Flowering, gibberellic acid, shoot apex, sugarcane**

Flowering is an essential process for breeding programme in commercial crops. Floral induction usually starts when the plant attains physiological maturity. Flowering is also controlled both by endogenous cues, such as the developmental age of the plants as well as environmental signals. Concomitant with the induction of flowering, an array of reactions of hormonal, biochemical and molecular level are activated (Most and Viltos 1966). The role of endogenous regulators and signal transduction in the transformation of vegetative to floral state has been well documented (Koshioka *et al.* 1984). Gibberellins accelerate growth and induce or promote flowering in certain plants, while specific proteins and mRNAs play an important role in floral induction in certain other plants (Moore *et al.* 1986). Like any other morphogenetic process, floral induction and subsequent development is considered to be mediated via protein and nucleic acid metabolism. An attempt has been made to study the endogenous gibberellins level in flowered and non flowered stalks of four varieties of sugarcane.

The endogenous level of gibberellins in the shoot apices of flowered and non-flowered stalks of varieties BO 91, Co 1148, Co 86249 and CoC 671 were quantified using HPLC (Shimadzu VP-series). The shoot apices of the flowered and non-flowered stalks were dissected and used. Shoot tips (20 g) drawn from twenty different stalks flowered and non-flowered (verified by dissection) were weighed and macerated with 70% methanol along with 2% ascorbic acid. The samples were replicated twice. The shoot apices were homogenized with 0.1 M phosphate buffer (pH 7) containing β-mercaptoethanol (1:1) in a pre-chilled mortar and pestle. The standard procedures were followed for the extraction of gibberellic acid in shoot apices as per Kuhnle *et al.* (1983).

The methanol fraction of the solvent was filtered through a membrane filter and degassed. The sample was run on a reverse phase C18 column with acetonitrile: water (1:3) as the mobile phase and the chromatogram was obtained at the flow rate of 1 ml/min and read in UV-VIS

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detector at 254 nm. The retention time (RT) for gibberellins (GA_3) was observed at 6-8 min. The identification of GA_3 was done by the comparison of retention times with authentic standards of GA_3 (Sigma). Finally, the spiking test was adopted to confirm the results. The concentration of the gibberellins in plant samples was calculated using the peak area against the GA_3 standard values and expressed as µg/g.

The endogenous gibberellin levels in the shoot apices of the flowered and non-flowered stalks of varieties BO 91, Co 1148, Co 86249 and CoC 671 given in Table 1. Significant differences were observed between the flowered and the non-flowered stalks of the four varieties studied. In the variety BO 91, the content of endogenous gibberellin level was relatively higher (31.3 µg/g) in the flowered stalks as against 17.3 µg/g in the non-flowered stalks. The gibberellin content thus was 45% higher in the flowered stalks than in the non- flowered stalks (Fig.1 a & b). In CoC 671 the gibberellin content increased by 33% in the flowered stalks over that of the non-flowered stalks. The gibberellin content in the flowered and non- flowered stalks as well as the interaction, flowered x non-flowered stalks, are highly significant.

Table 1. Endogenous gibberellin content (µg/g) in the shoot apices of four sugarcane varieties

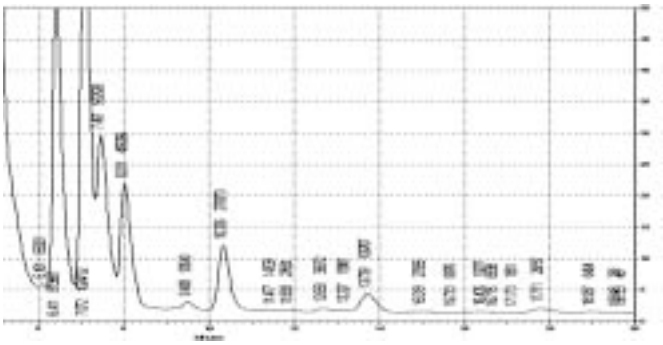
Clone	Flowered	Non-flowered	Mean
BO 91	31.3	17.3	24.3
Co 1148	7.1	4.7	5.9
Co 86249	21.6	6.9	14.3
CoC 671	8.1	6.0	7.1
Mean	17.0	8.7	
		SE	**CD (P =0.01)**
Flowered stalk		0.645	1.526
Non flowered stalk		0.913	2.159
Flowered x Non-flowered stalk		1.291	3.053

The endogenous GAs plays a vital role in flower induction in several plants (King *et al.* 2003). The endogenous GA levels in the shoot apices of four different sugarcane varieties were determined. Varieties

Method	Detector	Column	Mobile phase	Absorbance
CLASS-VP (SHIMADZU VP-10)	Photo diode array (PDA) detector	C18 u Bondapak	Acetonitrile: water (30:70)	254 nm

a. Flowered stalks

RT	AREA	CONCENTRATION
6.411	873887	31.32µg/g



b. Non-flowered stalks

RT	AREA	CONCENTRATION
6.411	483170	17.32µg/g

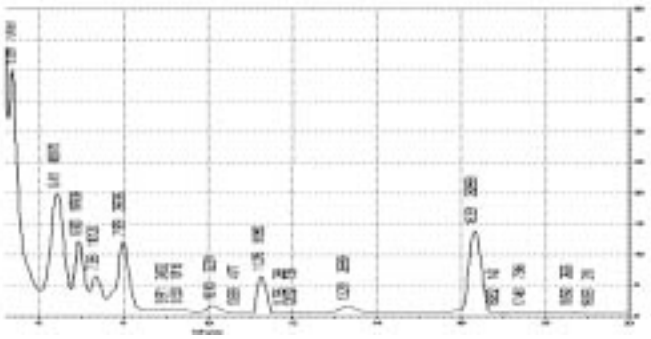


Fig. 1. Endogenous gibberellin content in the shoot apices of clone BO 91

differed in their endogenous GA levels. In general, the flowered stalks of all the four varieties had significantly higher GA content than the non-flowered stalks. The shoot apices of flowered stalks had 25 to 45% higher endogenous GA content in the four varieties studied. Moore (1986) reported that the flowering apices contained 8-9 times more endogenous gibberellins (A1/3 and iso GA_3) than in vegetative shoot apices. Vegetative apices contained significant levels of GA_{19} and GA_{36}. The increased levels of $GA_{1/3}$ and iso-GA_3

were correlated with the flowering state rather than with photoperiod or photoperiod changes per se.

REFERENCES

King, R.W., Evans, L.T., Mander, L.M., Moritz, T., Pharis, R.P. and Twitchin, B. (2003). Synthesis of gibberellin GA_6 and examination of its role in flowering of *Lolium temulentum*. *Phytochemistry* **62:** 77-82.

Kuhnle, J.A., Moore, P.H., Haddon, W.F. and Fitch, M.M. (1983). Identification of gibberellins from sugarcane plants. *J. Plant Growth Regul*. **2:** 59-71.

Koshioka, M., Pharis, R.P. and Moore, P.H. (1984). Identification of gibberellins A4 and A36 in sugarcane apices by gas chromatography - slected ions monitoring. *Agric. Biol. Chem*. **46:** 2395-2396.

Moore, P.H. Pharis, R.P. and Koshioka, M. (1986). Gibberellins in apical shoot meristems of flowering and vegetative sugarcane. *J. Plant. Growth. Regul.* **5:** 101-109.

Most, B.H. and Vlitos, A.J. (1966). Gibberellins of sugarcane. *Plant Physiol.* **41:** 1090-1094.