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EFFECTS OF PHYTOHORMONE ON LATERAL BUD ELONGATION AND ACIDINVERTASE ACTIVITY DURING THE REGROWTH OF SORGHUM BICOLOR M.

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ABSTRACT

The relationships of phytohormone and sucrose metabolism in the stem of sorghum after cutting were studied using the stem disks treated with various plant growth regulators. The release of buds after incubating was accelerated by 6-benzyladenoprine riboside (6-BAR) treatment. But, on abscisic acid (ABA) and indole acetic acid (IAA) treatment the release of buds was retarded. The length of elongated buds on all hormonal treatments was shorter than the non-treated at the end of incubated period tested. Invertase activities were stimulated on all hormonal treatments. On 6-BAR treatment, invertase activities were the highest. But there were no relationships between invertase activities and the bud growth. Therefore, we considered that the release of buds was regulated directly by hormone balance and then the elongation during 3 days after incubation was not affected by invertase activities.

KEYWORDS

Sorghum, phytohormone, acid invertase, sucrose contents

INTRODUCTION

The regrowth of sorghum starts from the release of axillary buds situated in stubble. Axillary buds are able to develop into shoots after release from inhibition. We reported that the cytokinin played an important role in the release from inhibition of buds (Nojima et al., 1985). The main carbohydrate reserve of sorghum in stubble is sucrose. The rate at which stubble carbohydrates are available for metabolism is enzyme-dependent (Yamamoto and Mino, 1987; Prud'Homme et al., 1992). On the other hand, evidence exists indicating that formation of some acid invertases is regulated by hormones such as indole acetic acid (IAA) and abscisic acid (ABA) (Rutherford and Bard, 1971; Ackerson, 1985). In this paper, we investigated the relationship between exogenous hormone and acid invertase activity in sliced stem with one bud to elucidate the mechanism of regrowth of sorghum after cutting.

METHODS

Sorghum (*Sorghum bicolor* M. cv.FS902) plants grown during about 4.5 months (15 days after heading) were collected at a height of 10 cm to 20 cm above ground level. The stems were cut into a slice with each disk having one lateral bud. Each disk was placed in 10^{-5} mole 6-BAR, 10^{-5} mole IAA, 10^{-5} mole ABA and H_2O solution and was incubated at 25°C for 3 days.

The disks for each treatment were extracted for sucrose and acid invertase activity and analyzed with the method described by Ackerson (1985).

RESULTS AND DISCUSSION

The release of bud was accelerated by 6-BAR treatment. The percentage of the released buds at 41 hrs after incubating increased from 10% to 80% with the 6-BAR treatment. On IAA and ABA treatments, the release of buds was retarded (table 1). Harrison and Kaufman (1980) reported that tiller bud growth in isolated stem segments of oats could be promoted exogenously applied kinetin, and strongly inhibited by applied ABA. The 6-BAR stimulation on the release of buds is consistent with the rise in endogenous cytokinin at on one day after cutting that has been previously demonstrated (Nojima et al. 1985). Therefore, it is considered that the hormone has an immediate effect after cutting, and the hormonal balance af-

fects the release of axillary buds.

The length of elongated buds on all hormonal treatments was shorter than the water treated control. On ABA treatment, the outgrowth of buds was suppressed markedly. The effect of 6-BAR on the bud length was different from the results of previous paper (Nojima et al. 1985). It may be the difference of carbohydrate utilization on elongation after the release of buds since the release was faster on 6-BAR treatment.

Invertase activities in disks increased rapidly at 12 hrs after incubation and then were stimulated on all hormonal treatments. On 6-BAR treatment invertase activities were the highest. In chicory roots, IAA and kinetin stimulated invertase synthesis (Rutherford and Bard 1971). Abscisic acid stimulated invertase activity in pod wall tissue of soybean (Ackerson 1985). Prud'Homme et al. (1992) showed that acid invertase activity was highest in stubble of ryegrass on the first day after cutting.

The concentration of sucrose in disks decreased after incubation and were lower on all hormone treated disks. There was the inverse relationship between sucrose concentration and invertase activities. Ackerson (1985) has described that abscisic acid stimulates acid invertase in pod walls and may also serve to promote glucose flux from the pod wall to the developing seed. In this paper, 6-BAR, IAA and ABA stimulate the invertase activity, and the carbohydrate reserves become to be available. However, there is no relationship between invertase activity and bud outgrowth. It is suggested that hydrolysis of sucrose to hexose can be utilized directly not for outgrowth of buds but for the respiration of maintenance.

Therefore, we concluded that the release of buds was regulated directly by hormonal balance and then the elongation during 3 days after incubation was not affected by invertase activities.

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Figure 1

Acid invertase activities (glucose $\mu\text{g g}^{-1}\text{FW. min}^{-1}$) (A) and sucrose contents (mg g^{-1}FW) (B) in the stem disks treated with 6-BAR, IAA, ABA and water. Vertical bars indicate SE.

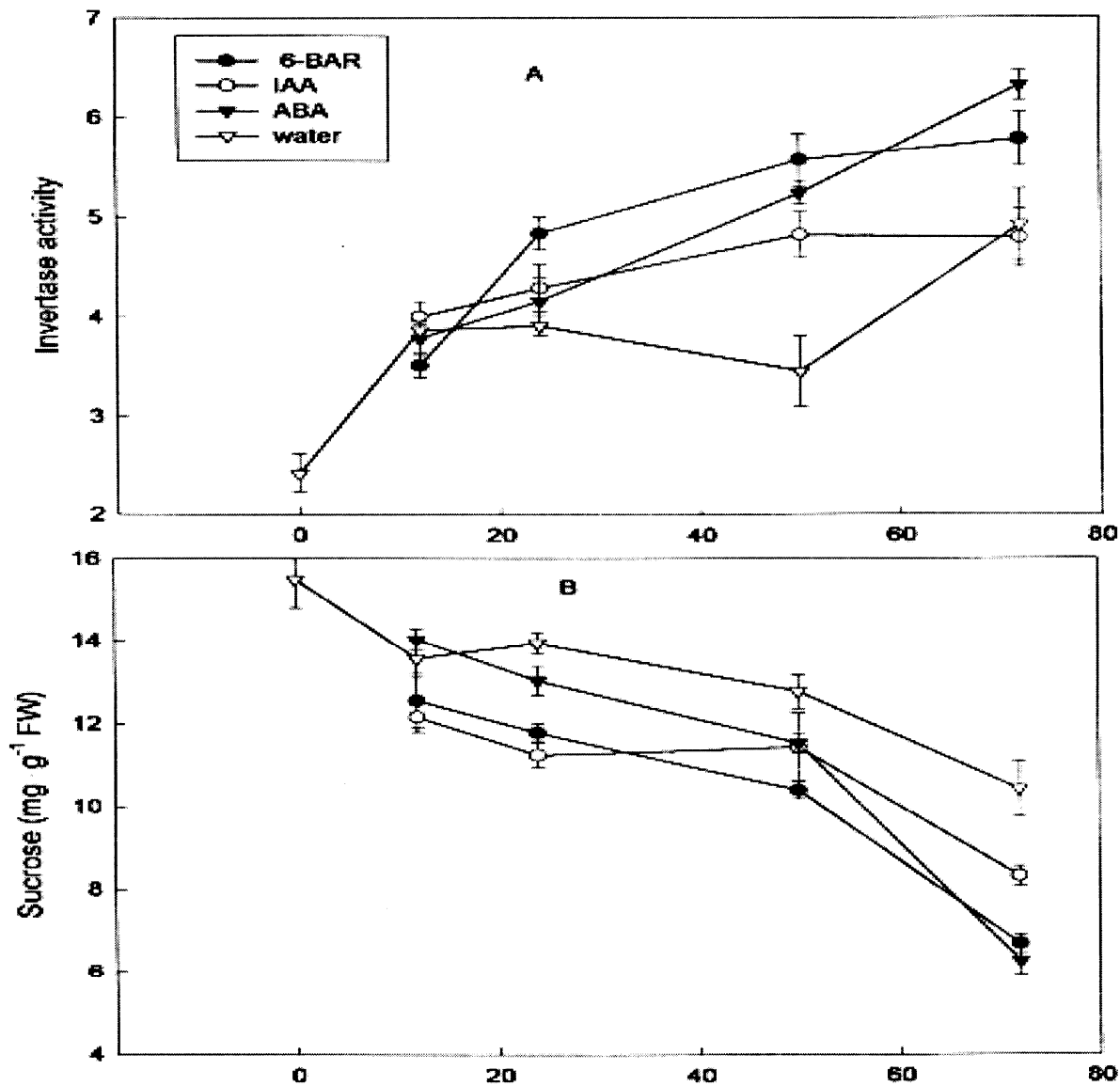


Table 1

Effects of hormone treatments on the release of buds and elongated bud length.

	release of buds (%) after incubation				elongated bud length
	29hr	41hr	53hr	65hr	72hr (mm)
6-BAR	10	80	100	100	27.5a*
IAA	0	20	90	100	22.1 ^b
ABA	0	0	40	90	18.7 ^b
water	0	50	100	100	28.6 ^a

*The same letter is not significant ($p < 0.05$).