EFFECT OF ETHEPHON ON SUGARCANE GROWN UNDER SUB-TROPICAL CLIMATES

By

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Abstract

In the Asian sub-tropics, sugarcane is an important commercial crop, but sugar productivity per se is rather low, in spite of the introduction of improved cane varieties and better agri-management practices. The full genetic potential of these improved varieties cannot be realised due to many biotic and abiotic stresses that impede growth and sugar accumulation. To minimise these physio-biochemical constraints, agro-chemical manipulation techniques were used at different stages of sugarcane growth. Ethephon was found to promote seed cane sprouting (13-17%), improve tillering and millable cane formation (12-16%) and help in initiation and formation of ratoon shoots/tillers of winter-harvested cane (8-10%). Its beneficial response had been observed in the advancement of cane maturity (plant crop) with appreciable gain in CCS percent, giving adequate flexibility to cane growers on the time of harvest.

Introduction

Increasing sugar production is a major concern for the global sugar industry due to increases in sugar consumption in Asia, Africa and Latin America and other developing countries. To improve sugar production efficiency, most of the recent research work is focused on agri-bio dynamics of cane growth and sugar accumulation. Recent studies show that on an industry-wise basis, production of sugar per unit area is not increasing as rapidly as might be expected, given past research achievements and improved management-technology. The upcoming gene technologies and new generation plant growth regulators (PGRs) may have the desired potential to increase sugar content and improve crop economics. Thus, there is further scope for increasing sugar productivity if physiological and biochemical constraints are identified and modified through chemi-technology or genetic transformation.

In the sub-tropical region of Asia, particularly the sugar belt of north India, which constitutes over 2.0 million hectares of land under sugarcane cultivation, sugar yields are restricted by a short growing season. The objective of this study was to evaluate the effect of ethephon on the entire growth cycle of sugarcane from germination to maturity.

Materials and methods

Seed cane treatment with ethephon

The foliage of a 12-month old crop was completely drenched with ethephon at 1000 mg/L and the crop was harvested one week after treatment. Three-bud sett (mixed samples) were planted end-to-end in the furrows that were 10-15 cm. deep. The settings were raised as per the recommended cane husbandry practices. Sprouting percentages were recorded at 25, 35, 45 and 55 days after planting (DAP).

Effect of ethephon on tillering and biomass production

Ethephon at 500 to 1000 mg/L was applied post-emergence to the crop 60 to 70 DAP. The number of tillers produced per unit area were recorded 135 DAP. The number of millable stalks and cane yield were recorded at harvest. The total aerial biomass (TAB) production was recorded at the time of final harvest.

Effect of ethephon on sprouting of winter initiated ratoon growth

Ethephon at 1000 mg/L + 2% urea was applied as foliar spray to the standing crop 7 to 10 days before its scheduled winter harvest. The sprouting of subterranean buds and number of tillers in the subsequent ratoon were recorded.

Effect of ethephon on ripening

Sugarcane was subjected to a foliar spray of ethephon at 1000 mg/L in the first week of October. The juice quality attributes (Brix, pol, purity) were recorded at regular intervals in treated and non-treated plots.

Results and discussion

Effect of ethephon in improving sprouting of seed cane and settling vigour

In the sub-tropics, sprouting percentages of cane set range from 30-35%. Therefore, a heavy input in the form of cane seed is a regular practice. Ethephon enhanced cane sprouts by 13-17%. Reaction to ethephon application on seed cane varies considerably, ranging from 10-15%. Ethephon-treated setts also had a greater shoot-to-root ratio and higher dry matter per shoot (data not presented).

KEYWORDS: Cane Quality, Over-Stand, Ratoon, Sprouting, Sugar Recovery, Tillering.
Effect of ethephon in enhancing tillering and biomass production

The results indicate considerable improvement in tiller number, millable canes (NMC) and cane yield following Etaphon treatment in the varieties Co1148 and Co997. The response seems to be best with 1000 mg/L ethephon spray. The gain in NMC varied from 12-16%, which was reflected in cane yield at harvest. Yadav and Prasad (1987) reported a significant improvement in tillering and yield of late-planted sugarcane with ethephon. Another report from India showed that varieties CoJ64, Co1148 and CoH12 tillered freely in response to postemergence spray of ethephon and gave higher yields at final harvest than the non-treated control.

Effect of ethephon on sprouting and regrowth of winter harvested sugarcane

The early sprouting and subsequent growth of winter-harvested cane of early maturing varieties is one of the important aspects of ratoon production in the sub-tropics. Experiments carried out by our group revealed that pre-harvest folic application of ethephon (December and January harvested plant crop), 7 to 10 days before harvest not only improves juice quality of plant cane but also has a stimulatory effect on bud sprouting, and growth of stubble buds during winter months (Solomon, 1996). A significant increase in stubble bud sprouting and tiller number was recorded following ethephon treatment. Enhancement in stubble bud sprouting under field condition was about 8–10% after a fortnight of ratoon initiation as compared to the non-treated check. The number of ratoon tillers per unit area, as recorded after 120 days of ratoon initiation, was 15–17% more in the treated plots.

Effect of ethephon on ripening

In Indian sub-tropics, climatic conditions for ripening are favourable, but sugar recovery has been poor during the early part of the milling season (7.5+0.5% cane). A significant increase in commercial cane sugar (CCS %) percent in the varieties CoJ64 and CoS767 was recorded following ethephon treatment (data not shown). An appreciable increase in CCS percent could be noticed after 6th week of ethephon spray. In the ratoon crop, a positive response of ethephon was noticed but to a lesser extent. This is probably due to the early attainment of maturity in the ratoon crop.

Based on the extensive practical evidence and field exploration, it could be concluded that aerial application of ethephon has the potential to improve sugar recovery by about 0.5–1.0 units, early in the season. A similar finding was reported by Yang (1986) from Taiwan, indicating that aerial spray of ethephon (2 L/ha), 6–10 weeks prior to harvest consistently increases sucrose content in juice with no adverse effect on stalk density, height and cane yield of the succeeding ratoon crop. These studies indicate that ethephon could be successfully used in advancing cane maturity under a sub-tropical climate, as well.

REFERENCES


EFFETS DE L'ETHEPHON SUR LA CANNE A SUCRE EN CLIMATS SOUS TROPICAUX

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Résumé

Dans la région sous-tropicale d'Asie, la canne à sucre est une culture commerciale importante, mais la productivité elle-même est plutôt faible, malgré l'introduction de meilleures variétés de canne et de meilleures pratiques de gestion agricole. Le potentiel génétique absolu de ces meilleures variétés ne peut être atteint en raison de plusieurs contraintes biotiques et non-biotiques qui entravent la croissance et l'émagasinage du sucre. Pour minimiser ces contraintes physio-biochimiques, des techniques de manipulation agro-chimique furent utilisées à différents stades de développement de la canne. Il a été constaté que l'Ethephon augmentait la germination des graines de canne (13-17%), améliorait le tallage et le développement de cannes usinables (12–16%), et aidait à l'initiation et au développement de tiges de repousse dans la canne récoltée en hiver (8–10%). Ses avantages ont été constatés dans la promotion de la maturité de la canne (canne vierge) avec des gains appréciables dans la teneur en sucre, donnant une flexibilité adéquate aux planteurs quant aux choix de la période de récolte.

Mots-clés: qualité de la canne, surpeuplement, repousse, germination, récupération de sucre, tallage.
EFECTO DEL ETHEPHON EN LA CAÑA DE AZÚCAR EN CLIMAS SUBTROPICALES

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Resumen

En el subtrópico Asiático la caña de azúcar es un cultivo comercial importante, pero la productividad en sí es baja, a pesar de la introducción de material genético mejorado y del uso de mejores prácticas de manejo. El potencial genético de las variedades no es alcanzado debido a factores bióticos y abióticos que impiden el crecimiento y la acumulación de sacarosa. Para minimizar los factores físico-bioquímicos se usaron técnicas agroquímicas en distintos estados del desarrollo de la caña. Se encontró que el Ethephon promueve la germinación de las yemas (13–17%), mejora el macollamiento y la formación de tallos molinables (12–16%) y ayuda en el rebrote de las cepas de la caña sembrada en invierno (8–10%). Se han registrado beneficios al avanzar la maduración de las plantillas con ganancias apreciables en CCS, dando flexibilidad a los agricultores para la cosecha.