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# サトウキビ栽培における限界除草期間



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# Critical Period for Weed Management in Sugarcane Field.

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## Introduction

Weeds are the number one enemy that compete with crops from the very beginning of the growth and ultimately reduces the growth, vigour and yield of the crops. Weeds compete for light, water, and soil nutrients with crop resulting in serious yield reduction (Blackman and Templeman, 1938). In case of sugarcane, long interval between planting and emergence, slow seedling growth, wider row spacing, liberal fertilizer application at planting and frequent irrigation during early growth season are the principal factors which enhacce weed population and their vigorous growth in between the sugarcane rows. Thus it is very important to keep weed free environment during the early growth stages of cane (Goudar et al, 1981). The loss in cane productivity due to weed infestation is estimated up to 75% (Singh and Adhalakha, 1954, and Singh and Moolani, 1975). In sugarcane field, weed free environment until full canopy development is very much important for better crop growth. Usually, Weeds' growth are suppressed below economic injury level after full canopy development of sugarcane. According to Rangiah et al. (1988) sugarcane crop requires a weed free environment up to 90 days from planting, for realizing its maximum yield potential. Therefore, control of weeds in proper time is very much essential for obtaining satisfactory cane yield. However, it is very difficult to determine the critical stage/period for controling weeds effectively. Also the method of weed control is important to eliminate the weed population from the field. From the very beginning sugarcane growers in Bangladesh control weeds manually without thinking about the economy. Moreover, high price of herbicides and inadequate supply led the farmers to control weeds mechanically. So, it is important to determine the extent of critical period/stage for manual weed control in sugarcane field for obtaining maximum yield. Therefore, the present experiment was designed to determine the critical growth period of sugarcane during which weeds must be controlled or suppressed below the economic injury level for obtaining maximum cane yield.

## Materials and Methods

An experiment was conducted at Muladully farm of North Bengal Sugar mills of Bangladesh during 1990–1991 crop season. The high yielding and popular cane variety Isd. 16 was used as a test crop. The experiment was laid out in randomized complete block design with three replications. Treatments were as follows :

$T_1$ : No weed control.
$T_2$ : No weeding up to 45 days after planting (DAP).
$T_3$ : No weeding up to 75 DAP.
$T_4$ : No weeding up to 105 DAP.

$T_5$ : No weeding up to 135 DAP.
$T_6$ : Keeping weed free up to 45 DAP.
$T_7$ : Keeping weed free up to 75 DAP.
$T_8$ : Keeping weed free up to 105 DAP.
$T_9$ : Keeping weed free up to 135 DAP.

The plot size was 48㎡. Trenches were prepared on mechanically prepared land with a row spacing of 1 m. Fourty two days old settlings (previously raised in 12.5×10 cm sized polyethylene bags) were transplanted on 14th November, 1990. Commercial fertilizers viz. Urea, Triple-super Phosphate and Muriate of Potash were applied about 150, 150 and 110 kg/ha of N, $P_2O_5$ and $K_2O$, respectively. The entire dose of $P_2O_5$ was applied as basal dressing while N and $K_2O$ were applied in two equal splits as top dressing. One live irrigation and two supplimentary irrigations were applied during entire growth period of crops. Data on cane yield, yield attributes and quality parameters were also recorded. Dry weight of weeds were recorded for different treatments. Cost benefit ratio for weed control was also calculated. Relevent data were tabulated and analized statistically.

## Results and Discussions

The weed flora in the experimental plots included 22 different species. *Cyperus rotundus, Cynodon dactylon, Amaranthus spinosus, Amaranthus viridis, Colocassia esculenta, Commelina diffusa, Chenopodium album, Gnaphalium luteo-album, Saussurea lappa, Uforbia perbiflora, and Wahlenbergia marginata* were the major weeds. After effects due to weed infestation under different period of infestation on various yield contributing parameters of sugarcane are presented in Table 1.

The lowest number of tillers ($122\times10^3$/ha) were recorded in unweeded control ($T_1$) plots while the highest tillers of $187\times10^3$/ha were obtained from $T_9$ treatment. Keeping the land weed free up to 135 days after planting (DAP) significantly increased tiller production compared with the control. Also the treatment $T_2$ was at par with $T_9$ in respect of tiller production. Higher number of tiller production in $T_9$ and $T_2$ treatments might be due to no weed or little weed infestation during the early growth stage of sugarcane. Under these two treatments sugarcane has got weed free environment and utilized the soil resources for better growth and development. Prolonged weed infestation ($T_5$) during early growth stage of cane reduced tillering severely. Similar results were also observed in millable stalks production. Significantly maximum number of millable stalks ($108\times10^3$/ha) were obtained from $T_9$ treatments followed by $T_2$ treatments. Higher the period of weed infestation, lower was the millable cane production. Minimum number of millable stalk ($74\times10^3$/ha) was obtained from unweeded check plot. Significantly the highest cane yield (132 ton/ha) was obtained from the plots keeping weed free up to 135 DAP ($T_9$). In the $T_9$ treatment, weed free environment in the field coupled with higher economic shoot population may have contributed to higher cane yield. Similar results were also reported by Pandian et al. (1991). Further, the second highest yield (117 ton/ha) was obtained from $T_2$ treatment with minimum weed infestation. The unweeded control plot gave the lowest cane yield of 80 tons/ha. The percent yield increased due to weeding over the control was directly related to the period of

**Table 1. Effect of weeding on yield and yield contributing parameters of sugarcane**

| Treatments | Tiller (× 1000/ha) | Millable cane stalks (× 1000/ ha) | Yield (ton/ha) | % yield increase due to weeding | Recoverable sucrose (%) | Height of cane stalk (m) | Dry wt of weed/plot (kg) |
|---|---|---|---|---|---|---|---|
| $T_1$ : No weed control | 122 | 74 | 80 | — | 8.85 | 2.30 | — |
| $T_2$ : No weeding up to 45 DAP | 185** | 101** | 117* | 46.25 | 9.70* | 2.84 | 1.22 |
| $T_3$ : No weeding up to 75 DAP | 176** | 96** | 114* | 42.50 | 9.52 | 2.80 | 3.15 |
| $T_4$ : No weeding up to 105 DAP | 156* | 94* | 109* | 36.25 | 9.44 | 2.68 | 4.50 |
| $T_5$ : No weeding up to 135 DAP | 130 | 89 | 102 | 27.50 | 9.03 | 2.60 | 5.12 |
| $T_6$ : Keeping weed free up to 45 DAP | 147 | 83 | 86 | 7.50 | 9.42 | 2.46 | 0.20 |
| $T_7$ : Keeping weed free up to 75 DAP | 154* | 87 | 90 | 12.50 | 9.78* | 2.58 | 0.45 |
| $T_8$ : Keeping weed free up to 105 DAP | 167** | 90* | 96 | 20.00 | 9.82* | 2.61 | 0.71 |
| $T_9$ : Keeping weed free up to 135 DAP | 187** | 108** | 132** | 65.00 | 9.94** | 2.67 | 1.35 |

* indicates significant different at 5% level of significance as per LSD test.
** indicates significant different at 1% level of significance as per LSD test.

weed infestation. A weed free environment in cane field from planting to 135 days (canopy development stage) increased the cane yield by 65 percent. Keeping the land weed free during the early growth stages help increase recoverable sucrose percent in sugarcane. Significantly increased recoverable sucrose% (9.70—9.94) was obtained when sugarcane field was kept weed free from 45 days to 135 days after planting. Higher percentage of recoverable sucrose in weed free cane was also reported by Rangiah et al. (1988). Height of cane stalk was also badly affected by weed infestation. The minimum height of 2.30m was recorded in the unweeded control plot ($T_1$) and maximum height of 2.84m was obtained in the $T_2$ treatment. Longer the period of weed infestation, lower was the height of cane stalk. These results are in agreement with those reported by Malavia et al. (1991). Dry weight of weed per plot was maximum in $T_5$ treatment which was weeded very late. Minimum dry weight of weed per plot was found in $T_6$ treatment where the field was weeded at the very early stage.

Table 2 showed economic analysis of weed management in sugarcane. Cost of weeding per hectare was maximum (296 US $) in the $T_9$ treatment followed by the $T_8$, $T_3$, $T_2$ treatments. The lowest cost for weeding (74 US $) was in the $T_5$ and $T_6$ treatments. Additional yield over

**Table 2. Economic analysis of weed management in sugarcane field**

| Treatments | Cost of weeding per ha. TK. | $ (US) | Additional yield over control (ton/ha) | Additional income due to weeding/ha. TK. | $ (US) | Net income due to weeding/ha. TK. | $ (US) |
|---|---|---|---|---|---|---|---|
| $T_1$ : No weed control | – | | – | – | | – | |
| $T_2$ : No weeding up to 45 DAP | 7780 | 222.28 | 37 | 37000 | 1057.14 | 29220 | 777.71 |
| $T_3$ : No weeding up to 75 DAP | 7780 | 222.28 | 34 | 34000 | 971.42 | 26220 | 749.14 |
| $T_4$ : No weeding up to 105 DAP | 5188 | 148.23 | 29 | 29000 | 828.57 | 23812 | 680.34 |
| $T_5$ : No weeding up to 135 DAP | 2594 | 74.11 | 22 | 22000 | 628.57 | 19406 | 554.45 |
| $T_6$ : Weed free up to 45 DAP | 2594 | 74.11 | 6 | 6000 | 171.42 | 3406 | 97.31 |
| $T_7$ : Weed free up to 75 DAP | 5188 | 148.23 | 10 | 10000 | 285.71 | 4812 | 137.48 |
| $T_8$ : Weed free up to 105 DAP | 7780 | 222.28 | 16 | 16000 | 457.14 | 8220 | 234.85 |
| $T_9$ : Weed free up to 135 DAP | 10374 | 296.40 | 52 | 52000 | 1485.71 | 41626 | 1189.31 |

During 1990–91 1 US $=35 TK.
Price of cane was @ 1000 TK (28.57$) per ton.
Cost of labour was 35 TK. (1 $) per day per labour.

control was found highest (52 ton/ha) in the $T_9$ treatment followed by the $T_2$ treatment. Additional income as well as net income due to weeding was much higher in the $T_9$ treatment. Also the $T_2$ treatment gave satisfactory economic return compared with the control.

From the results, it is seen that keeping the sugarcane field weed free up to 135 days after planting is most significant for obtaining maximum economic benefit. Also keeping the land weed free from 45 days to 135 days after planting gave significantly higher yield increase as well as satisfactory economic benefit compared to the control. Therefore, the critical period for weed management in sugarcane field lies between 45 and 135 days after planting. For commercial cultivation of sugarcane, it is recomended to keep the sugarcane land weed free from the period of 45–135 DAP for obtaining higher economic benefit in Bangladesh.

**Summary**

An experiment was carried out at Muladully farm of North Bengal Sugar mills, Bangladesh during 1990–1991 crop season to determine the critical period for weed management in sugarcane. The experiment consisted of nine treatments with three replications and fitted in a randomized complete block design. Variety Isd. 16 was used as a test crop. Nine different weed infestation

period was included in this experiment to meet up the needs of the study. Yield and various yield contributing parameters and economic impact of weeding were investigated under different treatments.

The lowest number of tillers and millable stalks were obtained from the unweeded control plots ($T_1$) while the highest tillers and millable cane stalks were from the $T_9$ treatment where the plots were kept weed free up to 135 DAP. Similar results were also obtained in case of yield per plot. Further, prolonged weed infestation ($T_5$) during early growth stage of cane reduced tillering, millable stalks production and yield of cane. The treatment $T_2$ (keeping the land weed free from 45 to 135 DAP) was at par with the $T_9$ treatment in respect of tillering, millable canes and yield (ton/ha). The highest yield in the $T_9$ treatment was due to weed free environment in the plot coupled with maximum economic shoot. The percent yield increase due to weeding over control was directly related to the period of infestation. A weed free environment in cane field up to 135 DAP increased the cane yield maximum by 65 percent. Also keeping the land weed free during the early growth stage of cane helped increase recoverable sucrose (%).

Economic analysis also revealed that additional yield over control was highest in the $T_9$ treat-ment. Additional income and net income due to weeding was higher in the $T_9$ treatment. Also the $T_2$ treatment gave satisfactory economic return compared with the control. From the results, it is clear that keeping the land weed free from 45 to 135 DAP gave significantly higher yield and maximum economic benefit over the non-weeded check or other treatments. So the critical period for weed management in sugarcane field was found between 45 to 135 DAP for obtaining maximum economic return.

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# サトウキビ栽培における限界除草期間

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**摘 要**

この実験は、サトウキビ（a収量）に対する限界除草期間を決定するために1990～91年、バングラデシュ国、ノース、ベンガル製糖工場、ムラドリー農場で実施した。供試品種としてIsd. 16を使い、9処理区を3反復で、配置は乱塊法で実施した。すなわち、9種類の異なった除草処理期間（infestation period）を設置し、それぞれに対する収量、収穫構成要素及び除草処理の経済効果を検討した。

その結果、除草をしなかった無処理区（：$T_1$）で分けつ茎数及び原材料茎数が最も少なくなり、植付けから135日間除草した区（：$T_9$）が最も多くなった。収量においても同様になった。逆に、植付けから135日間放置した区（：$T_8$）では分けつ茎数、原材料茎数、及び原材料茎収量は減少した。除草処理期間が45から135日間での処理区（：$T_2$）は分けつ茎数、原材料茎数及び収量において$T_9$と殆ど同じであった。$T_9$処理区における最高収量は、除草による有効茎の増加（maximum economic shoot = millable shoot）によるものである。無処理に対する増収割合は、除草期間と直接的に関係した。135日除草処理区（：$T_9$）は、無処理区より収量で65%増加し、可製糖率（recoverable sucrose %）も増加した。経済効果もまた増収を反映し、$T_9$で優った。すなわち、$T_9$では、追加収入（additional income）及び純収量が最も高くなった。また、$T_2$も無処理区（$T_1$）に比較して満足すべき収益（economic return）が見られた。そして、無処理及び他の処理区に比較し、45～135 D.A.P処理区（：$T_2$）は著しい増量が得られ、最高経済効果（maximum economic benefit）が得られた。

このことから、サトウキビ栽培における最高経済回収を行なうための限界除草期間は、45～135日であることがわかった。