

**EFFECT OF SOME HERBICIDES AND GROWTH
REGULATORS ON GROWTH, YIELD AND
QUALITY OF SUGAR BEET IN SALINE SOILS**

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SUMMARY

Two field experiments were carried out at Tamiya Agricultural Research Station, Agricultural Research Center, El-Fayoum Governorate (Middle Egypt) in both successive growing seasons of 2017/18 and 2018/19.

The principal aim was to investigate the effect of soaking sugar beet seeds in gibberellic acid (GA3) and some weed control programs on abundance of weeds, weed control, growth characteristics, yield and yield components of sugar beet crop (*Beta vulgaris* L).

Each field experiment included 21 treatments representing the combination between three soaking concentrations and seven weed control program as follows:

A. Soaking treatments:

1. Soaking beet seeds in water (zero GA3)
2. Soaking beet seeds in 100 ppm GA3
3. Soaking beet seeds in 150 ppm GA3

Sugar beet seeds were soaked in GA3 for 24 hours before planting date. The planting irrigation applied directly after seeds sowing.

Weed control programs:

1. Acetochlor (2-chloro-N-(ethoxymethyl)-N-(2-ethyl-6-methylphenyl)acetamide known commercially as Harness 84 % EC at the rate of 750 cm³/fed. applied pre-planting.
2. Metamitron (4-amino-4,5-dihydro-3-methyl-6-phenyl-1,2,4-triazin-5-one;4-amino-3-methyl-6-phenyl-1,2,4-triazin-5(4H)-one) known commercially as Goltix 70% SC at the rate of 1.5L /fad. applied post emergence (4 true leaves of sugar beet)
3. Harness 84 % EC at the rate of 750 cm³/fed. applied pre-planting followed

by Goltix 70% SC at the rate of 1.5L /fad. applied post emergence (4 true leaves of sugar beet)

4. Harness 84 % EC at the rate of 750 cm³/fed. applied pre-planting followed by one hoeing after one month from application
5. Goltix 70% SC at the rate of 1.5L /fad. applied post emergence (4 true leaves of sugar beet) followed by one hoeing after one month from application
6. Hoeing three times at 4, 8 and 12 weeks from sowing.
7. Unweeded (control, without any weed control treatment).

The split plot design with four replications was used in these experiments. The levels of soaking allocated in the main plots, while, weed control treatments were distributed in the sub plots.

The most important results could be summarized as follow:

I. Effect of soaking sugar beet seeds in gibberellic acid, weed control treatments and their interaction on associated weeds.

The major weed species associated sugar beet crop in both seasons were mostly

broad leaved and some annual grassy as follows; wild beet(*Beta vulgaris*, L.), dentateddock (*Rumexdentatus*,L.),burclover (*Medicagohispida*, Gaerth), common lambsquarters (Chenopodium album, L.), mallow (Malvaparvflora, L.), rough cocklebur (Xanthium strumarium, L.) scarlet pimpernel (Anagallsiarvensis, L.) and canary (Phalaris minor Retz.).

A-After 75 days from planting:

1. Grassy, broad-leaved and total weeds were significantly affected by soaking sugar beet seeds in GA3 in both seasons.
2. Decreased soaking sugar beet seeds in gibberellic acid concentration from 150 to 100 and to zero (water) increased significantly number of

total weeds by 43.8 and 93.2% in the 1st season and 44.6 and 90.9% in the 2nd one, respectively.

3. All the applied weed control treatments reduced significantly, but to different extents, the number of broad leaved, grassy and total weeds than the unweeded (control) treatment.
4. Hand- hoeing (3 times) treatment gave the significantly lowest number of broad-leaved, grassy and total weeds. The reduction of number of these groups after 75 days from planting than the unweeded treatment by 98.1, 100 and 98.8%, 98.3, 100 and 98.9 in the first and second season, respectively. Goltex plus one hoeing came in the second order.
5. Soaking beet seeds in 150 ppm GA3 with conventional hand-hoeing (3 times) weed control treatment gave the lowest number of broad-leaved and total weeds. Grassy weeds were not existed and completely disappeared in all experimental plots with (150 ppm GA3).
6. Soaking sugar beet seeds in gibberellic acid exerted a significant impact on dry weight of beet weeds (g/m²) after 75 days from planting. Dry weight of weeds/m² was increased as beet seeds soaked in water.
7. Most efficient weed control treatment was hand-hoeing (three times) treatment which decreased broad leaved, and total weeds by 97.9 and 98.3%, 98.02 and 98.1 in the 1st and 2nd seasons, respectively. Goltix followed with one hoeing was the most efficient chemical weed control treatment against grassy weeds and their activity came also in the second order.
8. Soaking beet seeds at 150 ppm GA3 with conventional hand – hoeing treatment gave the lowest weight of beet weed groups whereas the heaviest ones were recorded from unweeded plots planted with seeds soaked in water only.

B. After 105 days from planting:

9. Soaking sugar beet seeds in water only was correlated with a progressive and significant increase in number of broad-leaved and total weeds, whereas the reverse was true for number of grassy weeds with soaking in GA3 concentrations.
10. Integration between herbicides with one hoeing as well as conventional hand – hoeing (3 times) treatments decreased significantly number of weed groups than the unweeded (control) treatment.
11. Interaction between soaking of sugar beet seeds in gibberellic acid and weed control treatment after 105 days from planting was significant. Sugar beet plots planted with seed soaked in GA3 and hoed three times exhibited the lowest number of broad- leaved and total weeds, whereas the highest number was obtained from the water soaking with unweeded plots.
12. Soaking sugar beet seeds in water only without gibberellic acid increased the abundance of total weeds and consequently increased significantly their dry weight/m² by 131.2 and 74.5% compared with 150 and 100 ppm GA3, respectively in the 1st season and 127.4 and 73.1, respectively, in the 2nd one.
13. Conventional hand-hoeing (3- times) gave the lowest total weed infestation and decreased their dry weight than the control by 99.1 and 98.7% in the 1st and 2nd seasons, respectively.
- 14.. Plots planted with seeds soaked at 150 ppm GA3 and hoed three times exhibited the lowest abundance of beet weeds, whereas the highest weed infestation was recorded from the soaking seed in water planted unweeded plots.

II. Soaking sugar beet seeds in gibberellic acid, weed control treatments and their interaction in relation to growth parameters of beet plants:

- 1- Soaking of sugar beet seeds in gibberellic acid had a significant effect on the percent of emerged hills. Soaking sugar beet seeds in gibberellic acid i.e. 100 and 150 ppm favored germination percentage of sugar beet seeds and consequently increased percentage of emerged hills compared with soaking sugar beet seeds in water only. Moreover, conventional hand-hoeing, Goltix + one hoeing and Goltix treatments had no harmful effect on survival of beet hills comparing with the un weeded treatment. Otherwise, Harness and Harness+ Goltix (metamitron) seems to be with a significant deleterious impact on beet germination, Harness gave the highest depressing effect followed with Harness+ metamitron in both seasons. The highest survived hills were recorded with either Goltix or unweeded with soaking sugar beet seeds in gibberellic acid at 150 ppm.
- 2- Overall weed control treatments, beet soaked in GA3 at 100 and 150 ppm possessed taller plant height without significant differences between them as compared to water soaking. Soaking sugar beet seeds in water produced plants were significantly shorter than those of 100 and 150 ppm by 25.4, 22.5, 19.4 and 17.1 % after 90 days; 27.8, 26.8, 21.9 and 21.2 % after 120 days; 19.3, 20.3, 15.5 and 17.9% after 150 days and 14.5, 15.7, 11.5 and 12.8 % after 180 days in the first and second season, respectively. All weed control treatments increased significantly plant height of sugar beet at the different ages than the un weeded treatment. The highest increase in plant height was obtained after 90, 120, 150, and 180 days from hoeing 3 times treatment followed by that of Goltix + one hoeing and Harness + one hoeing treatments and then followed by Harness + Goltix. soaking sugar beet seeds

in water was accompanied with a reduction in plant height of sugar beet plants of all weed control treatments.

- 3- Significant differences in LAI values were detected between soaking sugar beet seeds in gibberellic acid (100 and 150 ppm) and water soaking. This finding was fairly true at the four applied assessments and both seasons. Maximal increase in LAI value was attained by conventional hand – hoeing treatment which increases LAI than the un weeded treatment after 90 and 120 days from planting in the 1st and 2nd season by 207.1, 292, 273.5 and 198.9.0%, respectively. The highest value of this trait was obtained by interaction between hoeing 3- time treatment with 150 ppm GA3.
- 4- Top fresh weight/ plant progressively decreased as the beet seeds were soaked in water only. This finding was fairly true at the different growth stages and both seasons. Decreasing the soaking concentration of GA3 from 150 to 100 ppm and water only decreased significantly top fresh weight of plant 90, 120, 150 and 180 days' age by 24.7 and 25.8; 16.7 and 26.9; 6.02 and 8.6 and 3.7 and 7.1 % in the 1st season, respectively. While, in the 2nd season the reductions in this trait were 24.1 and 25.5; 16.5 and 8.8; 6.3 and 8.7 and 6.8 and 8.6, respectively. The heaviest top fresh weight of beet plant was attained by conventional hand – hoeing 3 times which significantly increased such trait value after 90, 120, 150 and 180 days than the un weeded plants and recorded 986.9, 1005, 1145.2, 1166, 888.2, 904.5, 584.6 and 595.7 in the 1st and 2nd seasons, respectively. hoeing sugar beet three times with soaking sugar beet seeds in gibberellic acid at 150 ppm surpassed the different interactions with respect to its effect on top weight/plant of sugar beet.
- 5- Decreasing sugar beet soaking of sugar beet seeds in gibberellic acid from 150 to 100 ppm and water decreased significantly root length of 90, 120, 150 and 180 days old plants than those of control. Root lengths of

hoed plants at the four mentioned assessments were 18.78, 23.35, 28.37 and 36.42 in the 1st season, respectively. Otherwise, in the 2nd season this trait recorded 19.23, 23.8, 28.82 and 36.87, respectively. Goltix + one hoeing along with Harness + one hoeing treatments came in the second order. The highest values of this trait was recorded by soaking sugar beet in 150 and/or 100 ppm GA3 and hoeing sugar beet plants 3- time. Result is true at the different growth stages.

6- Decreasing the concentration of GA3 from 150 to 100 ppm and water soaking decreased significantly diameter of roots of plants 4,5 and 6 months old. Conventional hand- hoeing treatment exhibited the maximal root diameter value followed by Goltix + one hoeing along with Hanes + one hoeing and then followed by the post emergence herbicide Goltix and pre-emergence herbicide Harness. These results were fairly true at all the studied growth stage samples. The interaction between soaking of sugar beet seeds in gibberellic acid and weed control treatments was significant at all growth stages. The highest values of this trait were recorded by hoeing 3-time with the two concentrations of GA3.

7- Decreasing concentration of GA3 from 150 to 100 ppm and water progressively and significantly decreased their root fresh weight after 90 days by 8.3 and 54.7%, after 120 days by 11.6 and 50.3%; after 150 days by 6.6 and 17.2% and after 180 days by 4.4 and 37.6% in the 1st season and 10.9 and 69.5; 15.1 and 60.5; 9.2 and 32.3; 4.4 and 50.4, respectively. Hoed plots gave the significantly heaviest root fresh weight than all the applied weed control treatments. This trend is fact at the four sampling assessments. Fresh weight of sugar beet roots of hand- hoeing treatment at 90,120,150 and 180 days from planting was 387.2 and 482; 617.4 and 819.3; 874.3 and 1155.5; 1149.9 and 1713.9 in the 1st and 2nd season, respectively. The

maximal and significantly root fresh weight was achieved from seed soaked in 150 ppm GA3 which hoed three times.

III- Soaking sugar beet seeds in gibberellic acid, weed control treatments and their interaction in relation to yield and yield attributes.

1. The highest concentration of GA3 (150 ppm) recorded the highest number of beet roots at harvest 29730 and 31022 in the 1st and 2nd season, respectively. Conventional hand-hoeing gave the maximal and significantly increases in number of beet roots than all other treatments. Such potent treatment increased final root number of sugar beet than the control by 22.4% in both seasons. Goltix + one hoeing treatment exhibited the highest value for beet root number among all the applied herbicidal treatments, and manifested equalities with Harness + one hoeing. The interaction between soaking of sugar beet seeds in gibberellic acid and weed control treatments exerted significant effects on root number/fed. The highest number of beet roots (32430 and 33840 roots/fed) was obtained when sugar beet seeds were soaked in 150 ppm GA3 and hoed 3-time in the 1st and 2nd season.
2. Soaking sugar beet seeds in gibberellic acid concentration from 150 to 100 ppm decreased root yield (ton/fed) by about 8.1 and 11.3 % and dropped on water soaking to 30.7 and 27.9 % in the 1st and 2nd season. Root yield of such potent treatment (hoeing 3-time) was 11.2 and 11.3 folds greater than that of un weeded treatment and exceeded significantly the most efficient chemical treatment of Goltix +one hoeing which came in the second yielding order, but it was found with comparable yield with that of Harness + one hoeing, Harness + Goltix and Goltix (metamitron) treatments. Hereof, Harness alone treatment yielded the lowest root yield.

However, its yield was significantly greater than that of un weeded treatment. Once more, the highest values of root yield were recorded by hoeing sugar beet 3- times per season. Root yield of this potent treatment significantly exceeded those obtained from all other weed control treatments. the interaction deduced that the maximal and significantly increases in sugar beet root yield (t./fed.) was yielded from conventional hoed plots which planted with seed soaked in 100 and 150 ppm GA3.

3. The highest concentration of GA3 (150 ppm) along with 100 ppm (middle) level gave the higher sugar yield and out yielded that of water soaking (zero GA3).Hoeing 3- times treatment produced the highest sugar yield followed with Goltix + one hoeing, whereas Harness was the lowest. Differences between the three mentioned weed control treatments were significant. the highest (150 ppm) and middle (100 ppm)GA3 concentration, hoeing beet field three time/season was the best treatment in this respect.

V- Sugar beet weed control treatments with relation to quality.

1. Dry matter percentage of sugar beet plants in terms of leaves and roots were significantly decreased as soaking of sugar beet seeds in water only.A significant increase in root dry matter percentage was recorded by Goltix + one hoeing; Haness + one hoeing treatments and hoeing 3- times over the un weeded plants. However, treated sugar beet plants with Harness alone produced the lowest root dry weight.Both leaves and roots dry weight % were significantly affected by the interaction between two studied factors. Soaking of sugar beet seeds in water only (zero GA3) was accompanied with the reduction in leaves and roots dry matter percentages of all weed control treatments.

2. Soaking sugar beet seeds in water significantly and gradually decreased the percent of total soluble solids of sugar beet roots. The two concentrations of GA3 (100 and 150 ppm) almost were an equal. On the other hand, Goltix + one hoeing as well as the post emergence treatment and the hand hoeing treatment attained a superiority over those treatments as well as un weeded treatment with respect to their effect on TSS%.The combination between the soaking sugar beet seeds in gibberellic acid (150 ppm.) with Goltix + one hoeing recorded the highest value of TSS%.
3. Soaking sugar beet seeds in 100 ppm GA3 produced significant increase in the value of sucrose percentage of sugar beet roots than the highest (150 ppm) and zero (water).All the applied weed control treatments except Harness treatment increased significantly but to different extents sucrose percentage in sugar beet roots at harvest. Goltix +one hoeing and/or hoeing three times recorded the highest significant increase in sucrose percentage. Soaking sugar beet seeds in the medium level i.e. 100 ppm GA3 and hoeing it manually three times/season attained the highest value of sucrose percentage (22.38 and 19.15%).
4. Purity percentage was statistically affected by the studied soaking concentrations hand hoeing three times was surpassed all the other weed control treatments with respect to juice purity percentage not only comparing with the un weeded treatment but also over all the different chemical weed control treatment soaking sugar beet seeds in water (zero GA3) attained the highest value of juice purity percentage with the pre-emergence weed control Goltix +one hoeing (80.79 and 92.8%) in the 1st and 2nd season, respectively.