# Some physiological studies on the growth of fodder beet plant (beta vulgaris L.)

Noga Abdo Afande Anton

SUMMARYThe present investigation was carried out to get more information about the behaviour of fodder beet plant under Egyptian conditions with respect to the effect of some growth regulators, some elements as well as the water regime of the crop. Therefore, three field experiments were conducted at Bahtim Agricultural Experiment Station, Agricultural Research Center, Kalubia Governorate during the two seasons 1987/1988and 1988/1989.The first experiment (A) deals with the effect of two growth regulators i.e. GA3 as promoter and Alar as a retardant. Each substance was used at three concentrations beside the control treatment. As for GA3, the three levels were 25, 50 and 100 ppm, while Alar was used at 500, 1000 and 1500 ppm. The second experiment (B) deals with the effect of some elements i.e. potassium (K), sodium (Na) and micro nutrients (a complete mixture having the name Librel). The treatments used were, control, 400 ppm K, 400 ppm Na,500ppm libre1,400 ppm K + 500 ppm librel,400ppm Na+500ppm librel, 200 ppm K + 200 ppm Na and200ppm K+200ppm Na + 500 ppm librel; Plants in experiment A andB were sprayed twice when aged 60 and 75 days with theused chemicals according to the concentrations described previously. The third experiment (C) is concerned with the effect of water regime on fodder beet. Four irrigation treatments were tested i.e. irrigation at 15 day intervals, 21 day intervals, 30 day intervals and 45 day intervals. The previous treatments were started after the first irrigation. A complete randomized block design was used in the three experiments with five replications. Agricultural practices were completed according to the usual methods being adopted for such crop.The most important results obtained from this investigation could be summarized as follows:Experiment (A) :1-The application of GA3 at different rates stimulated significantly the elongation of root length, while Alar at the used rates depressed root length.2-Spraying fodder beet plants with GA3 or Alar increased significantly root diameter over the control.3-GA3 and Alar at the three levels used decline slightly the root length/diameter ratio compared with the control.4-Fodder beet plants treated with GA3 had higher number of leaves than the control. However, Alar decreased such character compared with the control.5-Leaf area increased by time up to 139 days after sowing then decreased. GA3 application stimulated leaf area. The most pronounced concentration was found to be 50 ppm. On the contrary, Alar had a depressive effect on fodder beet leaf area.6-Dry matter of root, leaves as well as whole fodder beet plant was enhanced by the application of GA3 at the three levels used. The most effective concentration was found to be 50 ppm. The use of Alar at 500 ppm only increased dry matter accumulation in root, leaves and whole plant.7-Leaves comprise the main dry matter content at earlier stage of growth then decreased gradually till the end of the season. The reverse trend could be concluded for root.8-Fodder beet yield expressed in tons/feddan as fresh or dry weight was increased by the use of GA3 at the three rates used. The rate of 50 ppm GA3 seemed to be more effective in such character.9-Final yield of fodder beet was enhanced by the application of 500 ppm Alar.10-GA3 or Alar affected the translocation of nitrogenous compounds from leaves to rootsduring later periods of growth. Both1substances accelerate`' the accumulation ofnitrogenous compounds in fodder beet plant.11-GA3 or Alar accelerate the absorption of phosphorus by fodder beet plant. Alar was found to be less than GA3 in this respect. The most pronounced level of GA3 was found to be 100 ppm.12-Potassium content had a similar trend to that observed either with nitrogen or

phosphorus.13-Sodium content was increased by the application of either GA3 or Alar. GA3 at 100 ppm or at 500 ppm was found to be more effective in increasing Na content of fodder beet plant.14-Both substances (GA3 or Alar) increased the accumulation of sugars in root or leaves as well as the whole plant.15-Fodder beet plants treated with GA3 have higher total carbohydrate content than those sprayed with Alar.16-Fodder beet root had higher proportion of carbohydrates than the corresponding values of leaves except,the-first period of growth. The used substances i.e. GA3 or Alar affect9the distribution of carbohydrates between root and leaves.Experiment (B) :1-Fodder beet plants sprayed with potassium either alone or with complete micro nutrients increased root length.2-The highest values of root diameter were gained from treatments received K + M.n, followed by K + Na or K alone without any significant differences between them.3-Different element treatments slightly affected root length/diameter ratio.4-The application of K + micro nutrients increased number of leaves/plant at 97 or 118 days only.5-Spraying fodder beet plant with a complete micro nutrient solution resulted in a significant increase in total leaf area/plant. Such increase was enhanced by K application.6-Foliar application of 400 ppm K stimulated greatly the accumulation of dry matter in roots specially at later periods.7-Foliar spray with Na decreased the root dry matter of fodder beet plant during different growth periods.8-Maximum dry matter of leaves was gained from treatment sprayed with 400 ppm K. The combination of K + M.n increased leaves dry matter than the control without any more increase than K treatment alone.9-Foliar spray with Na or Na + M.n resulted in a pronounced decrease in leaves dry matter.10-Dry matter of whole fodder beet plant showed a similar trend to that observed either in roots or leaves.11-Maximum fodder beet yield either as fresh or dry in terms of tons/feddan was produced from treatments sprayed with 400 ppm K, 400 ppm K + M.N., 200 ppm K + 200 ppm Na + M.n and those plots received micro nutrients only without any significant differences between them. The application of Na either alone or with micro nutrients depressed fodder beet yield.12-Foliar application of potassium either alone or with micro nutrients increased nitrogen, phosphorus and potassium content of leaves, root and whole fodder beet plant.13-Under surplus of potassium, sodium content of fodder beet plant seemed to be increased.14-Foliar spray with complete micro nutrients solution increased the concentration of Fe, Mn, and Zn in root and leaves of fodder beetplant in most periods of growth.15- The application of potassium fertilizer increased the amount of carbohydrates in root, leaves as well as whole fodder beet plant.Experiment (C) :1-Water deficit enhanced the growth of fodder beet root in length. Maximum root length was gained from treatment irrigated at 45 day intervals.2-Increasing soil moisture stress did result in a significant decrease in root diameter.3-Frequent irrigations resulted in a lower root: length diameter ratio.4-Increasing irrigation intervals caused a significant reduction in number of leaves/plant on most of sampling periods.5-The moist treatment has the maximum value of leaf area/plant followed by the wet soil moisture level. However, the medium and dry water regime produced the lowest value of leaf area/plant.6-The highest dry matter of fodder beet root was gained from the moist treatment (irrigated every 21 days) followed by wet and medium soil moisture levels and the least root dry matter was obtained from the dry treatment (irrigated at 45 day intervals).7-For maximum leaves dry matter content, soil moisture must be maintained at a high level.8-Soil moisture stress had a significant effect on dry matter accumulation by whole fodder beet plant. The highest dry matter content of whole plant was produced from moist treatment and the least value was obtained from the dry one.9-Water deficit had a significant effect upon the productivity of fodder beet plant either as a fresh or dry weight basis. The maximum fodder beet yield i.e. roots, leaves and total yield was scored from the moist treatment (irrigated at 21 day intervals) followed by the wet or medium water regime and the least production was gained from severe soil moisture stress.10-Seasonal evapotranspiration varies widely between 338.20 and 621.20 mm. and 337.91 and 565.21 mm under different water regime treatments in the first and second season respectively.11-Evapotranspiration values were increased as soil moisture stress decreased. The least water consumption was brought about under dry conditions, whereas, the highest water use was attained under wet level, while under moist or medium water supply the valuesfall in between.12-Daily evapotranspiration rates were lower early in the season and increased as fodder beet plants developed to reach a maximum during May and March (in the first and second season respectively). A decline in water consumption rates occurred at the end of the season as expected

with mature palnts.13-Potential evapotranspiration values estimated by Turc were lower than those obtained from either Penman or modified Turc method.14-The values of potential evapotranspiration calculated by modified Turc are very close to those estimated by Penman method.15-Seasonal crop coefficient (Kc) for fodder beet plant was 0.8.16-Water use efficiency was much lower early in the season as the plant vegetation was not established. A slight increase in water use efficiency values was then observed (at 97 days). A great increase in water use efficiency values was gained during the period from 97 to 118 days then reached its maximam when plants aged 139 days. Thereafter, water use efficiency redecreased again when plants started to mature.17-Nitrogen, phosphorus, potassium and sodium content decreased as soil moisture stress increased.18-Sodium content of various fodder beet organs showed a lower values as compared with potassium.19-The accumulation of carbohydrate in different plant parts was decreased by increasing soil moisture stress.