Physiological studies on fodder beet plant

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SUMMARYThe present investigation was carried out to get someinformation about the behaviour of fodder beet plant as anew introduced crop under Egyptian conditions, with respectto the effect of some macronutrients either soil or foliarapplication and some specific growth regulators.Thereafter, three field experiments were conducted at theExperimental Farm, Faculty of Agriculture, Moshtohor,Kalubia Governorate during the two seasons 1992/1993 and1993/1994.The first experiment aimed to study the effect ofnitrogen, phosphorus and potassium as soil application,each alone or in combination. In the first season, N, P andK were added at: 30, 60 & 90kg N/fed.; 15.50 & 23.25kgPz05/fed. and 48, 72 & 96kg KzO/fed., respectively. Inaddition, a control treatment (no fertilizers) was carriedout. In the second season, elements were added at: 0, 60 ,90 & 120kg N/fed. and 0, 96 & 120kg KzO/fed., while Pfertilizer was excluded as it was found that P treatmentshad no effect during the first season.The second experiment aimed to study the influence ofnitrogen and potassium as foliar application, each alone orin combination . In the first season, two sources of N wereused: ammonium nitrate 33.5%N) and urea (46%N) atthree concentrations of each (0, 500 and 1000ppm), whileK was sprayed at three concentrations 0, 500 and1000ppm) in the form of potassium sulphate 52%KzO) .Plants were sprayed three times when aged 60, 75 and 90days. In the second season, another group of plants weresprayed with the same concentrations used in the first onebut sprayed four times when plants reached 60, 75, 90and 105 days.The third experiment aimed to study the effect of twogrowth regulators, i.e, GA3 and NAA, each alone or incombination. In the first season, GA3 and NAA were sprayedtwice when the plants aged 60 and 81 days at theconcentrations of 0, 100, 200ppm and 0, 25, 50ppm,respectively. In the second season, spraying took place atthe age of 60, 81 and 102 days with the concentrations of0, 100, 200, 300ppm and 0, 25ppm for GA3 and NAA,respectively.Agricultural practices were completed according to theusual methods being adapted for such crop.The obtained results may be summerized as followsExperiment I:1. Root length of fodder beet plant was significantlyincreased as nitrogen and potassium increased, where thetreatment of 90kg N/fed. and 96kg K20/fed. gave thehighest value of root length.2. The highest values of root diameter were gained from thetreatments of 90kg N + 96kg K20/fed. followed by l20kg N+ l20kg K20/fed. at either 15.50 or 23.25kg p20s/fed.without significant differences between them.3. Most factors under study affected slightly root length /diameter ratio but the treatments of zero or 60kg N +120kg K20/fed. gave the highest value of such ratio.2044. The application of 90kg N/fed. and 96kg KzO/fed. eachalone increased significantly number of leaves over theother treatments at most sampling dates except at thelast one.5. Total leaf area/plant was significantly increased underthe treatments of 90kg N +96kg KzO/fed. or l20kg N +120kg KzO/fed. during most growth periods.6. Increasing rates of N or K stimulated greatly theaccumulation of dry matter in roots especially duringlater periods. The treatments of 90kg N + 96kg KzO/fed.followed by 120kg N + l20kg KzO/fed.··gave significantlythe highest vlues of root dry matter.7. The maximum leaves dry matter was gained under the sametreatments observed with root dry matter.8. Dry matter of whole fodder beet plant showed a similartrend to that observed either in roots or leaves.9. Leaves dry matter proportion of fodder beet was higherduring the earlier periods of growth, then decreasedcontinuously till the harvesting time, while theopposite trend was true with root. The applicationof macronutrients affected the accumulation of dry matterand its redistribution within plant organs.lO.Root, foliage and total yields (either fresh or dryweight (ton/feddan) were significantly increased withincreasing Nand K levels. The maximum yields wereproduced from the treatments of

90kg N +96kg KzO/fed.followed by 120kg N + l20kg KzO/fed. comparing with anyother treatment without significant differences betweenthem.II.Soil application of nitrogen either alone or incombination with potassium increased nitrogen content ofroot, leaves and whole fodder beet plant. The highestvalues of nitrogen content of different plant organs aswell as whole plant were recorded with the applicationof 90 or 120kg N/fed. + 120kg K20/fed.12.Phosphorus content of root, leaves and whole plant wasincreased by N applied with K, and the highest valueswere recorded with the addition of 96kg K20/fed. incombination with 90 or 120kg N/fed.13.Soil application of potassium either alone or incombination with nitrogen caused an increase ofpotassium content in root, leaves and whole plant. Thehighest values of K content in different plant organs aswell as whole plant were observed under the treatmentsof l20kg K20/fed. + 90 or 120kg N/fed.14.Both elements increased the accumulation of sugars inroot and leaves as well as whole fodder beet plant.Increasing N levels up to 90kg N/fed. and K levels up to120kg K20/fed. caused an increase in total sugarscontent, while a slight decrease occurred with the levelof 120kg N/fed.IS.Total carbohydrate content showed a similar trend tothat observed with total sugars, where the highestvalues were recorded with the application of 90kg N + 96or 120kg K20/fed.16.Fodder beet root had higher proportion of carbohydratesthan the corresponding one during growing seasons exceptat the first period. Both Nand K affected thedistribution of carbohydrates between root and leaves.Experiment II:1.Spraying fodder beet plants 4 times with Nand Kincreased significantly root length. The highest valuesof root length were gained under the treatments oflOOOppm K + lOOOppm N either in the form of ammoniumnitrate or urea with spraying 4 times.2.Root diameter was significantly increased by sprayingfodder beet plant with N alone or in combination with K.The highest values of root diameter were recorded whenplants were sprayed 4 times with K at lOOOppm + urea-N orammonium nitrate-N at lOOOppm at most sampling dates.3.Different sprayed elements each alone affected slightlyroot length/diameter ratio but the interaction among themrevealed a significant effect on such ratio, where thehighest values were recorded with the plants which didn’treceive either N or K at most sampling dates.4.The application of Nand K affected significantly numberof leaves/plant. The plants treated 3 or 4 times with anysource of N at lOOOppm and K at lOOOppm had the highestnumber of leaves/plant.5.Leaves area/plant was significantly affected by t~eapplication of both Nand K. The most pronounce.)concentrations were lOOOppm N as urea followed by lOOOr~~N as ammonium nitrate and lOOOppm K, where the highljsignificant values of such character were gained undc~these treatments.6.Foliar application of N or K stimulated theaccumulation of root dry matter especially during laterperiods. Foliar application of 1000ppm N either in theform of urea or ammonium nitrate + 1000ppm K increasedsignificantly root dry matter content. Moreover, suchincrease was maximized when fodder beet plants were sprayed4 times compared to those sprayed 3 times only.7.The maximum dry matter ofplants were sprayed 3 or 4combination with K at lOOOppm.leaves was g ined when thetimes with at lOOOppm inB.The trend of whole plant dry matter was as similar asthat observed with either root or leaves.9.Foliar application of N alone or in co ination with Kaffected significantly forage yield fresh or dryweight. The maximum yield was produced : plantssprayed 4 times with N at 1000ppm either u~ea or ammonium initrate + K at 1000pprn.lO.Foliar application of N alone or in co~ination with Kincreased nitrogen content of root, leaves and wholefodder beet plant. The plants sprayed with N at lOOOppmand K at 500 or 1000ppm had higher val~es of nitrogencontent in comparison with that of plants,sprayed with Nand K at the other concentrations.ll.Spraying fodder beet plants 3 or 4 timelswith any of Nsources at any concentration caused an increase Inphosphorus content of root, leaves anp whole plant.Meanwhile, K application at 1000pprnincrdased phosphoruscontent of different plant organs.12.Potassium content of root and leaves as well as wholeplant was increased by the application of Nand K. Theplants sprayed 4 times with K at lOOOppm alone or incombination with urea-N at 500 or 1000ppm or withammoniwnni trate-N at 1000ppm had higher potassium contentof different plant organs.13.Both Nand K at any concentration enhanced the amount ofsugars. The most pronounced concentrations were 500 orlOOOppm N-urea or lOOOppm N-ammonium nitrate and lOOOppmK.14.Sirnilar trend of poly-saccharides were observed as thatfound with the effect of Nand K.lS.Total carbohydrate content followed the same trend oftotal sugars with respect to the effect of Nand K.Experiment III :1.The application of GA3 at different rates stimulatedsignificantly the

elongation of root comparing with thecontrol during the third and fourth periods, while NAAaffected such character during the third growth periodonly.2.Spraying fodder beet plants with GA3 or NAA gave asignificant increase in root diameter over the control atmost sampling dates in both seasons.3. GA3 at 100slightly thecontrol.or 200ppm and NAA at 25 or SOppm declinedroot length/diameter ratio compared to the4.Fodder beet plants sprayed with GA3 at the used levelshad higher number of leaves per plant than those didn’treceive s~ch substance during most growth periods.However, NAA affected such trait in the first seasononly. The stimulative effect of GA3 on leaves productionwas more pronounced with the concentration of lOOppm.5.Leaves area/plant was gradually increased by time up to151 days after sowing, then decreased. Both GA3 andNAA at any adopted concentration stimulated suchcharacter in the second season. The most pronouncedconcentrations were found to be 100ppm GA3 and 25ppm NAA.6.Dry matter of root, leaves and whole fodder beet plantwas enhanced by the application of GA3 and NAA at anyconcentration. The most effective concentrations werefound to be 100ppm GA3 and 25ppm NAA.7.Leaves comprised the main dry matter content at earlierstage of growth, then gradually decreased till the end ofthe season. The reverse trend could be concluded forroot. Fodder beet plant sprayed with GA3 and NAA hadslightly the higher proportion of root dry matter contentthan that didn’t receive such substances.8.Fodder beet yield as fresh or dry weight was increased bythe application of GA3 and NAA at the adoptedconcentrations. The most pronounced concentrations were100ppm GA3 and 25ppm”NAA.9.Fodder beet plants sprayed with GA3 at lOOppm and NAA 3t25ppm had higher nitrogen content of roots, leaves3r.dwhole plant than those sprayed with such substances ~rany other concentration. Both substances accelerated :::.~210accumulation of nitrogenous compounds in fodder beetplant.lO.GA3 and NAA acceleratedthe absorption of phosphorus byfodder beet plant. The most pronounced concentrations ofGA3 and NAA were lOOppm and 25ppm, respectively.11.Fodder beetcontent tophosphorus.plants had athat observedsimilar trend of potassiumwith either nitrogen or12.Both substances increased the accumulation of sugars inroot and leaves as well as the whole plant. The highesttotal sugars content was gained from the application ofGA3 at lOOppm and NAA at 25ppm.13.Spraying fodder beet plant with GA3 or NAA stimulatedthe accumulation of carbohydrates in the various plantparts. The most effective concentrations were lOOppm GA3and 25ppm NAA.14.The used substances (GA3 or NAA) affected thedistribution of carbohydrates between root and leaves.