Effect of Some Organic Sources, Chemical Fertilization, Active Dry Yeast and Pinching on Productivity of *Hibiscus sabdariffa* L. Plants

Ali, M.A.M.
Plant Production and Protection Department
Faculty of Environmental Agriculture Sciences, EL-Arish-Suez Canal University
Received: 1/1/2006

Abstract: *The present study was conducted to clarify the effects of the combinations of fertilization [organic fertilization as sheep manure (20m³/fed.), chicken manure (20m³/fed.), sheep manure (10m³/fed.) plus chicken manure (10m³/fed.) and chemical fertilization of ammonium nitrate 33%N, calcium super phosphate 16%P_2O_5 and potassium sulphate 48%K_2O at the rates of 300,200 and 100 kg/fed. respectively], active dry yeast 0.2% as [none (O), foliar spray (FS) and soil drench (SD)] and pinching treatments on the vegetative growth, fruits and dry sepals production, anthocyanin and acidity percentages in the natural dried sepals. Also, some chemical constituents i.e. nitrogen, phosphorus, potassium and total carbohydrates percentages in the leaves of roselle plants at fruiting stage. Under sandy soil using drip irrigation system in North Sinai conditions. The obtained results showed that using sheep manure plus chicken manure combined with foliar spray of active dry yeast and pinching treatments were effective in enhancing all growth criteria, sepals dry weight, anthocyanin and acidity percentages compared to either sheep manure or chicken manure or chemical fertilization each alone. The combined treatment between the three factors, sheep manure plus chicken manure, active dry yeast and pinching resulted 115.54-75.38% increase in dry sepals yield when active dry yeast was used as foliar spray. Meanwhile when used as soil drench, the increase in sepals dry yield ranged between 109.97- 69.32% in the two seasons, respectively. The interaction effect between the three factors enhanced total nitrogen percentage significantly in the leaves, sheep manure plus chicken manure enhanced N, P and K percentages, active dry yeast and pinching did not show significant enhancements on phosphorus, potassium and total carbohydrate percentages.*

INTRODUCTION

Roselle plant (*Hibiscus sabdariffa*, L.) belongs to family Malvaceae. The drink of sepals is used for its therapeutic properties which are due to its content of citric acid and presence of large amount of emollient and sedative mucilage which permits rapid digestion, decrease in hyperviscosity of blood, arterial pressure and relaxing the plain muscles of the ureters and intestines. Also, roselle has a favorable effect on the functions of stomach abundant its soporific action (Sharaf, 1962)

Among the plants which contains anthocyanin glycosides, and flavones pigments in the sepals in roselle, it is economically considered as one of the most important crop, in preparing both hot and cold soft drink known as karkade (Osman and Jacob, 1970).

The response of roselle plants to chemical fertilization has been studied by many investigation, Haikal (1994), Saafan (1994) and Malik (1996). They found that NPK fertilization increased vegetative growth, fruit number/plant, sepal's dry weight and anthocyanin content in roselle sepals. Harridy and Amara (1998), Badawi (2000) and Shalan *et al.*, (2001) also investigated the chemical fertilizer in addition to bio-fertilization using local strains of *Azospirillum sp*, *Azotobacter sp* and *Rhizobium sp*.

Foliar spray of yeast on fruit plants has recently received apparent interest. The various positive effects of applying active dry yeast were attributed to its content of different nutrients, higher percentage of proteins, large amount of vitamin B and natural plant growth hormones, namely, cytokinins. In addition, application of active dry yeast is very effective in releasing CO_2 which improves net photosynthesis (Ferguson *et al.*, 1987).

The possibility of using yeast for improving growth, chemical constituents and productivity of various horticultural crops were mentioned by Ahmed *et al.*, (1998) and Al-Qubaie (2002) on roselle reported that application of yeast was very necessary for promoting anthocyanin and flavones. The stimulation of such two pigments was correlated with increasing the concentrations of yeast without considerable differences between using 0.2% and 0.4% yeast. Also, Ali (2001) as well as El-Hindi and El-Boraie (2004) on marigold plants reported that spraying yeast for three times at 3 g/l was superior to the other applications (1and 2g/l).

Concerning, the effect of pinching treatments on roselle plants, Abed *et al.*, (1996) reported that the decapitated roselle plant produced less height and more branches besides increase in fresh and dry weights of sepals. While, Krissana-Boonsiri (1992) reported that pinched had no significant effect on fresh and dry weights of sepals and anthocyanin content.

Therefore, the aim of the present work was to study the possibility of enhancing growth and sepals yield parameters as well as improving the anthocyanin percentage of roselle plant by using natural and safety compounds such as organic manures, yeast extract and pinching or unpinching treatments under North Sinai conditions.

MATERIALS AND METHODS

This investigation was carried out at the Experimental Farm, Faculty of Environmental Agricultural Sciences at El-Arish, North Sinai Governorate during two years of 2003 and 2004. The physical and chemical analysis of the experimental soil and irrigation water are presented in Tables 1, a and 1, b.

The source of chicken manure was a poultry farm at North Sinai, while the source of sheep manure was the animal production farm in the Faculty of Environmental Agricultural Sciences. The two organic manures were composted for three months before applying. During composting period manures were wetted and mixed every two weeks. The C/N ratio at the end of this period was at save limit as shown in Table (2).

The seeds of roselle (*Hibiscus sabdariffa*, L. cv. Sabahia 17" light red) were sown on the first week of April during both seasons. The seeds were sown in rows at 50cm distance in hills at 50 cm between each (5 seeds/hill). After one month from sowing the seedlings were thinning to one plant/hill. Drip irrigation system was used with dripper having a discharge of 4 l/h. at one bar. The irrigation was added (two hour) by four days intervals in the morning along plant life

The normal agricultural treatments of growing roselle plant were practiced.

Complete randomized block design was done. The treatments were arranged in a split- split plot design with three replicates. The fertilization types were randomly arranged in main plot. The methods of application the active dry yeast were randomly distributed in sub plots and the pinching treatments were randomly distributed in sub –sub plots.

Therefore the experiment included 24 treatments as follows:

Main plot: four types of fertilization:
1-Sheep manure (20 m^3/fed.) SM.
2-Chicken manure (20 m^3/fed.) CM.
3-Sheep manure (10 m^3/fed.) + chicken manure (10 m^3/fed.) SM+CM.
4-Chemical fertilization (N, P and K) as recommended by Badawi (2000).

The amounts of organic manures were added during soil preparation. The sources of chemical fertilization were: ammonium nitrate (33%N) 300kg/fed., calcium super phosphate (16%P_2O_5) 200kg/fed. and potassium sulphate (48%K_2O) 100kg/fed. The chemical fertilizations were divided and added in two equal doses applied after 45 and 75 days from sowing date.

Sub plot: The methods of application of the active dry yeast solution (0.2%) as follow:
- Without active dry yeast (O)
- Foliar spray (FS)
- Soil drenches (SD)

Active dry yeast solutions were prepared before application by adding 10g sucrose/L for activating the reproduction of yeast. The active dry yeast amount was dissolved in 10 L warm water (30^0 C) and 100 g sucrose /10 L water was added and let stand for ten minutes before application. Triton B as a wetting agent at 0.2% was added to the solutions (El-Ghamriny *et al*, 1999). Application of active dry yeast solution until dripping point was established three times at 45, 75 and 105 days from sowing date. The addition of active dry yeast solution as soil drench was applied at the rate of 100cm^3/plant. The chemical composition of the used active dry yeast (*Saccharomyces cerevisiae*) according to Nagodawithana (1991) was recorded in Table (3)

Sub-sub plot: The plants were pinched (about 30 cm of plant height) after 30 days from thinning by removing the growing apex of the plants. Therefore the pinching treatments were: - Unpinched and Pinched.

The following data were recorded:

Samples of plant leaves were taken for chemical analysis at the beginning of fruiting stage in the two seasons. Leaves were dried at 70°C for 72 hours and chemically analyzed to determine leaves content of nitrogen, phosphorus and potassium as well as total carbohydrate. Nitrogen, phosphorus, potassium and total carbohydrate percentages were determined according to A.O.A.C. (1980), Hucker and Catroux (1980), Brown and Lilliland (1946) and Dubois *et al.*, (1956), respectively.

At the harvest time in October 15th in the two seasons, growth parameters were recorded including plant height (cm), number of branches /plant. Herb fresh and dry weights/plant (g), number and fresh weight of fruits/plant (g), fresh and dry weights of sepals /plant (g). Also, titration acidity in the air dried sepals as citric acid was determined and calculated by the method of titration against alkali (A.O.A.C., 1980). The extraction of total anthocyanin pigments were done by using ethyl alcohol and determination by using the method of Fuleki and Francis (1968) and developed by Du and Francis (1973).

All the obtained data were tabulated and statistically analyzed according to Snedecor and Cochran (1980). The means separations were done according to Duncan (1958).

RESULTS

1-Plant height:

Data in Table (4) showed that the combination between sheep manure plus chicken manure was the most effective treatment in increasing plant height, followed in descending order by using chicken manure, the least values were belong to the used of sheep manure and NPK fertilization without significant differences between them. In the same Table (4) the data indicated that active dry yeast application as foliar spray highly significantly enhanced plant height comparing to soil drench and untreated plants. Pinching the plants indicated that the unpinched plants significantly surpassed the plant in their height. This may be due to that pinching process nullified the apical dominances effect consequently decreased the growth of the main stem which reflected as reduction in plant height.

Table (1, a): Physical and chemical analyses of the experimental soil.

Soil properties	First season 2003	Second season 2004
Mechanical analysis		
Coarse sand %	68.0	67.9
Fine sand%	20.6	20.5
Silt %	3.50	3.52
Clay %	7.90	7.94
Soil texture	Sand	Sand
Bulk density (g. cm^{-3})	1.53	1.53
Particle density (g. cm^{-3})	2.49	2.49
Chemical analysis (soluble ions in 1:5 extract)		
Ca^{++} (meq. $/l^{-1}$)	3.03	2.10
Mg^{++} (meq. $/l^{-1}$)	2.11	2.20
Na^{+} (meq. $/l^{-1}$)	1.18	4.49
K^{+} (meq. $/l^{-1}$)	0.48	0.31
CO_3^{--} (meq. $/l^{-1}$)	-	-
HCO_3^{-} (meq. $/l^{-1}$)	2.00	2.40
Cl^{-} (meq. $/l^{-1}$)	1.02	2.30
SO_4^{--} (meq. $/l^{-1}$)	3.78	4.40
EC. (ds m^{-1})	0.68	0.91
pH in (1:2.5 extract)	8.10	8.20
Organic matter (%) in air dry soil	0.16	0.21
$CaCO_3$ % in air dried soil	3.95	3.95

Table (1, b): Chemical analysis of irrigation water.

		Soluble ions (meq.l^{-1})							
pH	**EC. (dsm^{-1})**	**Cations**				**Anions**			
		Ca^{++}	Mg^{++}	Na^{+}	K^{+}	Cl^{-}	HCO_3^{-}	CO_3^{--}	SO_4^{--}
6.7	5.65	18.12	20.20	17.72	0.25	38.40	6.25	-	11.64

Table (2): Chemical analysis of organic manure sources.

Organic manure source	N%	P_2O_5	K_2O	Organic matter %
Sheep manure	2.76	3.1	2.3	26.0
Chicken manure	3.00	0.4	1.2	8.0

Table (3): Chemical composition of the active dry yeast.

Major compositions %		Vitamins contents		Mineral elements			
			U/g		mg/g		Ug/g
Protein	47	Thiamine	60-100	Ca	0.75	Cr	2.2
Carbohydrates	33	Riboflavin	35-50	Fe	0.02	Cu	0.1
Minerals	8	Niacin	300-500	K	21.0	Li	0.17
Nucleic acids	8	Pyridoxine HCL	28	Mg	1.65	Mn	0.02
Lipids	4	Pantothenate	70	Na	0.12	Mo	0.4
		Biotin	1.3	P	13.5	Ni	3.0
		Choline	4000	S	3.9	Se	0.1
		Folic acid	5.13	Si	0.03	Sn	3.0
		Vit. B_{12}	0.001	Zn	0.17	Va	0.04

It is clear from data in Table (5) that the interaction treatments between fertilization, active dry yeast and pinching showed insignificant differences for plant height. However, the highest plant height (193.3 and 181.0cm) during the two seasons, respectively were belong to the unpinched plants fertilized with sheep manure + chicken manure and foliar sprayed with yeast. 0n the other side the least values of plant height (118.0 and 110.6 cm) during the two seasons, respectively were belong to the pinched plants which fertilized with sheep manure and did not receive active dry yeast treatments.

2- Number of branches /plant:

Data in Table (5) showed that the chicken manure fertilization resulted in the highest significant number of branches/ plant (15.01 and 12.6o) then followed descending by sheep manure + chicken manure (14.00 and 11.15). The least branches number was belong to sheep manure or NPK fertilization without significant differences between them. Foliar spraying of active dry yeast resulted in high significant number of branches (14.45 and 11.56), followed by soil drench, where the least number was belongs to untreated plants (11.18 and 8.78). The pinched plants resulted in the highest significant number of branches/ plants (16.10 and 13.19) while the unpinched ones resulted in least significant number (9.77 and 7.15). This may be due to the pinching process that nullified the effect of apical dominance, consequently favored the development of axial bud to branches. These results were agreements in the two seasons.

The results in Table (5) clear that the triple interaction treatments between fertilization, active dry yeast and pinching were insignificant. However the highest branches number was belong to pinched plants which treated with chicken manure or sheep manure + chicken manure regardless yeast spraying.

3-Number of fruits/plant:

The results in Table (4) showed that the highest significant increase in fruits number was obtained from sheep manure + chicken manure (176.3 and 232.9) where the least one was belong to NPK fertilization (129.2 and 161.5). Spraying active dry yeast was significantly effective than soil drench. Also, the pinched plants produced the highest significant number of fruits than unpinched ones.

It is clear from data in table (5) that fruits number/plant was significantly affected by interaction between the three factors under study during the second season. However, the highest fruits number/plant was obtained from the pinched plants which fertilized with sheep manure +chicken manure and sprayed with active dry yeast.

4- Fresh weight of fruits /plant:

Data in Table (4) showed that there were no significant differences between chicken manure and sheep manure + chicken manure fertilization where they resulted in the highest fresh weight of fruits/plant. In the same time, spraying active dry yeast was significantly effective on increasing fruits fresh weight/plant than soil drench method. The pinched plants resulted in high significant value of fruits fresh weight than unpinched ones.

The fresh weight of fruits/plant was significantly affected by the interaction treatments in the two growing seasons. The highest increments in the fruits fresh weight values were obtained from the pinched plants fertilized with sheep manure plus chicken manure and foliar spray with active dry yeast treatments in both growing seasons, (Table 5).

5- Fresh and dry weights of herb/ plant:

It is obvious from data in Table (6) that the highest significant fresh and dry weights of herb/plant resulted from sheep manure + chicken manure application followed descending by chicken manure fertilization, then chicken manure fertilization. The least values were belonging to NPK fertilization. Also, the highest significantly increased in fresh and dry weights of herb/plant were resulted from foliar spraying of active dry yeast followed descending by soil drench, while the

least values were belong to untreated plants. Pinching treatment was significantly effective in increasing both fresh and dry weights of herb. The pinched plant resulted in 1239.5 and 1438.1 g fresh weight and 357.7 and 406.2 g dry weight against 1079.6 and 1152.6 g fresh weights and 308.0 and 331.5 g dry weight during the two seasons, respectively.

Data presented in Table (7) illustrated that the interaction treatments between the three factors significantly increased fresh and dry weights of herb/plant. The highest values resulted from the pinched plants fertilized with sheep manure + chicken manure and sprayed with active dry yeast. While the least values were belong to the unpinched plants fertilized with NPK and untreated with active dry yeast.

6- Sepals fresh and dry weights /plant:

Data in Table (6) showed that sheep manure + chicken manure fertilization treatment was the highest effective in increasing significantly both fresh and dry weights of sepals/plant, since it resulted in 39.42 and 43.58 g dry sepals/plant against 26.11 and 32.64 g for NPK fertilization during the two seasons, respectively. The differences between the treatments of sheep manure and NPK fertilization were significant each alone in most cases. The treatment of active dry yeast as foliar spray was significantly effective than soil drench. Also the pinched plants resulted in more significantly increased in fresh and dry weights of sepals/plant than the unpinched ones.

The interaction between fertilization, active dry yeast and pinching treatments had no significant effect on fresh and dry weights of sepals /plant in most cases (Table 7). The highest values of fresh and dry weights of sepals/plant were obtained from the pinched plants fertilized with sheep manure +chicken manure and sprayed with active dry yeast, followed by the same fertilized and pinched plants but received active dry yeast application through soil drench.

7-Yield of dry sepals (kg/fed.):

Data in Table (8) clear that the obtained yield of dry sepals' kg/fed. were 662.31-732.23 kg/fed. for sheep manure plus chicken manure ($10m^3$+$10m^3$/fed.) against 438.59 - 548.44 kg/fed. dry sepals for NPK treatment. This increase ranged between 51.00-33.51% in the two seasons, respectively (Table 8). Also, the data in the same Table show that yield of dry sepals/fed. was increased with application of active dry yeast as foliar spray compared with other treatments. Likewise, pinched plants compared with unpinched treatments.

The combination of the used treatments i.e., fertilization, active dry yeast and pinching could be result in appreciable increase in dry sepals yield as clear from Table (8). This increase ranged from 740.88 - 793.46 kg/fed. for sheep manure + chicken manure fertilization combined with pinching and spraying active dry yeast treatments which parallel to 115.54 - 75.38% over NPK fertilization with untreated by active dry yeast and unpinched treatments in the two seasons, respectively. On the other side, the increase with sheep manure + chicken manure combined with pinched and soil drench of yeast application attain some how less increase than foliar spray of active dry yeast (721.73 - 766.08 kg/fed. dry sepals parallel to 109.97-69.32%) so using active dry yeast spray may be preferred than soil drench.

8- Anthocyanin percentage:

Data in Table (8) showed that the highest anthocyanin percentage was obtained from either chicken manure or sheep manure +chicken manure fertilization without different significantly between them. While least significant values were obtained from either sheep manure or NPK fertilization. The effect of active dry yeast was significantly pronounced, where the highest anthocyanin percentage was obtained from active dry yeast as foliar spray. Concerning pinching treatments there was no significant differences between pinched and unpinched treatments in the two seasons.

The results in Table (9) show that the triple interaction had insignificant effects especially in the first season. However, the highest anthocyanin percentages were obtained from either pinched or unpinched plants fertilized with sheep manure + chicken manure and sprayed with active dry yeast. On the other hand, the least values was obtained from pinched or unpinched plants fertilized with sheep manure and did not treated with active dry yeast spray or that received active dry yeast as soil drench.

9- Acidity percentage:

Data in Table (8) show the main effect of acidity percentage in sepals extract as affected by fertilization, active dry yeast and pinching treatments. The data clear that, sheep manure + chicken manure fertilization increased significantly acidity percentage (13.18 and 14.37%). The least acidity percentages were belongs to sheep manure and NPK fertilization. Also the highest acidity treatment (12.87 and 13.77 %) whereas, were highly significantly increased, while the untreated plants recorded the least significant values (11.31 and 12.78 %). The pinching process showed an increase in acidity percentage which was significant during the first season only.

In this respect, the interaction treatments had no significant effect however; the highest acidity percentage was obtained from sheep manure +chicken manure fertilization combined with active dry yeast spray treatments, regardless of pinching process (Table 9).

10- Total nitrogen percentage:

Data clearly in Table (10) indicate that chicken manure alone or sheep manure + chicken manure fertilization were significant effective in enhancing total nitrogen percentage in the leaves of roselle plant than sheep manure or NPK fertilization each alone. It was found previously from fertilizer analysis that chicken manure contains high nitrogen percentage than sheep manure. So, using chicken manure alone or combined with sheep manure was more effective in enhancing total nitrogen percentage in the leaves than sheep manure or NPK each alone. Active dry yeast spraying appeared to be effective in enhancing total nitrogen percentage this may be due to the high content of yeast from proteins and amino acids as declared from yeast

Table (4): Main effects of fertilization , active dry yeast and pinching treatments on plant height, number of branches, number and fresh weight of fruits of Hibiscus sabdariffa, L. plants during 2003 and 2004 seasons.

Parameters	Plant height (cm)		Number of branches/plant		Number of fruits/plant		Fresh weight of fruits(g)/plant	
Treatments	First season	Second season	First season	Second season	First season	Second season	First season	Second season
Fertilization:								
SM	144.4 bc	137.7 c	11.77 c	8.94 b	134.4 b	172.1 c	740.7 c	635.9 c
CM	154.0 ab	143.5 b	15.05 a	12.6 a	159.9 a	208.0 b	1003.8 b	790.4 b
SM+CM	160.0 a	149.6 a	14.05 b	11.16 ab	176.3 a	232.9 a	1171.0 a	908.6 a
NPK	147.4 b	137.7 c	11.00 c	8.05 b	128.4 b	161.5 c	707.8 d	598.2 c
Active dry yeast (ADY):								
O	141.5 b	133.3 b	11.20 c	8.79 c	138.2 c	175.2 b	790.6 c	648.9 c
FS	159.9 a	149.6 a	14.45 a	11.58 a	162.5 a	214.1 a	1033.7 a	822.3 a
SD	152.8 ab	143.5 ab	13.25 b	10.20 b	148.4 b	191.6 b	893.1 b	728.7 b
Pinching:								
Unpin.	174.6 a	164.1 a		7.16 b	138.8 b	177.2 b	803.1 b	663.5 b
Pin.	128.3 b	120.1 b		13.22 a	160.7 a	210.0 a	1008.5 a	803.1 a

SM=sheep manure, CM= chicken manure, NPK= chemical fertilization, 0, FS and SD =applications of active dry yeast (ADY) by none, foliar spray and soil drench respectively. Unpin = unpinched, pin = pinched. Values followed by the same alphabetical letters do not differ significantly according to Duncan's multiple range tests at 5% level.

analysis (Table 3). The pinched plant contained high nitrogen percentage than unpinched ones. This may be due to that pinching process enhanced plant growth percentage was belong to active dry yeast spraying consequently nitrogen absorption. The differences between three active dry yeast and two pinching treatments were significantly in the two seasons.

The interaction effect between fertilization, active dry yeast and pinching treatments was significant on nitrogen percentage in the second season only. The highest total nitrogen percentages were belong to the pinched plants and treated with yeast either as spraying or soil drench and fertilized with chicken manure. On the contrary the least value was belong to unpinched one fertilized with NPK (Table 11).

11- Phosphorus percentage:

Data presented in Table (10) indicate that the pronounced effect of increasing phosphorus percentage (Table 2) organic manure analysis) so using mixture of sheep manure + chicken manure enhanced phosphorus percentage in the leaves than using chicken manure or NPK each alone. Applications of yeast either foliar spray or soil drench did not prove significant effect on phosphorus percentage. Pinching process did not show that unpinched plants recorded high phosphorus percentage than pinched ones.

The effect of interaction between the three factors under study was not significant on phosphorus percentage (Table 11). However, the highest phosphorus percentage was belong to sheep manure treatment regardless yeast or pinching treatments.

12- Potassium percentage:

It is evident from the data in Table (10) that the NPK fertilization resulted the highest significant increase in potassium percentage in the leaves followed by sheep manure or sheep manure + chicken manure, then the least was chicken manure. The analysis of organic manure pointed to less potassium percentage in chicken manure than sheep manure, so the mixture of there was effectors in enhancing potassium percentage in plant leaves than using chicken manure alone. Active dry yeast application did not show significant effect on potassium percentage in plant leaves. Also, Pinching process showed uneven trend for potassium percentage during the two seasons.

Results in Table (11) reveal that the interaction treatment effect was insignificant, however it appear that the most effective treatment in enhancing potassium percentage in plant leaves was NPK fertilization regardless pinching process or active dry yeast application.

13- Total carbohydrate percentage:

Data in Table (10) show that NPK fertilization was the effective treatment in enhancing total carbohydrate percentage in plant leaves. The organic manures can in the second order in this regard without more significant differences between them. Active dry yeast application did not show significant differences on total carbohydrate in plant leaves especially in second season. Pinching process showed uneven significant effect during the two seasons.

The results in Table (11) show the interaction treatment

Table (5): Effect of interaction between fertilization, active dry yeast and pinching treatments on plant height, number of branches, number and fresh weight of fruits of *Hibiscus sabdariffa*, L. plants during 2003 and 2004 seasons .

Treatments	Active dry yeast (ADY)					
	0	FS	SD	0	FS	SD
	First season (2003)			Second season (2004)		
	Plant height (cm)					
Pinched:						
SM	118.0 a	127.6 a	122.3 a	110.6 a	119.3 a	114.0 a
CM	120.3 a	140.0 a	128.6 a	112.0 a	131.6 a	120.3 a
SM+CM	121.0 a	145.6 a	132.6 a	112.6 a	136.0 a	124.0 a
NPK	120.0 a	137.6 a	126.3 a	113.0 a	128.0 a	119.6 a
Unpinched:						
SM	155.3 a	173.6 a	169.6 a	158.3 a	162.3 a	161.6 a
CM	162.3 a	188.0 a	184.6 a	148.3 a	176.6 a	172.0 a
SM+CM	177.3 a	193.3 a	190.3 a	166.3 a	181.0 a	178.0 a
NPK	158.3 a	173.3 a	169.0 a	145.3 a	162.0 a	158.3 a
	Number of branches/ plant					
Pinched:						
SM	13.6 a	16.0 a	14.3 a	10.0 a	13.3 a	12.0 a
CM	15.3 a	21.0 a	19.6 a	13.3 a	19.0 a	17.0 a
SM+CM	15.3 a	19.0 a	18.6 a	12.3 a	16.3 a	14.3 a
NPK	11.6 a	15.0 a	14.3 a	9.00 a	11.6 a	10.3 a
Unpinched:						
SM	7.33 a	10.3 a	9.00 a	5.33 a	7.00 a	6.00 a
CM	10.0 a	13.0 a	11.3 a	8.00 a	10.0 a	8.33 a
SM+CM	9.00 a	11.6 a	10.6 a	7.00 a	9.00 a	8.00 a
NPK	7.33 a	9.66 a	8.00 a	5.33 a	6.33 a	5.60 a
	Number of fruits /plant					
Pinched:						
SM	128.3 a	147.3 a	145.0 a	164.0 i-k	205.3 fg	196.3 gh
CM	160.6 a	192.3 a	183.0 a	213.3 ef	244.6 a	237.0 a-c
SM+CM	176.0 a	204.6 a	190.0 a	235.3 a-c	247.3 a	241.6 ab
NPK	125.6 a	140.3 a	135.3 a	158.6 jk	190.6 h	186.3 h
Unpinched:						
SM	120.0 a	143.0 a	123.0 a	132.3 lm	193.0 h	141.6 l
CM	124.6 a	168.3 a	130.6 a	155.3 k	228.3 cd	169.6 ij
SM+CM	156.3 a	172.3 a	159.0 a	218.6 de	230.0 b-d	224.6 c-e
NPK	115.0 a	132.3 a	122.0 a	124.0 m	173.6 i	136.0 lm
	Fresh weight of fruits (g)/plant					
Pinched:						
SM	705.5 no	808.8 ij	798.1 j	596.9 lm	774.9 hi	738.9 ij
CM	825.3 i	1382.7 b	1299.6 d	809.4 gh	951.6 b	929.0 bc
SM+CM	1241.0 e	1476.1 a	1356.0 c	916.5 bcd	1012.7 a	942.3 b
NPK	692.6 op	772.7 k	743.8 l	570.4 mn	706.8 jk	688.2 k
Unpinched:						
SM	662.7 q	790.8 j	678.3 pq	467.3 op	732.8 I-k	504.7 o
CM	688.1 op	1108.0 g	718.6 mn	558.0 mn	877.8 d-f	616.8 l
SM+CM	873.9 h	1204.1 f	874.7 h	834.9 fg	885.5 c-e	560.1 ef
NPK	636.0 r	726.1 lm	675.8 pq	437.7 p	636.6 l	549.8 n

SM=sheep manure, CM= chicken manure, NPK= chemical fertilization, O, FS and SD =applications of active dry yeast (ADY) by none, foliar spray and soil drench respectively. Unpin = unpinched, pin = pinched. Values followed by the same alphabetical letters do not differ significantly according to Duncan's multiple range tests at 5% level.

Table (6): Main effects of fertilization, active dry yeast and pinching treatments on fresh and dry weights of herb and sepals of *Hibiscus sabdariffa*, L. plants during 2003 and 2004 seasons.

Parameters	Fresh weight of herb (g)/plant		Dry weight of herb (g)/plant		Fresh weight of sepals(g)/plant		Dry weight of sepals(g)/plant	
Treatments	First season	Second season	First season	Second season	First season	Second season	First season	Second season
Fertilization:								
SM	1125.5 c	1106.9 b	325.7 ab	321.7 b	217.0 c	232.9 c	28.50 b	34.90 b
CM	1225.1 b	1441.4 a	351.5 a	403.4 a	248.3 b	267.7 b	34.84 a	40.05 ab
SM+CM	1289.6 a	1568.8 a	364.3 a	437.0 a	299.8 a	292.1 a	39.42 a	43.58 a
NPK	998.2 d	1064.9 b	290.1 b	312.6 b	194.5 c	217.9 c	26.11 b	32.64 b
Active dry yeast (ADY):								
O	1054.0 b	1144.0 b	299.2 b	333.9 b	215.0 b	233.7 b	28.87 b	35.20 c
FS	1291.9 a	1427.7 a	364.0 a	402.3 a	259.8 a	272.4 a	35.65 a	40.71 a
SD	1132.9 b	1314.7 ab	335.4 ab	370.0 ab	244.8 a	251.8 ab	32.12 ab	37.48 b
Pinching:								
Unpin.	1079.6 b	1152.8 b	308.1 b	331.5 b	218.1 b	235.4 b	29.05 b	35.42 b
Pin.	1239.6 a	1438.1 a	357.7 a	406.0 a	261.6 a	270.0 a	35.38 a	40.18 a

SM=sheep manure, CM= chicken manure, NPK= chemical fertilization, 0, FS and SD =applications of active dry yeast (ADY) by none, foliar spray and soil drench respectively. Unpin = unpinched, pin = pinched. Values followed by the same alphabetical letters do not differ significantly according to Duncan's multiple range tests at 5% level.

Table (7): Effect of interaction between fertilization, active dry yeast and pinching treatments on fresh and dry weights of herb and sepals of *Hibiscus sabdariffa*, L. Plants during 2003 and 2004 seasons.

Treatments	Active dry yeast (ADY)					
	0	FS	SD	0	FS	SD
	First season (2003)			Second season (2004)		
	Fresh weight of herb (g)/plant					
Pinched:						
SM	1069.6 h	1317.3 e	1262.6 f	1129.6 jk	1280.3 f-h	1231.3 g-i
CM	1302.0 e	1433.6 b	1331.6 e	1300.6e-g	1831.3 a	1690.6 b
SM+CM	1328.6 e	1539.6 a	1365.0 d	1662.0 b	1844.3 a	1796.3 a
NPK	962.6 j-l	1150.3 g	932.6 l	1121.3 jk	1197.3 h-k	1173.3 i-k
Unpinched:						
SM	952.6 kl	1131.6 g	1019.0 i	862.3 i	1213.6 g-j	924.3 l
CM	986.6 ij	1244.0 f	1053.0 h	1102.6 k	1392.0 de	1331.0 ef
SM+CM	988.0 ij	1398.0 c	1118.3 g	1135.6 i-k	1508.0 c	1464.3 cd
NPK	842.3 m	1120.6 g	981.0 jk	838.0 l	1155.3 i-k	904.3 l
	Dry weight of herb (g)/plant					
Pinched:						
SM	293.0 g-i	384.3 c	365.9 cd	335.5 i	365.3 e-h	354.1 f-i
CM	372.1 cd	420.1 ab	391.6 bc	368.6 e-g	496.1 a	463.6 bc
SM+CM	351.2 de	430.1 a	418.4 ab	458.9 c	514.9 a	489.2 ab
NPK	253.9 j	324.9 e-g	287.0 hi	332.3 i	347.8 f-i	345.3 g-i
Unpinched:						
SM	276.5 ij	327.5 ef	306.9 f-i	258.0 j	352.0 f-i	265.5 j
CM	285.9 h-j	328.1 ef	311.5 f-h	329.0 i	388.9 de	374.9 ef
SM+CM	286.4 h-j	383.7 c	315.6 f-h	338.9 hi	412.9 d	407.2 d
NPK	274.8 ij	313.7 f-h	286.5 h-j	249.9 j	340.5 g-i	260.0 j
	Fresh weight of sepals(g)/plant					
Pinched:						
SM	212.5 hi	253.7 f	249.4 fg	221.4 a	261.1 a	258.9 a
CM	259.9 f	236.9 g	315.2 b	276.7 a	314.5 a	289.3 a
SM+CM	300.0 c	338.8 a	336.4 a	289.8 a	320.6 a	305.3 a
NPK	186.8 j	238.1 g	212.1 hi	220.8 a	240.9 a	240.4 a
Unpinched:						
SM	168.1 k	239.6 g	178.7 jk	196.2 a	246.2 a	213.7 a
CM	180.3 jk	281.8 de	215.5 h	215.9 a	284.1 a	225.9 a
SM+CM	260.4 f	289.1 cd	274.0 e	271.4 a	285.7 a	280.1 a
NPK	151.9 l	200.8 i	177.5 jk	177.6 a	226.4 a	201.2 a
	Dry weight of sepals (g)/plant					
Pinched:						
SM	28.13 a	33.80 a	32.46 a	33.90 a	40.13 a	37.80 a
CM	34.86 a	43.13 a	40.56 a	40.57 a	46.10 a	43.73 a
SM+CM	39.33 a	44.10 a	42.96 a	42.86 a	47.23 a	45.60 a
NPK	25.86 a	30.60 a	28.76 a	33.26 a	35.80 a	35.16 a
Unpinched:						
SM	21.83 a	30.96 a	23.80 a	29.46 a	36.03 a	32.13 a
CM	24.80 a	37.10 a	28.60 a	33.30 a	42.77 a	33.86 a
SM+CM	35.73 a	38.26 a	36.16 a	41.33 a	42.86 a	41.63 a
NPK	20.46 a	27.30 a	23.66 a	26.93 a	34.76 a	29.96 a

SM=sheep manure, CM= chicken manure, NPK= chemical fertilization, O, FS and SD =applications of active dry yeast (ADY) by none, foliar spray and soil drench respectively. Unpin = unpinched, pin = pinched. Values followed by the same alphabetical letters do not differ significantly according to Duncan's multiple range tests at 5% level.

Table (8): Mean effects of fertilization, active dry yeast and pinching treatments on the yield of dry sepals (kg/fed.) and the relation to control [NPK fertilizer, 0 yeast and unpinched treatments] and anthocyanin as well as acidity percentages of *Hibiscus sabdariffa*, L. plants during 2003 and 2004 seasons.

Parameters / Treatments	Yield of dry sepals (kg/fed.)		Yield of dry sepals (kg/fed.)and the relation to control		Anthocyanin %		Acidity %	
	First season	Second season	First season	Second season	First season	Second season	First season	Second season
Fertilization:								
SM	478.74 c	586.46 bc	+ 9.15	+ 6.93	0.595 b	0.586 b	10.88 b	12.28 b
CM	585.34 b	672.93 ab	+ 33.46	+ 22.70	0.656 a	0.675 a	12.89 a	13.88 a
SM+CM	662.31 a	732.23 a	+ 51.00	+ 33.51	0.663 a	0.681 a	13.18 a	14.37 a
NPK	438.59 c	548.44 c	0000	0000	0.598 ab	0.607 b	11.34 b	12.59 b
Active dry yeast (ADY):								
O	485.10 c	591.38 a	0000	0000	0.605 b	0.617 b	11.31 c	12.78 c
FS	599.03 a	683.93 a	+ 23.49	+ 15.65	0.659 a	0.660 a	12.87 a	13.77 a
SD	539.62 b	629.73 a	+ 11.24	+ 6.45	0.620 b	0.639 a	12.00 b	13.28 b
Pinching:								
Unpin.	488.12 b	595.03 b	0000	0000	0.627 a	0.634 a	11.91 b	13.28 a
Pin.	594.37 a	675.00 a	+ 21.77	+ 13.44	0.629 a	0.641 a	12.24 a	13.28 a

SM=sheep manure, CM= chicken manure, NPK= chemical fertilization, 0, FS and SD =applications of active dry yeast (ADY) by none, foliar spray and soil drench respectively. Unpin = unpinched, pin = pinched. Values followed by the same alphabetical letters do not differ significantly according to Duncan's multiple range tests at 5% level.

Table (9): Effect of interaction between fertilization, active dry yeast and pinching treatments on the yield of dry sepals (kg/fed.) and the relative increase percentage on dry sepals yield relation to control [NPK fertilizer, 0 yeast and unpinched treatment] and anthocyanin as well as acidity percentages of *Hibiscus sabdariffa*, L. plants during 2003 and 2004 seasons.

Treatments	Active dry yeast (ADY)					
	0	FS	SD	0	FS	SD
	First season (2003)			Second season (2004)		
	The yield of dry sepals (kg/fed.)					
Pinched:						
SM	472.58 a	567.84 a	545.33 a	569.52 a	674.18 a	635.04 a
CM	585.65 a	724.58 a	681.41 a	681.58 a	774.48 a	734.66 a
SM+CM	660.74 a	740.88 a	721.73 a	720.05 a	793.46 a	766.08 a
NPK	434.45 a	414.08 a	483.17 a	558.77 a	601.44 a	590.68 a
Unpinched:						
SM	366.74 a	520.13 a	399.84 a	494.93 a	605.30 a	539.78 a
CM	416.64 a	623.28 a	480.48 a	559.44 a	718.54 a	568.85 a
SM+CM	600.26 a	642.77 a	607.49 a	694.34 a	720.05 a	699.38 a
NPK	343.73 a	458.64 a	397.49 a	452.42 a	583.97 a	503.33 a
	The relative increase percentage on sepals dry yield relation to [NPK fertilizer, 0 yeast and unpinched treatment] control.					
Pinched:						
SM	37.48	65.19	58.65	25.88	49.01	40.36
CM	70.38	110.79	98.23	50.65	71.18	62.38
SM+CM	92.22	115.54	109.97	59.15	75.38	69.32
NPK	26.39	20.46	40.56	23.50	32.93	30.56
Unpinched:						
SM	6.69	51.40	16.32	9.39	33.79	19.30
CM	21.21	81.32	39.78	23.65	58.82	25.73
SM+CM	74.63	86.99	76.73	53.47	59.15	54.58
NPK	0000	33.43	15.64	0000	29.07	11.25
	Anthocyanin %					
Pinched:						
SM	0.562 bc	0.634 a-c	0.578 a-c	0.570 k	0.610 f-k	0.588 h-k
CM	0.643 a-c	0.676 ab	0.658 a-c	0.630 d-k	0.709 ab	0.692 a-d
SM+CM	0.651 a-c	0.680 a	0.666 a-c	0.660 a-g	0.715 a	0.663 a-g
NPK	0.571 a-c	0.637 a-c	0.593 a-c	0.646 b-i	0.618 e-k	0.601 g-k
Unpinched:						
SM	0.558 c	0.662 a-c	0.574 a-c	0.564 k	0.604 g-k	0.582 i-k
CM	0.638 a-c	0.670 a-c	0.653 a-c	0.641 c-j	0.705 a-c	0.675 a-f
SM+CM	0.647 a-c	0.678 ab	0.657 a-c	0.653 a-h	0.713 ab	0.683 a-e
NPK	0.569 a-c	0.636 a-c	0.581 a-c	0.575 jk	0.613 f-k	0.596 g-k
	Acidity %					
Pinched:						
SM	10.85 a	11.29 a	10.69 a	12.07 a	12.58 a	12.40 a
CM	11.95 a	14.60 a	13.15 a	13.30 a	14.63 a	13.81 a
SM+CM	12.15 a	14.73 a	13.40 a	13.60 a	14.96 a	14.28 a
NPK	10.96 a	11.70 a	11.48 a	12.22 a	13.06 a	12.49 a
Unpinched:						
SM	10.21 a	11.28 a	11.01 a	11.83 a	12.52 a	12.30 a
CM	11.74 a	13.65 a	12.30 a	13.48 a	14.35 a	13.74 a
SM+CM	12.05 a	14.05 a	12.75 a	13.69 a	14.84 a	14.90 a
NPK	10.61 a	11.66 a	11.68 a	12.14 a	13.32 a	12.36 a

SM=sheep manure, CM= chicken manure, NPK= chemical fertilization, O, FS and SD =applications of active dry yeast (ADY) by none, foliar spray and soil drench respectively. Unpin = unpinched, pin = pinched. Values followed by the same alphabetical letters do not differ significantly according to Duncan's multiple range tests at 5% level.

Table (10): Mean effects of fertilization, active dry yeast and pinching treatments on nitrogen, phosphorus, potassium and total carbohydrates percentages in the leaves of *Hibiscus sabdariffa*, L. plants during 2003 and 2004 seasons.

Parameters	Nitrogen %		Phosphorus %		Potassium %		Total carbohydrates %	
Treatments	First season	Second season	First season	Second season	First season	Second season	First season	Second season
Fertilization;								
SM	2.71 c	3.05 b	0.415 a	0.510 a	4.05 b	3.63 b	19.84 b	20.71 a b
CM	3.61 a	3.84 a	0.323 b	0.350 c	2.64 c	1.92 c	16.94 c	17.51 b
SM+CM	3.07 b	3.52 a	0.381 a b	0.438 b	3.68 b	3.42 b	18.61 b c	19.51 a
NPK	2.28 d	2.60 c	0.340 b	0.393 b c	4.84 a	4.20 a	21.78 a	23.19 a
Active dry yeast (ADY):								
O	2.74 c	3.08 b	0.356 a	0.403 a	3.65 b	3.19 a	18.85 b	19.56 a
FS	3.12 a	3.38 a	0.375 a	0.442 a	3.96 a	3.40 a	19.67 a	20.31 a
SD	2.90 b	3.30 a b	0.364 a	0.422 a	3.80 b	3.29 a	19.34 ab	19.99 a
Pinching:								
Unpin.	2.71 b	3.03 b	0.372 a	0.434 a	4.09 a	3.07 b	19.75 a	19.96 a
Pin.	3.12 a	3.43 a	0.357 b	0.411 b	3.44 b	3.51 a	18.81 b	19.94 a

SM=sheep manure, CM= chicken manure, NPK= chemical fertilization, O, FS and SD =applications of active dry yeast (ADY) by none, foliar spray and soil drench respectively. Unpin = unpinched, pin = pinched. Values followed by the same alphabetical letters do not differ significantly according to Duncan's multiple range tests at 5% level.

Table (11): Effect of interaction between fertilization, active dry yeast and pinching treatments on nitrogen, phosphorus, potassium and total carbohydrates percentages in the leaves of Hibiscus sabdariffa, L. plants during 2003 and 2004 seasons

Treatments	Active dry yeast (ADY)					
	0	FS	SD	0	FS	SD
	First season (2003)			Second season (2004)		
	Nitrogen %					
Pinched:						
SM	2.70 a	3.08 a	2.94 a	3.20 fg	3.52 de	3.40 ef
CM	3.64 a	4.00 a	3.75 a	3.79 a-d	3.89 ab	3.81 a-c
SM+CM	3.14 a	3.49 a	3.20 a	3.70 b-d	3.74 b-d	3.68 b-d
NPK	3.39 a	2.69 a	2.50 a	2.61 ij	3.06 gh	2.88 h
Unpinched:						
SM	2.40 a	2.62 a	2.54 a	2.43 jk	2.82 hi	2.94 h
CM	3.20 a	3.60 a	3.50 a	3.75 b-d	4.05 a	3.80 a-c
SM+CM	2.64 a	3.12 a	2.85 a	2.88 h	3.60 c-e	3.54 ce
NPK	1.81 a	2.37 a	1.95 a	2.33 k	2.40 jk	2.35 k
	Phosphorus %					
Pinched:						
SM	0.39 a	0.42 a	0.40 a	0.48 a	0.55 a	0.53 a
CM	0.32 a	0.33 a	0.32 a	0.30 a	0.33 a	0.32 a
SM+CM	0.35 a	0.38 a	0.37 a	0.40 a	0.45 a	0.43 a
NPK	0.33 a	0.34 a	0.34 a	0.38 a	0.39 a	0.38 a
Unpinched:						
SM	0.42 a	0.43 a	0.43 a	0.46 a	0.56 a	0.48 a
CM	0.32 a	0.33 a	0.32 a	0.38 a	0.39 a	0.38 a
SM+CM	0.38 a	0.42 a	0.39 a	0.43 a	0.46 a	0.46 a
NPK	0.34 a	0.35 a	0.34 a	0.40 a	0.41 a	0.40 a
	Potassium %					
Pinched:						
SM	3.68 a	3.79 a	3.42 a	3.80 a	3.92 a	3.84 a
CM	2.26 a	2.89 a	2.49 a	2.05 a	2.20 a	2.12 a
SM+CM	3.12 a	3.20 a	3.15 a	3.63 a	3.76 a	3.70 a
NPK	4.34 a	4.86 a	4.80 a	4.27 a	4.50 a	4.41 a
Unpinched:						
SM	4.30 a	4.60 a	4.52 a	3.35 a	3.50 a	3.42 a
CM	2.52 a	3.01 a	2.70 a	1.56 a	1.89 a	1.70 a
SM+CM	4.18 a	4.25 a	4.20 a	3.05 a	3.31 a	3.10 a
NPK	4.82 a	5.11 a	5.15 a	3.83 a	4.15 a	4.07 a
	Total carbohydrates %					
Pinched:						
SM	19.16 a	20.06 a	19.30 a	20.15 a	20.79 a	20.62 a
CM	16.05 a	16.94 a	16.72 a	16.94 a	17.22 a	17.05 a
SM+CM	17.37 a	17.86 a	17.50 a	19.32 a	19.88 a	19.64 a
NPK	21.15 a	21.93 a	21.74 a	22.05 a	23.16 a	22.48 a
Unpinched:						
SM	19.93 a	20.30 a	20.29 a	20.74 a	21.05 a	20.91 a
CM	16.20 a	18.23 a	17.53 a	17.35 a	18.42 a	18.10 a
SM+CM	19.55 a	19.76 a	19.63 a	18.62 a	20.13 a	19.48 a
NPK	21.36 a	22.34 a	22.15 a	21.31 a	21.87 a	21.63 a

SM=sheep manure, CM= chicken manure, NPK= chemical fertilization, O, FS and SD =applications of active dry yeast (ADY) by none, foliar spray and soil drench respectively. Unpin = unpinched, pin = pinched. Values followed by the same alphabetical letters do not differ significantly according to Duncan's multiple range tests at 5% leve

effect was insignificant, however the highest total carbohydrate percentage was belong to NPK fertilization regardless yeast application or pinching treatments.

DISCUSSION

This investigation proved the efficiency of pinching process, fertilization with sheep manure + chicken manure and spraying active dry yeast on the studied characters of roselle plants. The effect of pinching in decreasing plant height and enhancing branches number consequently fruits and sepals' yields can be attributed to eliminating apical dominance effect, so release the development of the auxiliary buds to branches. In this regard Schopher and Mohr (1995) stated that topping of apical merestems of plants increased branching. Also, El-Gamassy (1972) and Ghaly (1998) obtained similar conclusion with the perennial and annual castor bean plants.

Likewise, Abed et al., (1996) mentioned that the decapitated roselle plants produced less height and more branches besides increase in fruits number, fresh and dry weights of fruits and sepal's fresh and dry weights.

Moreover, the insignificant effect of pinching on anthocyanin content of sepals was in harmony with Krissana-Boonsiri (1992). In the herein work the obtained dry yield of sepals/fed. was ranged between 594.37- 675.00 kg. for pinched plants against 468.12 - 595.05 kg. for unpinched one with an increase 2.77 - 13.44 % in the two seasons respectively (Table 8).

As for the effect of active dry yeast, the herein work proved the efficiency of active dry yeast spraying on increasing the vegetative and yield characters. This result is in harmony with those obtained by Ahmed et al., (1998) and Al-Qunaie (2002) on roselle plant using active dry yeast as foliar spray up to 0.4%. Likewise Tagetes minuta, L. plant showed similar response (El-Hindi and El-Qunaie, 2004). The beneficial effect of yeast on plant could be explain on its content of protein (47.2 %), several amino acids, vitamins, especially vitamin B, besides it contains some natural growth regulators such as cytokinins and controlling the incidence of fungi diseases (Tarrow and Nakase, 1975, N.R.P; 1977 and Subba Rao,1984). The herein work clear that the yield of dry sepals /fed. ranged between 509.26-633.93 kg./fed. as a result of active dry yeast spraying against 485.26-592.38 kg./fed. for unsprayed plants. The range of increase was 23.49-15.65% in the two seasons, respectively. On the other side, although adding active dry yeast to soil attained increase in dry sepals yield by 11.24-6.45% (Table, 8), yet it less than spraying method. As such it appear that spraying method is more beneficial than application through soil.

Concerning the effect of fertilization, the results of this work indicate that using the mixture of sheep manure ($10m^3$/fed) + chicken manure ($10m^3$/fed) surpassed significantly using NPK fertilization (300, 200 and 100 kg/fed.), sheep manure ($20 m^3$/fed.) and chicken manure ($20m^3$/fed.) each alone concerning the vegetative and yield characters.

Concerning, the yield of dry sepals/fed. no available literature could be obtain for the comparison between chemical fertilization and organic fertilization on roselle yield. However, Ahmed et al., (1998) showed that chicken manure at $27m^3$/fed. resulted in the highest sepals yield comparing to animal manure (not identified). In the herein work the obtained enhancement of the mixture of sheep manure and chicken manure could be attribute to the favored amounts of NPK beside other microelements attained by this mixture. Chicken manure contains high N percentage, while sheep manure contains high P and K percentages (Table 2) against using each of them alone.

In the herein work most results of interaction between fertilization, yeast and pinching treatments were insignificant concerning the vegetative growth or sepals yield and/or NPK or total carbohydrate in the leaves as such it appear that factors achieved its effect separately so, the enhanced yield of sepals may be due to different mode of action of the three factors. It was found that the three factors enhanced total nitrogen percentage significantly in the leaves,while sheep manure + chicken manure enhanced NPK percentages, while yeast application and pinching treatments did not show significant effect on phosphorus, potassium and total carbohydrate percentages. Active dry yeast may be showed its effect through hormonal effect while pinching showed its effect through nullifying apical dominance.

EFERENCES

Abed, A.M.; R.A. Medany and L.R. Khafaga (1996): A comparative study of low and high levels of kinetin on morphological, anatomical, chemical characters and yield of intact and decapitated roselle plants. Menofiya J. Agric. Res. Vol. 21(5): 1097-1114.

Ahmed, S.K.; E.O. El-Ghawas and A. F. Aly: (1998): Effect of active dry yeast and organic manure on roselle plant. Egypt. J. Agric. Res., 76 (3): 1115-1145.

Ali, A.F.(2001): Response of pot marigold (*Calendula officinalis*, L.) plants to some rock phosphate sources and yeast. The 5th Arabian Hort. Conf. Ismailia, Egypt March 24-28: 31-41.

Al-Qubaie, A.I. (2002): Effect of fertilization with potassium and bio-fertilization with yeast on the tolerance of *Hibiscus sabdariffa*, L. plants to irrigation with saline water. J. Agric. Sci. Mansoura Univ., 27(9): 6111-6122.

A.O.A.C. (1980): Official Methods of Analysis. 12th ed. Association of Official Analytical Chemists. Washington. D. C., USA.

Badawi, A.M.A. (2000): Effect of some agricultural treatments on growth and active ingredients in roselle plants in North Sinai. Ph. D. Thesis, Fac. Agric., Zagazig Univ.

Brown, J. and G. Lilliland (1948): Rapid determination of potassium and sodium in plant material and soil extracts by flam photometry. Proc. Amer. Soc. Hort. Sci., 48: 341-346.

Dubois, M.; K.A. Gilles; J. Hamilton; R. Rebers and F. Smith (1956): Colorimetric method for determination of sugar and related substances. Anal. Chem. 28: 350.

Du, C.T. and F. J. Francis (1973): Anthocyanin of Roselle. J. Food Sci., 38(5): 810-812.

Duncan, B.D. (1958): Multiple ranges and multiple F-tests. Biometrics, 11: 1- 42.

El-Gamassy, K.M. (1972): Physiological studies on castor bean plants (*Ricinus communis*, L) Ph. D. Thesis, Fac. Agric. Ain Shams Univ. Cairo.

El-Ghamriny, E.A.; H.M.E. Arisha and K.A. Nour (1999): Studies in the tomato flowering, fruit set, yield and quality in summer seasons. 1-spraying with thiamine, ascorbic acid and yeast. Zagazig J. Agric. Sci. Res., 26 (5): 1345-1364.

El-Hindi, K.M. and E.A. El-Boraie (2004): Effect of spraying active dry yeast on growth and storage period on the essential oil of marigold plant (*Tagetes minuta*, L). J. Agric. Sci. Mansoura Univ., 29(11): 6455-6468.

Ferguson, J.J.; W.T. Avigne; L.H. Allen and K.E. Koch.(1987): Growth of CO_2 enriched sour orange seedlings treated with gibberellic and cytokinins. Proc. Florida State Hort. Soc. 99: 37-39.

Fuleki, T. and F. J. Francis (1968): Quantitative methods of anthocyanin.
1. Extraction and determination of anthocyanin in cranberries. J. Food Sci., 33 (1): 72.

Ghaly, N.C. (1998): Physiological studies on *Ricinus comunis*, L. plant. Ph. D. Thesis. Fac. Agric. Zagazig Univ. Egypt.

Haikal, M.H. (1994): Effect of mineral fertilization on the vegetative growth and anthocyanin content of *Hibiscus sabdariffa*, L. J. Agric.Sci. Mansoura Univ. 19(11): 3901-3911.

Harridy, I.M.A. and M.A. Amara (1998): Effect of presowing inoculation of seeds by nitrogen fixed bacteria on growth, fruit production, sepals yield and the chemical composition of roselle plants. Egypt. J. Appl. Sci., 13 (6): 217-231.

Hucker, T. and G. Catroux (1980): Phosphorus in sewage ridge and animals waster slurries. Proceeding of the EEC Seminar, Haren (Gr): Groningen Nether Lands 12, 13 June.

Krissana-Boonsiri (1992): Effect of planting date, spacing and pinching on yield and quality of roselle (*Hibiscus sabdariffa*, L. Var. *sabdariffa*). M. Sc. Thesis. Kasetsart Univ. Library, POB 1084, Kasetsart, Bangkok 10903 - Thailand. (C.F. CAP Abstracts)

Malik, M.H.A. (1996): Response of roselle plants (*Hibiscus sabdariffa*, L.) to combined effects of fertilization and growth regulators treatments. M. Sc. Thesis, Fac. Agric., Minia Univ.

Nagodawithana, W.T. (1991): Yeast Technology. Univ. Foods Corporation Milwaukee, Wisconsin. Published by Van Nostrand Reinhold New York, P. 273.

N.R.P. (1977): Nutrient requirements of domestic Animals, No. 17th. Rev Ed. National Academy of Science, Washington, D.C. USA.

Osman, A.E. and V.Jacob (1970): Effect of the cultivaton locality on the taste flavour and colour of roselle. Agric. Res. Rev. Egyptian Ministry of Agric. 48: 181-192.

Saafan, S.A.E. (1994): Physiological studies on roselle (*Hibiscus sabdariffa*, L.) plants. M.Sc. Thesis, Fac. Agric. Menofiya Univ.

Schopher, P. and H. Mohr (1995): Plant Physiology. (1995).

Shalan, M.N.; T.A.Abd-Elatif; S.G.I.Soliman and E.O.El-Gaawwas (2001): Effect of some chemical and bio-fertilizer treatments on roselle plants (*Hibiscus sabdariffa*, L.) Egypt J. Agric. Res. 79(2): 587-606.

Sharaf, A. (1962): The pharmacological characteristics of *Hibiscus sabdariffa*. Plant Medica, 10: 48-52.

Snedecor, G.W. and W.G. Cochran (1980): Statistical methods, 7th ed. Iowa State College Press, Ames., Iowa, USA.

Subba Rao, N.S. (1984): Biofertilizers in Agriculture. Oxford, IBH Company, New Delhi.

Tarrow, D. and Nakase (1975): DNA base composition of species of the genus *saccharomyces*. Antoine van Leeuwenhoek, 41, 81.

تأثير بعض مصادر الأسمدة العضوية و الكيماوية و الخميرة النشطة والتطويش على إنتاجية نباتات الكركدية

محمد احمد محمود علي
قسم الإنتاج النباتى ووقايتة- كلية العلوم الزراعية البينية بالعريش- جامعة قناة السويس

يهدف هذا العمل إلى توضيح التأثيرات المشتركة لكلا من التسميد العضوى (سماد الغنم ٢٠م٣/فدان، سماد الدواجن ٢٠م٣/فدان، الخليط بينهم بمعدل ١٠م٣/فدان سماد ألغنم + ١٠م٣/فدان سماد ألدواجن) و التسميد الكيماوي بنترات الأمونيوم ٣٣,٥% ن، سوبر فوسفات الكالسيوم ١٦,٥% فو٢ا٥ ، سلفات البوتاسيوم ٤٨% بو٢ا عند معدلات ١٠٠،٢٠٠،٣٠٠ كجم/ فدان على التوالي والخميرة الجافة النشطة بتركيز 0.2%(بدون إضافة , رش على النباتات ،إضافة للتربة) ومعاملات التطويش. على النمو الخضري وإنتاجية ومحصول النبات من الثمار و السبلات والنسب المئوية للانثوسيانين والحموضة في السبلات الجافة. كذلك تقدير بعض المكونات الكيماوية بالأوراق مثل النيتروجين والفوسفور والبوتاسيوم والكربوهيدرات الكلية وذلك تحت ظروف شمال سيناء والأرض الرملية.

أوضحت النتائج المتحصل عليها أن استخدام سماد الغنم + سماد الدواجن مع الرش با لخميرة وتطويش النباتات أدت ألي زيادة في مقاييس النمو ووزن السبلات الجافة والنسب المئوية للأنثوسيانين والحموضة بالمقارنة بكلا من سماد الغنم أو سماد الدواجن أو التسميد الكيماوي كلا على حدة.

أدت معاملات التفاعل بين الثلاث عوامل (سماد الغنم + سماد الدواجن والرش بالخميرة الجافة وتطويش النباتات) ألي زيادة مقدارها ١١٥,٥٤-٧٥,٣٨ % في محصول السبلات الجافة بينما بلغت نسبة الزيادة في حالة إضافة الخميرة للتربة ١٠٩,٩٧-٦٩,٣٢% في الموسمين على التوالي .

أيضا أدت معاملات التفاعل بين الثلاث عوامل ألي زيادة معنوية في نسبة النيتروجين في أوراق النباتات بينما سماد الغنم + سماد الدواجن أدى إلى زيادة في النسب المئوية لكلا من ن, فو, بو بينما معاملات الخميرة والتطويش لم تظهر أي زيادة معنوية في النسب المئوية للفوسفور والبوتاسيوم و الكربوهيدرات الكلية.