IV- RESULTS AND DISCUSSION

Effect of fertilization treatments and sowing dates on some vegetative, flowering and chemical constituents of *Tanacetum vulgare.* plants

IV-1-vegetative growth parameters:

IV-1-1- Plant height (cm):

The data presented in Table (1) and Fig (1-a). Show that the different fertilization treatments had a marked effect on the average plant height of *Tanacetum vulgare* plants in both seasons., fertilization with F6 (Biofertilizer + ammonium sulphate 300kg + 2ton compost/fed) produced the tallest plants compared to other fertilization treatments resulting in significant differences in most cases, the values reached (107.20 and 109.73 cm) in the first and second seasons, respectively.

However, the highest rate of chemical fertilizer F1 (ammonium sulphate 450 kg /fed) gave the next higher values of plant height followed by F7 (Biofertilizer + $10m^3$ Biogas manure/fed)

Meanwhile, F5 fertilization (Biofertilizer + 2 ton compost / fed) produced the shortest plants (74.69 and 77.50 cm) in the first and second seasons, respectively.

The beneficial influences of a combined application of (Biofertilizer + ammonium sulphate 300kg + 2ton compost/fed) may be due to the microbial activities of biofertilizer and compost which increased the availability of essential nutrient elements in the medium.

Table (1): Effect of fertilization treatments and sowing date on plant height (cm) of *Tanacetum vulgare* plants during 2002/2003–2003/2004 seasons.

Treatments		1st cut				2nd cut				Mean	
				Mean				Mean			
		1st season	2nd season	1st season	2nd season	1st season	2nd season	1st season	2nd season	1st season	2nd season
F1	Winter	95.00	91.25	99.40	100.63	98.75	105.00	103.77	106.90	101.58	103.76
	Summer	103.80	110.00			108.80	108.80				
F2	Winter	77.50	78.75	85.00	88.75	87.50	92.50	93.75	96.90	89.37	92.82
	Summer	92.50	98.75			100.00	101.30				
F3	Winter	81.25	76.25	84.38	83.75	83.750	87.50	88.75	89.375	86.56	86.56
	Summer	87.50	91.25			93.750	91.25				
F4	Winter	71.25	72.50	76.88	81.25	77.50	82.50	79.37	83.12	78.12	82.18
	Summer	82.50	90.00			81.25	83.75				
F5	Winter	70.00	67.50	74.38	75.62	72.50	75.00	75.00	79.37	74.68	77.50
	Summer	78.75	83.75			77.50	83.75				
F6	Winter	97.50	97.50	104.40	106.90	107.50	113.80	110.00	112.55	107.20	109.72
	Summer	111.30	116.30			112.50	111.30				
F7	Winter	88.75	82.50	94.38	95.65	95.00	98.75	97.50	97.50	95.93	96.57
	Summer	100.00	108.80			100.00	96.25				
F8	Winter	83.75	77.500	88.13	87.500	88.75	95.00	90.63	95.00	89.37	91.25
	Summer	92.50	97.50			92.50	95.00				
Mean		88.37	90.01	88.37	90.01	92.35	95.10	92.35	95.10	90.36	92.55
1st	L.S.D1 at 5% for F =2.51		for cuts=1.25		F.CUTS=3.55		F.S.CUTS.=5.03				
2nd	LSD2 at 5% for F =2.13		for cuts =1.07		F.CUTS = 3.02		F.S.CUTS =4.27				

F1 Ammonium sulphate 450 kg /fed.
F2 Biofertilizer + Ammonium sulphate 300 kg /fed
F3 Biofertilizer+10 m^3 poultry manure/fed (Bio+10 m^3 PM/fed.)
F4 Biofertilizer + Ammonium sulphate 300 kg /fed +10 m^3 poultry manure.
F5 Biofertilizer+2ton compost/fed
F6 Biofertilizer + Ammonium sulphate 300 kg /fed + 2ton compost/fed
F7 Biofertilizer + 10 m^3Biogas manure/fed.
F8 Biofertilizer + Ammonium sulphate 300 kg /fed +10 m^3Biogas manure/fed.

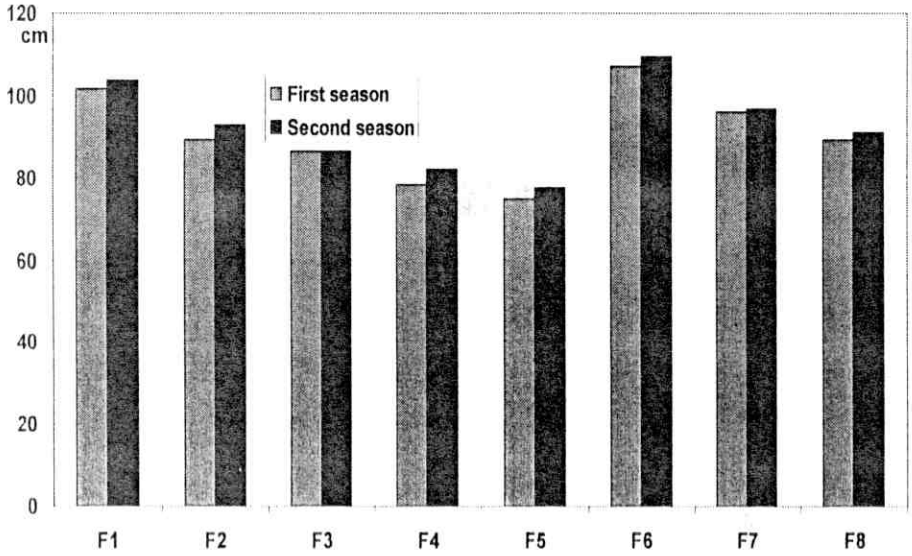


Fig (1-a): Effect of fertilization treatments on plant height (cm) of *Tanacetum vulgare* plants during 2002/2003 and 2003/2004 seasons.

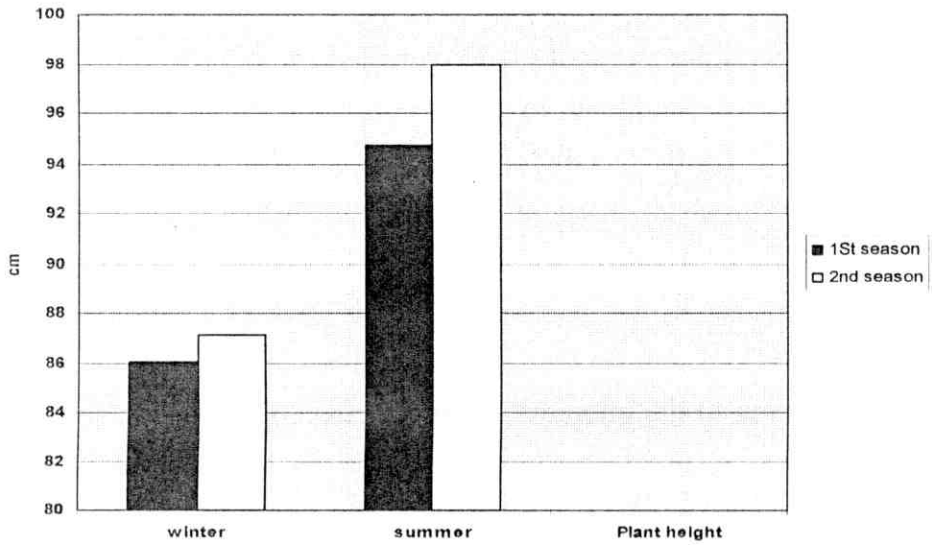


Fig (1-b): Effect of sowing dates on plant height (cm) of *Tanacetum vulgare* plants during 2002/2003 and 2003/2004 seasons .

Concerning the effect of sowing date on plant height, it was appeared from Table (19) Fig (1-b) that summer planting showed a promising effect in increasing plant height compared to winter planting date in both seasons.

Summer planting achieved (10.09 % and 12.45%) increases in plant height over winter planting date in the first and second seasons, respectively.

Referring to the interaction effect between fertilizers and cuts (regardless sowing dates) it is clear from data that the greatest mean values of plant height was gained in the second cut when the plants of *Tanacetum vulgare* fertilized with F6 (Biofertilizer + ammonium sulphate 300 kg /fed + 2ton compost/fed) which gave (110.00 and 112.55 cm) followed descendingly by using F6 in the first cut as it gave (104.40 and 106.90 cm) in the first and second seasons, respectively.

Besides, treated the plants of *Tanacetum vulgare* with F1 (450 kg ammonium sulphate/fed.) resulted in highly significant increment in this character in the second and first cuts in both seasons of this study. On the contrary, the lowest mean values of this parameter was obtained in the first cut when the plants were treated with F_5 as it gave (74.38 and 75.63 cm) followed by using the same fertilizer in the second cut which gave (75.00 and 79.37 cm) in the first and second seasons, respectively.

Referring to the interaction effect between fertilizers, sowing date and cuts, it is clear also from data that the combination between chemical fertilizer, biofertilizer and compost (F6) applied on summer sowing plants in the 1st cut in the second season as it recorded the highest values of plant height of *Tanasetum vulgare* plants as it gave (116.30) followed by the same treatment for winter

sowing plants at the 2nd cut in the second season as it gave (113.80) followed by summer sown plants treated with F6 in the 2nd cut in the first and second seasons as they registered (112.50 and 111.30 cm), respectively.

Meanwhile, the shortest plants of *Tanasetum vulgare* were obtained in the 1st cut with winter sown plants treated with F5 (Biofertilizer+2ton compost/fed) and F4 (Biofertilizer + ammonium sulphate 300kg +10 m^3 poultry manure) in both seasons. This results may be attributed to warm weather in summer than in winter in North Sinai condition. (Tables G,H and I). the increasing in growth parameters by F6 (Biofertilizer + ammonium sulphate 300kg + 2ton compost/fed) application may be turned to the effect of microbial activity and compost on increasing the availability of elements and their supply to plants and its effect on the physiological processes such as photosynthesis activity as well as the utilization of carbohydrates. Also, the increase in plant growth by nitrogen fertilization may be attributed to the role of nitrogen in formation of protoplasm and most organic components such as amino acids, nucleic acids, many enzymes and energy transfer compounds (ADP and ATP) **(Russel, 1973)**. These results were coincided with those obtained by, **Badawi (2000)** on roselle plants found that, the highest values of growth parameters (plant height) were recorded from the treatment of N300+P200+K100 kg/ fed.+ biofertilizer/fed. and **Ibrahem (2000)** on *Ammi visnaga* L. and *Foeniculum vulgare* Mill. Recorded that, in the presence of full dose of NPK (300 kg ammonium sulfate + 300 kg calcium super phosphate + 80 kg potassium sulfate/fed.) gave the tallest plants.

IV-1-2- Number of branches /plant:

Data obtained on number of branches/plant of *Tanacetum vulgare* plants as affected by some types of fertilizers, sowing dates and their interactions are shown in Table (2) and Fig (2-a) Data indicated that growth behaviors of *Tanacetum vulgare* plants showed logical relationship to different fertilization types. It is noticeable that application of F6 (Biofertilizer + ammonium sulphate 300kg + 2ton compost/fed) (regardless sowing date and cuts) which gave the best plant height resulted in the greatest number of branches/plant as it recorded (14.88 and 17.19 branches/plant) in the first and second seasons, respectively. Where as the F1 (ammonium sulphate 450 kg /fed) gave the next values in this parameter as it registered (14.00 and 15.44 branches/plant) in the first and second seasons, respectively, while the lowest number of branches (8.44 and 8.63) were obtained when the plants treated with F5 (Biofertilizer+2ton compost/fed) and F4 (Biofertilizer + ammonium sulphate 300kg +10 m^3 poultry manure) respectively. in the first season while in the second season the values were (9.13and 10.00 branches/ plant) for F5 and F4 respectively. However the other treatments occupied intermediate position between the above mentioned treatments.

As for the effect of sowing date on the number of branches of *Tanacetum vulgare* plants. The results recorded in Table (19) and Fig (2-b) show that summer planting had generally favorable effect on the number of branches than winter planting the percentages of increases in the number of branches/ plant of summer sown plants were (31.62% and 43.71%) over winter planting in the first and second seasons, respectively.

Table (2): Effect of fertilization treatments and sowing date on number of branches / plant of *Tanacetum vulgare* plants during 2002/2003–2003/2004 seasons.

Treatments		1st cut				2nd cut				Mean	
				Mean				Mean			
		1st season	2nd season	1st season	2nd season	1st season	2nd season	1st season	2nd season	1st season	2nd season
F1	Winter	10.25	10.25	13.75	14.37	14.25	15.25	14.25	16.50	14.00	15.43
	Summer	17.25	18.50			14.25	17.75				
F2	Winter	6.80	7.25	9.77	10.75	10.25	12.25	10.25	13.37	10.01	12.06
	Summer	12.75	14.25			10.25	14.50				
F3	Winter	7.25	7.25	9.87	10.50	9.25	11.00	9.25	12.00	9.56	11.25
	Summer	12.50	13.75			9.25	13.00				
F4	Winter	6.00	7.00	8.50	9.50	8.75	10.00	8.75	10.50	8.62	10.00
	Summer	11.00	12.00			8.75	11.00				
F5	Winter	6.00	5.50	8.62	8.62	8.25	9.00	8.25	9.62	8.44	9.12
	Summer	11.25	11.75			8.25	10.25				
F6	Winter	10.75	11.50	15.00	16.25	14.75	16.00	14.75	18.12	14.87	17.19
	Summer	19.25	21.00			14.75	20.25				
F7	Winter	8.50	8.50	11.37	11.87	11.75	12.75	11.75	13.37	11.56	12.62
	Summer	14.25	15.25			11.75	14.00				
F8	Winter	8.25	8.25	11.00	11.25	11.25	12.25	11.25	13.25	11.12	12.25
	Summer	13.75	14.25			11.25	14.25				
Mean		10.99	11.64	10.99	11.64	11.06	13.34	11.06	13.34	11.02	12.49

1st L.S.D.1 at 5% for F =0.248 for CUTS=0.496 F.CUTS=0.702 F.S.cuts=0.993

2nd LSD2 at 5% for F =0.457 for CUTS =0.457 F.CUTS = 0.646 F.S.cuts =0.914

F1 Ammonium sulphate 450 kg /fed.

F2 Biofertilizer + Ammonium sulphate 300 kg /fed

F3 Biofertilizer+10 m^3 poultry manure/fed (Bio+10 m^3 PM/fed.)

F4 Biofertilizer + Ammonium sulphate 300 kg /fed +10 m^3 poultry manure.

F5 Biofertilizer+2ton compost/fed

F6 Biofertilizer + Ammonium sulphate 300 kg /fed + 2ton compost/fed

F7 Biofertilizer + 10 m^3Biogas manure/fed.

F8 Biofertilizer + Ammonium sulphate 300 kg /fed +10 m^3Biogas manure/fed.

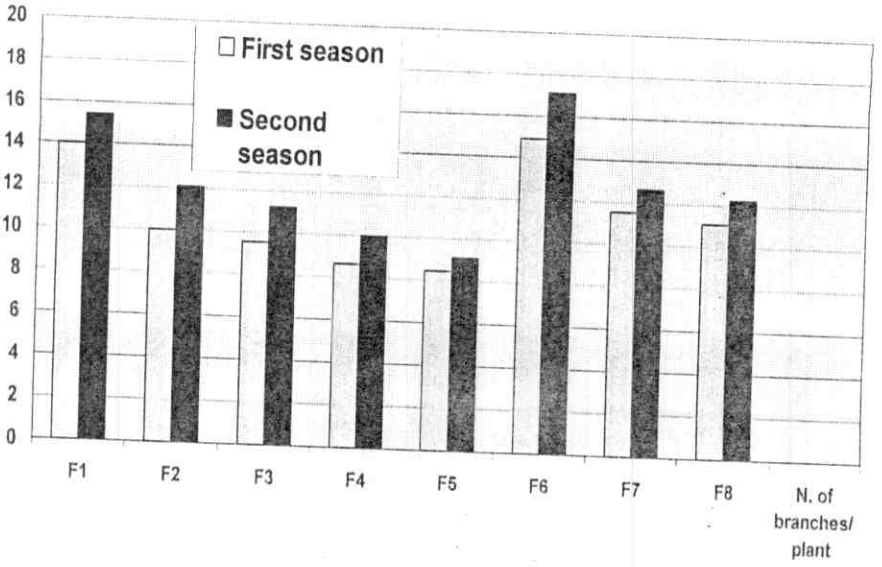


Fig (2-a): Effect of fertilization treatments on number of branches/ plant of *Tanacetum vulgare* plants during 2002/2003 and 2003/2004 seasons.

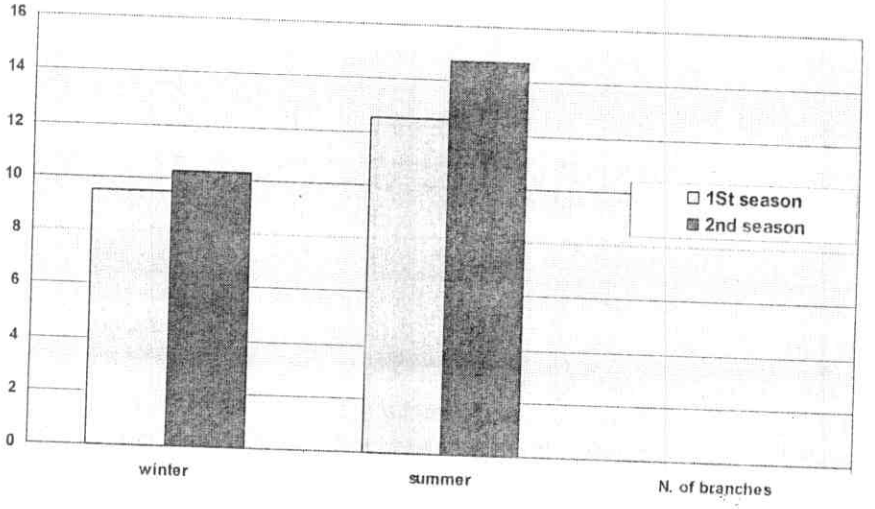


Fig (2-b): Effect of sowing dates on number of branches / plant of *Tanacetum vulgare* plants during 2002/2003 and 2003/2004 seasons.

Referring to the interaction effect between fertilizers and cuts (regardless sowing date) data presented in Table (2) showed that the greatest mean values of number of branches was gained in the first cut when the plants of *Tanacetum vulgare* fertilized with F_6 (Biofertilizer +2ton compost/fed+300 kg ammonium sulphate /fed) which gave 15.00 branches/plant in the first season while in the second one the greatest number of branches/plant was recorded in the second cut when the plants of *Tanacetum vulgare* was fertilized with F_6 as it gave (18.125 branches/plant).

Besides, treated the plants of *Tanacetum vulgare* with F1 (450 kg ammonium sulphate/fed) resulted in highly significant increments in this character in the second and first cuts in both seasons of this study. The values recorded (14.25 and 16.50) in the second cut and (13.75 and 14.38)in the first cut for the first and second seasons, respectively.On the other hand, the lowest mean values of this parameter were obtained by using F_4 and F_5 in both cuts in the first and second seasons.

With respect to the interaction effect between fertilizers, sowing date and cuts, data tabulated in Table (2) cleared that the greatest number of branches was recorded in the first cut when the plants sown in summer and fertilized with F_6 as it gave (19.25 and 21.00) in the first and second seasons, respectively, followed descendingly by using F_6 in the second cut when the plants of *Tanacetum vulgare* was sown in the summer. In the contrary, the lowest number of branches / plant of Tansy plants were obtained in the first cut when the plants were sown in the winter and treated with F_5 the values were (6.00 and 5.50 numbers of branches / plant) in the first and second seasons respectively. Followed by using F_4

when the plants were sown in winter which gave (6.00 and 7.00 number of branches / plant) in the first cut in the first and second seasons respectively .Besides, using F_1 (450 kg ammonium sulphate/fed.) resulted in highly significant increment in this parameter in the first and second cuts in both seasons.

These results are in agreement with those obtained by **Ibrahem (2000)** on *Ammi visnaga* L. and *Foeniculum vulgare* Mill. who recorded that, in the presence of full dose of NPK (300 kg ammonium sulfate + 300 kg calcium super-phosphate + 80 kg potassium sulfate/fed.) gave the highest number of umbels **Shalan *et al.* (2001)** on roselle plant found that,. Nitrobein recorded a lower number of branches than ammonium sulfate at 40 kg/fed, however, it produced more number of branches than ammonium sulfate at 60 kg/fed. Nitrobein as a biosource of nitrogen.

IV-1-3- Fresh weight /plant (g):

Data in Table (3) and Fig (3-a) clearly show that fertilization treatments showed significant differences in fresh weight of whole plant. However, the combination of F6 (Biofertilizer + ammonium sulphate 300 kg /fed + 2ton compost/fed) was the most effective in increasing Fresh weight /plant (g) as it gave (716.70 and 804.03 g) in the first and second seasons, respectively followed descendingly by applying the combination of F7 (Biofertilizer + 10m3Biogas manure/fed) which produced (643.15 and 725.28 g) Fresh weight /plant in the first and second seasons, respectively, as compared with the F_1 which recorded (630.33 and 664.35 g) in the first and second seasons, respectively.

Table (3): Effect of fertilization treatments and sowing date on fresh weight/ plant (g) of *Tanacetum vulgare* plants during 2002/2003–2003/2004 seasons.

Treatments		1st cut				2nd cut				Mean	
				Mean				Mean			
		1st season	2nd season	1st season	2nd season	1st season	2nd season	1st season	2nd season	1st season	2nd season
F1	Winter	461.30	413.80	721.90	747.40	512.50	541.30	538.75	581.30	630.32	664.35
	Summer	982.50	1081.00			565.00	621.30				
F2	Winter	392.50	387.50	621.90	631.25	457.50	495.00	477.50	525.00	549.70	578.12
	Summer	851.30	875.00			497.50	555.00				
F3	Winter	413.80	321.30	609.40	577.55	478.80	505.00	504.40	524.40	556.90	550.97
	Summer	805.00	833.80			530.00	543.80				
F4	Winter	350.00	303.80	567.50	550.05	480.00	421.30	459.40	450.65	513.45	500.35
	Summer	785.00	796.30			438.80	480.00				
F5	Winter	327.50	283.80	547.50	538.15	380.00	402.50	398.75	416.90	473.12	477.52
	Summer	767.50	792.50			417.50	431.30				
F6	Winter	505.00	453.80	829.00	842.40	591.30	631.30	604.40	765.65	716.70	804.02
	Summer	1153.00	1231.00			617.50	900.00				
F7	Winter	455.00	412.50	726.90	751.75	531.30	566.30	559.40	698.80	643.15	725.27
	Summer	998.80	1091.00			587.50	831.30				
F8	Winter	405.00	376.30	691.25	692.15	470.00	506.30	500.00	630.55	595.62	661.35
	Summer	977.50	1008.00			530.00	754.80				
Mean		664.42	666.34	664.42	666.34	505.33	574.16	505.33	574.16	584.88	620.25

1st L.S.D.1 at 5% for F =4.36 for cuts =2.18 cuts.F=6.17 F.S. cuts =8.73
2nd LSD2 at 5% for F3.03 =1.51 for F =1.51 cuts.F = 4.29 F.S. cuts =6.07

F1 Ammonium sulphate 450 kg /fed.
F2 Biofertilizer + Ammonium sulphate 300 kg /fed
F3 Biofertilizer+10 m^3 poultry manure/fed (Bio+10 m^3 PM/fed.)
F4 Biofertilizer + Ammonium sulphate 300 kg /fed +10 m^3 poultry manure.
F5 Biofertilizer+2ton compost/fed
F6 Biofertilizer + Ammonium sulphate 300 kg /fed + 2ton compost/fed
F7 Biofertilizer + 10 m^3Biogas manure/fed.
F8 Biofertilizer + Ammonium sulphate 300 kg /fed +10 m^3Biogas manure/fed.

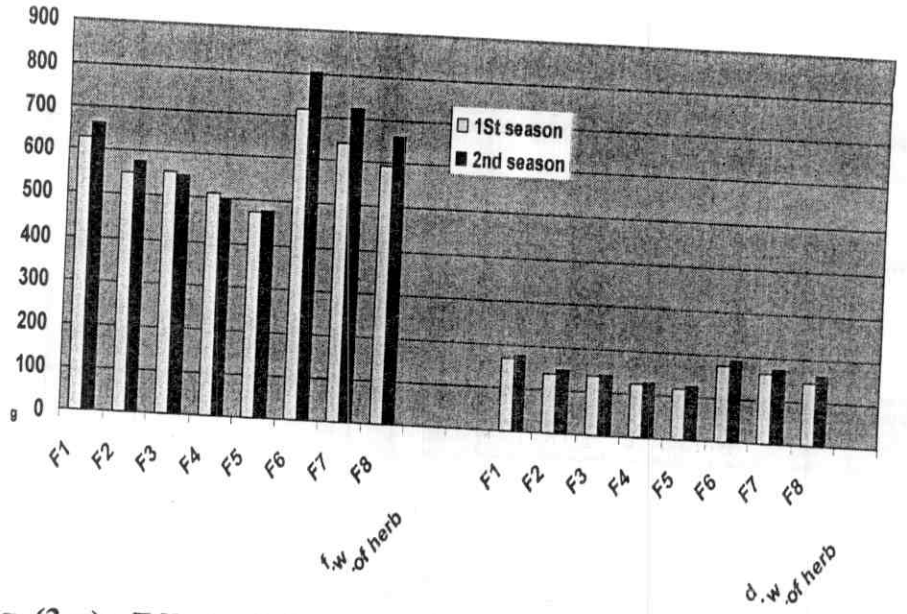


Fig (3-a): Effect of fertilization treatments on fresh and dry weights / plant (g) of *Tanacetum vulgare* plants during 2002/2003– 2003/2004 seasons.

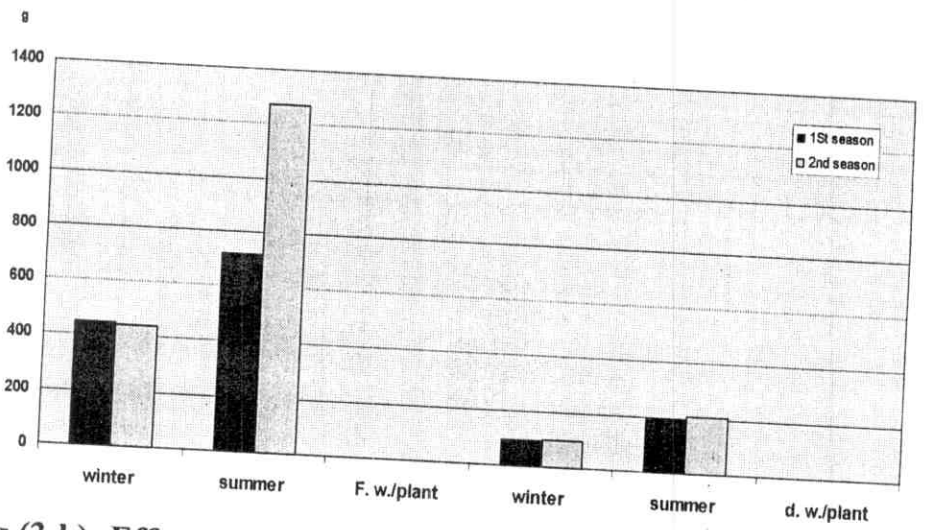


Fig (3-b): Effect of sowing dates on fresh and dry weights /plant (g) of *Tanacetum vulgare* plants during 2002/2003– 2003/2004 seasons.

On the other hand, the lowest mean values of plant fresh weight (473.13 and 477.53 g) in the first and second seasons, respectively which produced by treated the plants of *Tanacetum vulgare* with F5 fertilizer (Biofertilizer + 2 ton compost/fed).

These results might be due to the lake of chemical nitrogen fertilizer included in this mixture which produced the lightest fresh weight /plant as the percentages of decreases lower than F1 (450 kg ammonium sulphate/fed). were (24.94% and 28.12%) in the first and second seasons, respectively. followed descendingly by F4 (Biofertilizer + ammonium sulphate 300 kg /fed +10 m^3 poultry manure.) which gave the percentage of decreases (18.54 and 24.69 %) in the first and second seasons, respectively.

Anyhow, the other treatments occupied intermediate position between the abovementioned extremes.

Concerning the specific effect of sowing date, it is clear from the present data show in Table (19) and Fig (3-b) that the best effect in this respect was obtained by summer planting of *Tanacetum vulgare* plants which recorded (719.03 and 1270.38 g) for the mean fresh weight /plant in the two seasons, respectively compared with winter planting as it gave (450.72 and 438.86 g) in the two seasons, respectively. It might be attributed this increases in the fresh weight to the warm weather of summer which faster the process of mineralization of organic nitrogen and phosphate (Tables G,H and I).

With regards to, the effect of combination between fertilization forms and cuts (regardless sowing date), the data in Table (3) show that the maximum mean values of fresh

weight/plant (829.00 and 842.40 g) in both seasons, respectively was recorded in the first cut when the plants of *Tanacetum vulgare* received F6 fertilizer (Biofertilizer + ammonium sulphate 300 kg /fed + 2ton compost/fed). In addition plants fertilized by F7 (Biofertilizer + 10 m^3Biogas manure/fed) gave the next mean values (726.90 and 751.75 g) in both seasons, respectively in the first cut. Whereas, in the second cut F6 still express its superiority in increasing the fresh weight of tansy plants as it recorded (604.40 and 765.65 kg) in the first and second seasons, respectively. Followed by F7 (Biofertilizer + 10 m^3Biogas manure/fed). On the contrary, the least mean values of fresh weight/plant was obtained in both cuts and both seasons by F5 treatments (Biofertilizer +2ton CM/fed.)

Referring to the interaction effect between fertilizers, sowing date and cuts, data tabulated in Table (3) cleared that date, plants of Tansy sown in summer and received F6 (Biofertilizer + ammonium sulphate 300kg + 2ton compost/fed) produced the heaviest fresh weight /plant in the first cut as it gave (1153.00 and 1231.00 g) in the two seasons, respectively., followed in descending order by sowing the seeds in summer and received F_7 (Biofertilizer + 10 m^3 biogas/fed.) as it gave in the first cut (998.80 and 1091.00 g) in the first and second seasons, respectively. In contrast, the least effective treatment for increasing the fresh weight /plant was sown the seeds in winter and fertilized with F5 (Biofertilizer+2ton compost/fed) in the first cut as it gave (327.50 and 283.89 g) in the first and second seasons, respectively. Similar results were obtained on fresh weight/plant in the second cut in both seasons.

IV-1-4- Dry weight /plant (g):

Data of the dry weight /plant (g) of *Tanacetum vulgare* are presented in Table (4) and Fig (3-a) It was obvious that fertilized *Tanacetum vulgare* plants with F_6 showed its superiority for increasing the dry weight /plant as it gave (174.55 and 190.63 g) followed descendingly by using (450 kg ammonium sulphate/fed) as F1 which recorded (166.90 and 174.56 g) in the first and second seasons, respectively. Additionally, irrespective the abovementioned treatments, using the treatments of F_7 and F8 (Biofertilizer + ammonium sulphate 300 kg /fed +10 m^3 Biogas manure/fed.) succeeded in increasing the dry weight /plant when compared with the other treatments as they gave (160.25 and 144.22 g) in the first season and (172.65 and 160.33 g) in the second one, respectively. On the opposite, the least dry weight /plant was obtained by treated the plants with F_5 (Biofertilizer+2ton compost/fed) which produced the lowest values as the percentages of decreases lower than F1 (450 kg ammonium sulphate /fed). were (29.71% and 30.12%) followed descendingly by using F_4 (Biofertilizer + ammonium sulphate 300 kg /fed +10 m^3 poultry manure) which recorded the percentages of decreases (26.51% and 26.90%) in the first and second seasons, respectively. However, the rest treatments occupied intermediate place between the aforesaid treatments.

Concerning the effect of sowing date on dry weight / plant, it was appeared from Table (19) and Fig (3-b) that summer planting showed a promising effect in increasing dry weight / plant compared to winter planting date in both seasons. Summer planting a achieved (99.51%and 108.17%) increases in dry weight over winter planting date in the first and second seasons, respectively.

Table (4): Effect of fertilization treatments and sowing date on the dry weigh/plant (g) of *Tanacetum vulgare* plants during 2002/2003–2003/2004 seasons.

Treatments		1st cut				2nd cut				Mean	
				Mean				Mean			
		1st season	2nd season	1st season	2nd season	1st season	2nd season	1st season	2nd season	1st season	2nd season
F1	Winter	173.50	160.00	192.75	188.15	199.50	202.50	199.50	203.25	196.12	195.70
	Summer	212.00	216.30			199.50	204.00				
F2	Winter	127.50	121.30	145.00	144.40	143.80	157.50	144.15	155.00	144.57	149.70
	Summer	162.50	167.50			144.50	152.50				
F3	Winter	104.30	95.00	116.15	115.00	113.80	117.50	111.40	116.50	113.77	115.75
	Summer	128.00	135.00			109.00	115.50				
F4	Winter	92.75	86.25	103.52	103.02	101.50	113.80	101.50	111.30	102.51	107.16
	Summer	114.30	119.80			101.50	108.80				
F5	Winter	90.75	87.50	98.025	100.00	105.30	111.30	97.52	105.65	97.77	102.82
	Summer	105.30	112.50			89.75	100.00				
F6	Winter	186.50	176.30	203.75	201.90	203.80	212.50	206.40	212.65	205.07	207.27
	Summer	221.00	227.50			209.00	212.80				
F7	Winter	160.80	154.30	181.65	182.80	178.50	185.00	181.40	191.90	181.52	187.35
	Summer	202.50	211.30			184.30	198.80				
F8	Winter	151.50	135.00	171.25	166.90	174.50	177.50	169.90	179.40	170.57	173.15
	Summer	191.00	198.80			165.30	181.30				
Mean		151.51	150.27	151.51	150.27	151.47	159.46	151.47	159.46	151.49	154.86
1st L.S.D.1 at 5% for F =13.87				for cuts=6.93		F.cuts=19.61		F.S.cuts=27.72			
2nd LSD2 at 5% for F =11.34				for cuts =5.67		F.cuts = 16.04		F.S.cuts =22.63			

F1 Ammonium sulphate 450 kg /fed.
F2 Biofertilizer + Ammonium sulphate 300 kg /fed
F3 Biofertilizer+10 m^3 poultry manure/fed (Bio+10 m^3 PM/fed.)
F4 Biofertilizer + Ammonium sulphate 300 kg /fed +10 m^3 poultry manure.
F5 Biofertilizer+2ton compost/fed
F6 Biofertilizer + Ammonium sulphate 300 kg /fed + 2ton compost/fed
F7 Biofertilizer + 10 m^3Biogas manure/fed.
F8 Biofertilizer + Ammonium sulphate 300 kg /fed +10 m^3Biogas manure/fed.

Referring to the interaction effect between fertilizers and cuts. (regardless sowing date) data presented in Table (4) cleared that the heaviest dry weight /plant (g) was produced in the first cut, when the plants of *Tanacetum vulgare* treated with F_6 which gave (192.00 and 198.46 g) followed descendingly by using F_7 which registered in the first cut (182.49 and 188.41g) in the first and second seasons, respectively. Furthermore, fertilized *Tanacetum vulgare* plant with F_1 (ammonium sulphate 450 kg /fed) resulted in highly significant increases in this parameter in the first cut as it gave (180.24 and 183.24 g) in the first and second seasons, respectively. On the reverse, the lowest dry weight /plant obtained in the second cut when the plants of *Tanacetum vulgare* treated with F_5 and F_4 as they gave (88.71 and 90.40 (g) in the first season and (104.47and 107.30 g) in the second one, respectively.

As for the interaction effect between fertilizers, sowing date and cuts, data in Table (4) declared that the highest dry weight /plant of *Tanacetum vulgare* was obtained in the first cut when the plants sown in the summer and fertilized with F_6 as it produced (280.80 and 298.60 g) followed descendingly by using the treatment of F_7 when the plants sown in the summer as it gave (268.80 and 283.90 g) for cut, in the first and second seasons, respectively.

Also sown *Tanacetum vulgare* plants in the summer and treated with F1 (450 kg ammonium sulphate/fed) produced highly significant increments in this parameter in the first cut when compared with the rest treatments as it gave (265.40 and 276.90 (g) in the first and second seasons, respectively. On the contrary, the least mean values of this parameter was obtained by sown

Tanacetum vulgare plants in the winter and received F_5 (Biofertilizer + 2ton compost/fed.) as it gave (64.42 and 52.53 g), followed descendingly by sown the plants in the winter and fertilized with F_4 (Biofertilizer + ammonium sulphate 300 kg /fed +10 m^3 poultry manure) as it gave (67.72 and 57.24 g) in the first cut in the first and second seasons, respectively. The differences among the abovementioned two treatments were non significant as the plants under such treatments had nearly close dry weight values in both seasons of this study.

These results are in a parallel line to those of the herb fresh weight/plant and may be discussed in the same way.

These results coincided with those obtained by **Gomma (2002)** on *Coriandrum sativum* L. and *Majorana hortensis* Moench. observed that applying active dry yeast at 10 g/L as a soil drench and full dose of NPK plus biofertilizer (a mixture of *Bacillus megatherium* P.D.B., *Azospirillum lipoferum* and *Azotobacter chroococcum*) gave the best vegetative growth parameters as fresh and dry weights of vegetative growth /plant. **Hamed (2004)** studied the effect of biofertilization on *Salvia officinalis* using a mixture of 5 strains namely: *Azotobacter chroococcum*, *Azospirillum lipoferum*, *Bacillus polymixa*, *Bacillus megatherium* and *Pseudomonas fluorescence* in the presence of full dose of NPK (600 kg ammonium sulfate + 200 kg calcium super phosphate + 100 kg potassium sulfate/fed./ year). He mentioned that the highest vegetative growth was recorded at the treatment of biofertilizer plus full dose of NPK compared to control plants. and **Toaima (2005)** on *Achillea millefolium* L. Recorded that, in the presence of second chemical fertilizers level of NPK (300 kg ammonium sulfate +

200 kg calcium super phosphate + 50 kg potassium sulfate/fed.) plus organic manure (15 m^3/fed sheep manure) + biofetilizer (a mixture of *Azotobacter chroococcum*, *Azospirillum lipoferum* and *Bacillus megatherium*) one addition pre month gave the highest fresh and dry weights.

1V-2- Flowering parameter:

1V -2-1-Number of flower heads /plant:

It quite clear from data presented in Table (5) and Fig (4-a) that number of flower heads/plant was markedly affected by fertilization treatments F6 (Biofertilizer + ammonium sulphate 300 kg /fed + 2ton compost/fed) produced the maximum flower heads/ plant (205.08 and 207.28_flower heads /plant) in the first and second seasons, respectively.

Meanwhile F1 treatment (ammonium sulphate 450 kg /fed.) seems that the stimulative effect of N fertilization on favourite flowering growth took place and produced the next highest values in flower heads number as it gave (196.13 and 195.70 flower heads /plant) the first and second seasons respectively.

Regarding the effect of sowing date on number of flower heads Table (19) and Fig (4-b), it was observed that summer planting was most effective treatment in hastening and increasing the number of inflorescence yield /plant than winter planting.

Generally the percentages of increases for summer sowing were (10.11 and 18.90% flower heads/ plant) over winter sowing plants.

Table (5): Effect of fertilization treatments and sowing date on the number of flower heads / plant of *Tanacetum vulgare* plants during 2002/2003–2003/2004 seasons.

Treatments		1st cut				2nd cut				Mean	
				Mean				Mean			
		1st season	2nd season	1st season	2nd season	1st season	2nd season	1st season	2nd season	1st season	2nd season
F1	Winter	95.08	90.96	180.24	183.93	149.70	159.10	153.55	165.20	166.89	174.56
	Summer	265.40	276.90			157.40	171.30				
F2	Winter	80.96	80.50	166.38	167.35	102.00	112.20	110.85	128.95	138.61	148.15
	Summer	251.80	254.20			119.70	145.70				
F3	Winter	82.32	70.42	165.01	158.36	109.00	117.10	107.35	121.50	136.18	139.93
	Summer	247.70	246.30			105.70	125.90				
F4	Winter	67.72	57.24	154.91	147.92	87.18	98.70	90.40	107.30	122.65	127.61
	Summer	242.10	238.60			93.62	115.90				
F5	Winter	64.42	52.53	145.91	139.51	85.23	95.93	88.70	104.46	117.30	121.99
	Summer	227.40	226.50			92.18	113.00				
F6	Winter	103.20	98.32	192.00	198.46	142.80	168.20	157.10	182.80	174.55	190.63
	Summer	280.80	298.60			171.40	197.40				
F7	Winter	96.18	92.91	182.49	188.40	113.70	127.10	138.00	156.90	160.24	172.65
	Summer	268.80	283.90			162.30	186.70				
F8	Winter	81.17	78.20	167.08	175.45	89.40	104.70	121.35	145.20	144.22	160.32
	Summer	253.0	272.7			153.30	185.70				
Mean		169.25	169.92	169.25	169.92	120.91	139.03	120.91	139.03	145.08	154.48

1st L.S.D.1 at 5% for F=3.25 for cuts =3.25 F.cuts=4.60 F.S. cuts.=6.51
2nd LSD2 at 5% for F =3.20 for cuts =3.20 F.cuts = 4.53 F.S. cuts =6.00

F1 Ammonium sulphate 450 kg /fed.
F2 Biofertilizer + Ammonium sulphate 300 kg /fed
F3 Biofertilizer+10 m^3 poultry manure/fed (Bio+10 m^3 PM/fed.)
F4 Biofertilizer + Ammonium sulphate 300 kg /fed +10 m^3 poultry manure.
F5 Biofertilizer+2ton compost/fed
F6 Biofertilizer + Ammonium sulphate 300 kg /fed + 2ton compost/fed
F7 Biofertilizer + 10 m^3Biogas manure/fed.
F8 Biofertilizer + Ammonium sulphate 300 kg /fed +10 m^3Biogas manure/fed.

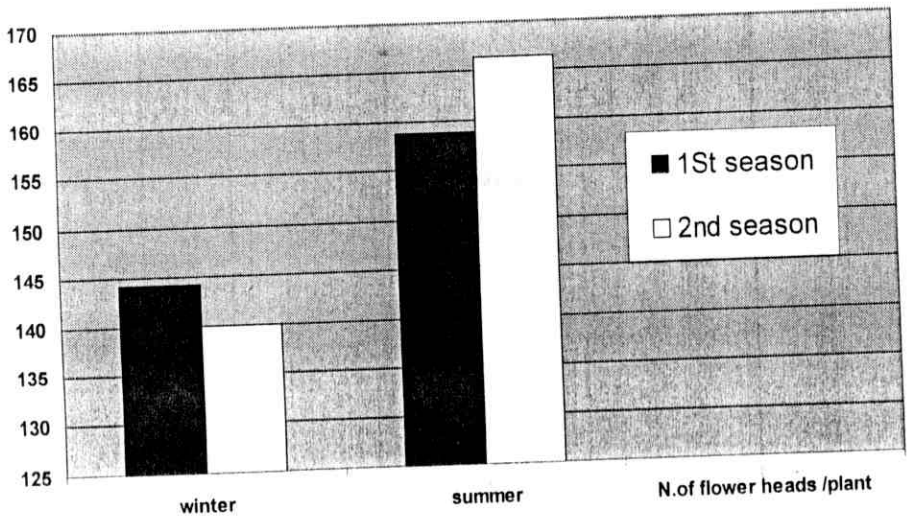


Fig (4-a): Effect of fertilization treatments on number of flower heads /plant of *Tanacetum vulgare* plants during 2002/2003– 2003/2004 seasons.

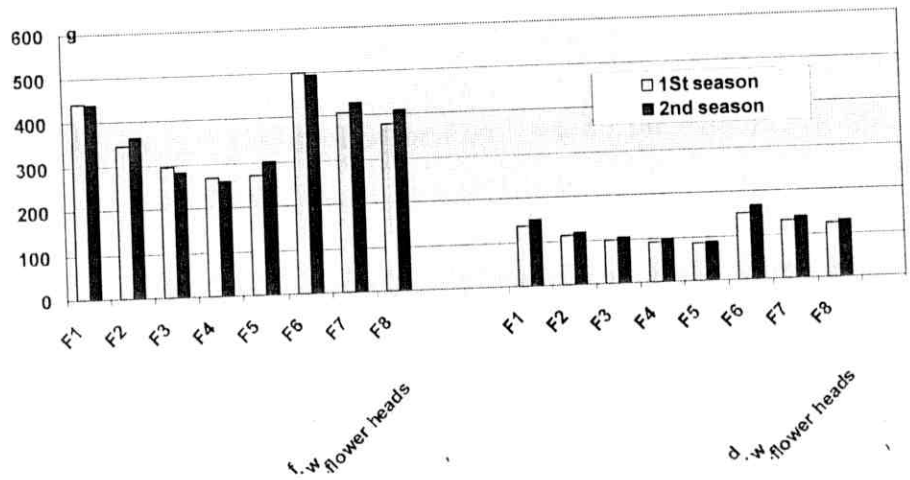


Fig (4-b): Effect of sowing dates on number of flower heads / plant of *Tanacetum vulgare* plants during 2002/2003– 2003/2004 seasons.

As for interaction effect between fertilizers and cuts (regardless sowing date) The results recorded in the two seasons Table (5) show that fertilization with F6 had a generally the most favorable effect on the number of flower heads/plant especially in the second cut, the values were (206.40, 212.65) and in the 1st cut the values were (203.75 and 201.90) in the first and second seasons, respectively.

Among the tested fertilizers from F1 (450 kg ammonium sulphate/fed.) was the second effective form of fertilizer in both cuts and both seasons, These results can be easily explained since, the nitrogen supplied by fertilization is essential in the structure of porphyries and consequently, leads to an increase in the content of chlorophyll. Also, the porphyries molecules are found in the cytochrome enzymes essential in photosynthesis. This increase in the contents of chlorophylls and cytochrome enzymes results in an increase in the rate of photosynthesis, and a promotion in carbohydrate synthesis and accumulation.

On the other hand F5 was the least effective fertilizer in this respect i.e. it caused the lowest increase in the number of flower heads/ plant in both cuts and both seasons.

Concerning the interaction effect between fertilizers, sowing date and cuts, data in Table (5) revealed that the highest number of flower heads/ plant was gained in the first cut when the plants of *Tanacetum vulgare*. were sown in summer and received F6 fertilizer as it gave (221.00 and 227.50 flower heads/ plant) in the first and second seasons, respectively. Followed by F1 (450 kg ammonium sulphate/fed.) for summer sown plants in the first cut which gave (212.00 and 218.30 flower heads/ plant) in both seasons, respectively.

In addition plants sown in summer and treated with F7 fertilizer ranked the third in this concern. On the other hand, winter sown plants and treated with F5 was the least effective treatment in this respect for the first cut in the first season. While, winter sown plants treated with F4 gave the least value for the first cut in the second season. Similar trend of results was obtained for fertilizers treatments in the second cut except for sowing date. In both seasons of the second cut the plants of *Tanacetum vulgare* were sown in the summer and winter then fertilized with F6 and F1 (450 kg ammonium sulphate/fed) produced the greatest number of flower heads/ plant. So, sowing date loss their relative effectiveness in the second cut. On the other hand, the opposite was observed i.e. plants sown in summer and received F5 fertilizer recorded the least values in number of flower heads/ plant in both seasons of the second cut.

Concerning, the interaction effect between fertilizers, sowing dates and cuts. Data in Table (5) revealed that the highest number of flower heads/plant was obtained in the first cut when the plants of *Tanacetum vulgare* were sown in the summer and fertilized with F6 and F_1 as they gave (221.00and 212.00) in the first season and gave (227.50 and 216.30) in the second one, respectively .Also, sown the plants in the summer and treated with F_6 recorded highly significant increments in this parameter in the second cut as it gave (209.00 and 212.80 flower heads/plant), followed by sown the plants in the summer and treated with F_7 as it gave (202.50 and 211.30 flower heads/plant) in the first cut in the first and second seasons, respectively. On the contrary, the lowest number of flower heads/plant was recorded in the first cut when the plants of *Tanacetum vulgare* were sown in the summer and treated with F_5 and F_4 in both seasons.

These results are in agreement with those obtained by **Ibrahem (2000)** on *Ammi visnaga* L. and *Foeniculum vulgare* Mill. who recorded that, in the presence of full dose of NPK (300 kg ammonium sulfate + 300 kg calcium super phosphate + 80 kg potassium sulfate/fed.) gave the highest number of umbels per hill, and **Shalan *et al.* (2001)** on roselle plant found that, Nitrogen as a biosource of nitrogen recorded significant higher number of fruits and yield of sepals (fresh and air-dried).

IV -2-2- <u>Fresh weight of flower heads /plant (g)</u>:-

According to data presented in Table (6) and Fig (5-a) it could be concluded that fertilized *Tanacetum vulgare* plants with F_6 (Biofertilizer + ammonium sulphate 300 kg /fed + 2ton compost/fed) (regardless cuts and sowing date) approved to be the most effective treatment for increasing the fresh weight of flower heads/ plant (g) as it recorded (497.530 and 494.400 g) followed descendingly by using F1 (450 kg ammonium sulphate/fed.) which gave (440.73 and 439.73 g) in the first and second seasons, respectively. Moreover, treated *Tanacetum vulgare*. plants with F_7 and F_8 resulted in highly significant increases in this parameter as they gave (404.98 and 377.75 g) in the first season, and (426.60 and 407.85g) in the second one when compared with F_4 (Biofertilizer + ammonium sulphate 300 kg /fed +10 m^3 poultry manure).

As well as F_3 (Biofertilizer + 10 m^3 PM/fed.) treatments which gave the least values in this concern as they gave (267.83and 260.03 g) for F_4 and (296.90 and 282.53 g) for F_3 in the first and second seasons, respectively. the other treatments took intermediate place compared with the aforesaid treatments in both seasons of this work.

Table (6): Effect of fertilization treatments and sowing date on fresh weight of flower heads/ plant (g) of *Tanacetum vulgare* plants during 2002/2003–2003/2004 seasons.

Treatments		1st cut				2nd cut				Mean	
				Mean				Mean			
		1st season	2nd season	1st season	2nd season	1st season	2nd season	1st season	2nd season	1st season	2nd season
F1	Winter	361.30	278.80	418.15	397.55	408.80	428.80	463.30	481.90	440.72	439.72
	Summer	475.00	516.30			517.80	535.00				
F2	Winter	292.50	271.30	355.00	361.90	308.80	336.30	336.30	364.40	345.65	363.15
	Summer	417.50	452.50			363.80	392.50				
F3	Winter	313.80	226.30	370.05	319.40	185.00	211.30	223.75	245.65	296.90	282.53
	Summer	426.30	412.50			262.50	280.00				
F4	Winter	250.00	207.50	327.50	306.90	181.30	198.80	208.15	213.15	267.82	260.02
	Summer	405.00	406.30			235.00	227.50				
F5	Winter	227.50	195.00	338.75	403.75	165.00	181.30	200.75	198.15	270.00	300.95
	Summer	450.00	612.50			236.50	215.00				
F6	Winter	405.00	393.80	490.65	456.90	423.80	462.50	504.40	531.90	497.53	494.40
	Summer	576.30	520.00			585.00	601.30				
F7	Winter	356.30	336.30	383.80	407.55	362.50	385.00	428.15	445.65	405.97	426.60
	Summer	411.30	478.80			493.80	506.30				
F8	Winter	305.00	278.80	363.00	397.55	317.50	348.80	392.50	418.15	377.75	407.85
	Summer	421.00	516.30			467.50	487.50				
Mean		380.86	381.44	380.86	381.44	344.73	362.37	344.73	362.37	362.79	371.90

1st L.S.D.1 at 5% for F =10.30 for cuts =5.15 F. cuts =14.57 F.S. cuts =20.60
2nd LSD2 at 5% for F =6.99 for cuts =3.75 F. cuts = 9.88 F.S. cuts =13.98

F1 Ammonium sulphate 450 kg /fed.
F2 Biofertilizer + Ammonium sulphate 300 kg /fed
F3 Biofertilizer+10 m^3 poultry manure/fed (Bio+10 m^3 PM/fed.)
F4 Biofertilizer + Ammonium sulphate 300 kg /fed +10 m^3 poultry manure.
F5 Biofertilizer+2ton compost/fed
F6 Biofertilizer + Ammonium sulphate 300 kg /fed + 2ton compost/fed
F7 Biofertilizer + 10 m^3Biogas manure/fed.
F8 Biofertilizer + Ammonium sulphate 300 kg /fed +10 m^3Biogas manure/fed.

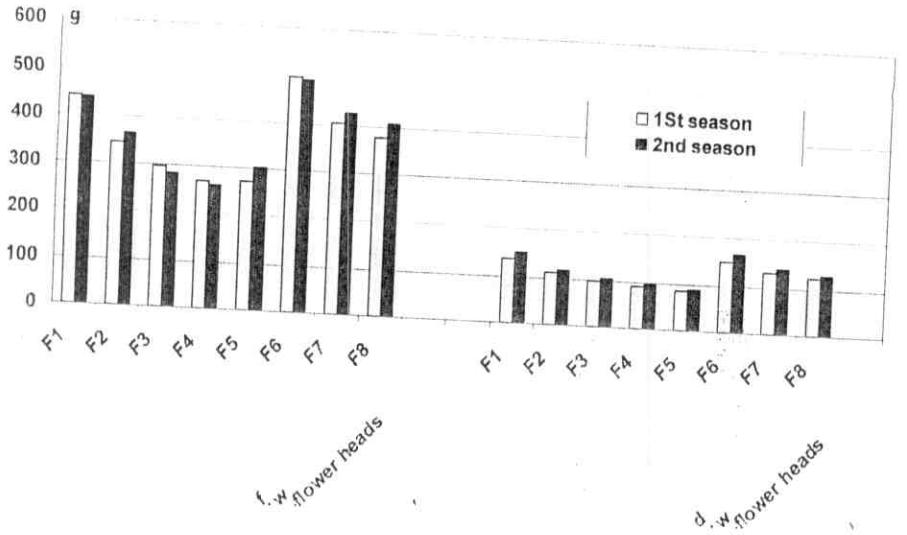


Fig (5-a): Effect of fertilization treatments on fresh and dry weights of flower heads/plant (g) of *Tanacetum vulgare* plants during 2002/2003 and 2003/2004 seasons.

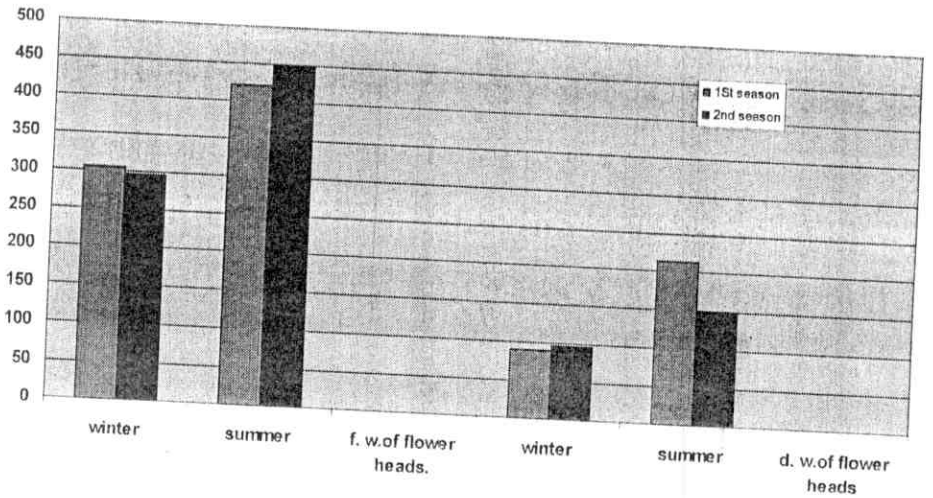


Fig (5-b): Effect of sowing dates on fresh and dry weights of flower heads/plant (g) of *Tanacetum vulgare* plants during 2002/2003 – 2003/2004 seasons.

Concerning the specific effect of sowing date, it is clear from the present data show in Table (19) and Fig (5-b) that the best effect in this respect was obtained by summer planting of *Tanacetum vulgare* plants which recorded (421.52 and 447.52 g) for the mean fresh weight /plant in the two seasons, respectively. compared with winter planting as it gave (304.01 and 296.29 g) in the two seasons, respectively. It might be attributed this increases in the fresh weight of flower heads/plant to the warm weather of summer which faster the process of mineralization of organic nitrogen and phosphate. (Tables G, H and I)

With respect to the interaction effect between fertilizers and cuts (regardless sowing date), it is quite clear to be noticed that using the treatment of F_6 produced the heaviest fresh weight of flower heads/plant (g) in the second cut as it gave (504.40 and 531.90 g), followed descendingly by fertilized the plant with F_6 which gave in the first cut (490.65 and 456.90 g) in the first and second seasons, respectively. Besides, treated *Tanacetum vulgare*. plants with F_1 (450 kg ammonium sulphate/fed.) and F_7 (Biofertilizer +10 m^3 biogas/fed.) resulted in highly significant increment in this parameter in the second cut as they gave (463.30and 428.15 g) in the first season, and (481.90 and 445.65 g) in the second season, respectively. On the reverse, the lowest fresh weight of flower heads /plant (g) was obtained by using F_5 (Biofertilizer +2ton compost/fed.) and F_4 in the first and second cuts in both seasons of this investigation.

Referring to the interaction effect between fertilizers, sowing date and cuts, data presented in Table (6) pointed out that sown *Tanacetum vulgare*. plants in the summer and fertilized with F_6

showed to be the most effective treatment for producing the greatest fresh weight of flower heads /plant (g) in the second cut as it gave (585.00 and 601.30 g) followed descendingly by using the same treatment in the first cut which gave (576.30 and 520.00 g) in the first and second seasons, respectively. Moreover, plants sown in the summer and treated with F_1 and F_7 resulted in highly increases in this parameter in the second cut as they gave (517.80 and 493.80) in the first season, and (535.00 and 506.30 g) in the second one, respectively. On the reverse, the least fresh weight of flower heads /plant (g) was recorded by sown *Tanacetum vulgare* plants in the winter and fertilized with F_5 as it gave in the second cut (165.00 and 181.30 g) followed descendingly by sown the plants in the winter and received F_4 as it gave (181.30 and 198.80 g) in the second cut in the first and second seasons, respectively.

1V -2-3 Dry weight of flower heads /plant:-

Data of the dry weight of flower heads /plant (g) of *Tanacetum vulgare*. are presented in Table (7) and Fig (5-a). It was obvious that fertilized *Tanacetum vulgare* plants with F_6 (Biofertilizer + ammonium sulphate 300 kg /fed + 2ton compost/ fed) showed its superiority for increasing the dry weight of flower heads as it gave (150.65 and 165.97 g) followed by using F1 (450 kg ammonium sulphate/fed.) which recorded (137.10 and 150.15 g) in the first and second seasons, respectively. Additionally, irrespective the abovementioned treatments, using the treatments of F_7 (Biofertilizer + 10 m^3 biogas/fed.) succeeded in increasing the dry weight of flower heads /plant when compared with the other treatments as it gave (132.80 and 140.48 g) in the first and second

Table (7): Effect of fertilization treatments and sowing date on dry weight of flower heads / plant (g) of *Tanacetum vulgare* plants during 2002/2003–2003/2004 seasons.

Treatments		1st cut				2nd cut				Mean	
				Mean				Mean			
		1st season	2nd season	1st season	2nd season	1st season	2nd season	1st season	2nd season	1st season	2nd season
F1	Winter	95.08	94.31	122.64	130.20	134.30	161.40	151.55	170.10	137.10	150.15
	Summer	150.20	166.10			168.80	178.80				
F2	Winter	80.96	74.77	112.38	113.78	100.80	113.10	111.15	120.15	111.77	116.97
	Summer	143.80	152.80			121.50	127.20				
F3	Winter	82.320	73.01	110.51	108.40	67.61	90.61	84.50	98.95	97.51	103.68
	Summer	138.70	143.80			101.40	107.30				
F4	Winter	67.72	63.63	101.36	99.96	63.27	86.77	79.22	93.63	90.29	96.80
	Summer	135.00	136.30			95.18	100.50				
F5	Winter	64.42	53.51	90.86	89.65	59.18	74.45	76.97	85.10	83.915	87.38
	Summer	117.30	125.80			94.76	95.76				
F6	Winter	103.20	95.68	140.15	149.09	139.20	167.40	161.15	182.85	150.65	165.97
	Summer	177.10	202.50			183.10	198.30				
F7	Winter	96.18	89.90	129.84	131.95	109.20	121.30	135.75	149.00	132.79	140.47
	Summer	163.50	174.00			162.30	176.70				
F8	Winter	81.17	74.21	113.08	115.00	104.80	114.80	131.40	141.80	122.24	128.40
	Summer	145.00	155.80			158.00	168.80				
Mean		115.10	117.25	115.10	117.25	116.46	130.19	116.46	130.19	115.78	123.72

1st L.S.D.1 at 5% for F =5.52 for cuts =5.52 F.cuts=3.56 F.S. cuts =5.04
2nd LSD2 at 5% for F =2.97 for cuts =2.97 F.cuts = 4.20 F.S. cuts =5.95

F1 Ammonium sulphate 450 kg /fed.
F2 Biofertilizer + Ammonium sulphate 300 kg /fed
F3 Biofertilizer+10 m^3 poultry manure/fed (Bio+10 m^3 PM/fed.)
F4 Biofertilizer + Ammonium sulphate 300 kg /fed +10 m^3 poultry manure.
F5 Biofertilizer+2ton compost/fed
F6 Biofertilizer + Ammonium sulphate 300 kg /fed + 2ton compost/fed
F7 Biofertilizer + 10 m^3Biogas manure/fed.
F8 Biofertilizer + Ammonium sulphate 300 kg /fed +10 m^3Biogas manure/fed.

seasons, respectively. On the opposite, the least dry weight of flower heads /plant was obtained by treated the plants with F_5 (Biofertilizer +2 ton compost/fed.) which produced the lowest values as the percentage of decrease were (38.79 and 40.80%) lower than F1 (450 kg ammonium sulphate/fed.) followed ascendingly by using F_4 (Biofertilizer + ammonium sulphate 300 kg /fed +10 m^3 poultry manure) which recorded the percentages of decreases (34.14 and 35.53%) in the first and second seasons, respectively. However, the rest treatments occupied intermediate place between the aforesaid treatments.

As for the effect of sowing date on dry weight of flower heads /plant of *Tanacetum vulgare* plants. The results recorded in Table (19) and Fig (5-b) show that summer planting had generally favorable effect on dry weight of flower heads/plant than winter planting the percentages of increases in the dry weight of flower heads / plant of summer sown plants were (136.38% and 55.63 %) over winter planting in the first and second seasons, respectively.

Referring to the interaction effect between fertilizers and cuts (regardless sowing date) data presented in Table (7) cleared that the heaviest dry weight of flower heads/plant (g) was produced in the second cut, when the plants of *Tanacetum vulgare* treated with F_6 (Biofertilizer + ammonium sulphate 300 kg /fed + 2ton compost/fed) which gave (161.15 and 182.85 g) followed descendingly by using F_1 (450 kg ammonium sulphate/fed.) which registered (151.55 and 170.10 g) in the first and second seasons, respectively. Furthermore, fertilized *Tanacetum vulgare* plants with F_6 for the first cut resulted in highly significant increases in this parameter as it gave (140.15 and 149.09 g) in the first and second

seasons, respectively. On the other hand the lowest dry weight /plant was obtained in the second cut when the plants of Tansy treated with F_5 and F_4 as they gave (76.97 and 79.23 g) in the first season and (85.11 and 93.64 g) in the second one, respectively.

As for the interaction effect between fertilizers, sowing date and cuts, data in Table (7) declared that the highest dry weight of flower heads /plant of *Tanacetum vulgare* was obtained in the first cut when the plants sown in the summer and fertilized with F_6 (Biofertilizer + ammonium sulphate 300 kg /fed +2ton compost/ fed) as it produced (202.50) in the second season followed descendingly by using the same treatment in the second cut in the summer as it gave (198.30) in the second season, this trend was true only in the second season, while, in the first one the aforesaid treatments exchanged their position. Also sown Tansy plants in the summer and treated with F1 (450 kg ammonium sulphate/fed). induced highly significant increments in this parameter in the second cut when compared with the rest treatments as it gave (168.80 and 178.80 g) in the first and second seasons, respectively. On the opposite, the least mean values of this parameter was obtained by sown *Tanacetum vulgare* plants in the winter and received F_5 (Biofertilizer +2ton compost/fed.) in both cuts, followed descendingly by sown the plants in the winter and fertilized with F_4 in both cuts in the first and second seasons, respectively.

These results are in line with those of the aforementioned parameters of plant height and number of branches per plant which may reflect on heavier herb fresh weight. These results were in parallel line with those achieved by **Gupta *et al.* (1999)** on *Tagetes*

erecta seedlings stated that, in general growth and flower yields were highest after treatments with Azotobacter + phosphorus solubilizing bacteria (applied to soil or seedlings) in combination with 75 or 100% nitrogen application. Biofertilizers were useful for recycling elements, reserving natural resources and for protection from increasing pollution due to extensive use of mineral fertilizers. **Badawi (2000)** on roselle plants found that, the highest values of growth parameters (dry weights of plant organs per plant and per feddan) were recorded from the treatment of N300+P200+K100 kg/ fed. + biofertilizer/fed. and **Abd El-Latif *et al.* (2002)** on chamomile plants found that, bio-nitrogen fertilizer produced enhancement in growth characters and yield particularly at the highest rate (4 kg/fed. biogen). The best results were recorded with combination between ammonium sulphate at 200 kg /fed. and biogen at 2 & 4 kg/fed.

IV-3- On chemical composition:

IV-3-1 - Essential Oil percentage in fresh leaves:

Data presented in Table (8) and Fig (6-a) discussed the effect of fertilization treatments and sowing date on oil percentage and the interaction between them it was obvious that, fertilized *Tanacetum vulgare* plants with F1 (450 kg ammonium sulphate/fed). showed its superiority for increasing the oil percentages in fresh leaves as it gave (0.57% and 0.62%) followed descendingly by using F_6 (Biofertilizer + ammonium sulphate 300 kg /fed + toncompost/fed) which recorded (0.51 and 0.48%) in the first and second seasons, respectively.

Table (8): Effect of fertilization treatments and sowing date on essential oil percentages (%) in fresh leaves of *Tanacetum vulgare* plants during 2002/2003–2003/2004 seasons.

Treatments		1st cut				2nd cut				Mean	
				Mean				Mean			
		1st season	2nd season	1st season	2nd season	1st season	2nd season	1st season	2nd season	1st season	2nd season
F1	Winter	0.45	0.43	0.73	0.48	0.33	0.52	0.41	0.76	0.57	0.62
	Summer	1.02	0.53			0.49	1.00				
F2	Winter	0.36	0.32	0.38	0.38	0.26	0.44	0.32	0.33	0.35	0.35
	Summer	0.41	0.45			0.39	0.22				
F3	Winter	0.38	0.35	0.40	0.39	0.25	0.42	0.32	0.32	0.36	0.35
	Summer	0.43	0.43			0.39	0.22				
F4	Winter	0.35	0.31	0.37	0.35	0.22	0.43	0.28	0.31	0.32	0.33
	Summer	0.39	0.40			0.35	0.19				
F5	Winter	0.32	0.30	0.34	0.34	0.18	0.38	0.26	0.29	0.30	0.31
	Summer	0.37	0.38			0.34	0.20				
F6	Winter	0.44	0.41	0.52	0.48	0.44	0.55	0.49	0.48	0.51	0.48
	Summer	0.61	0.55			0.55	0.41				
F7	Winter	0.41	0.42	0.46	0.47	0.37	0.51	0.41	0.41	0.43	0.44
	Summer	0.51	0.52			0.45	0.31				
F8	Winter	0.42	0.40	0.45	0.43	0.37	0.51	0.41	0.44	0.43	0.43
	Summer	0.49	0.47			0.45	0.37				
Mean		0.46	0.42	0.46	0.42	0.36	0.41	0.36	0.41	0.41	0.42
1st L.S.D.1 at 5% for F =0.031 for cuts =0.015 F. cuts =0.044 F.S. cuts =0.062 2nd LSD2 at 5% for F =0.025 for cuts =0.012 F. cuts = 0.035 F.S. cuts =0.050											

F1 Ammonium sulphate 450 kg /fed.
F2 Biofertilizer + Ammonium sulphate 300 kg /fed
F3 Biofertilizer+10 m^3 poultry manure/fed (Bio+10 m^3 PM/fed.)
F4 Biofertilizer + Ammonium sulphate 300 kg /fed +10 m^3 poultry manure.
F5 Biofertilizer+2ton compost/fed
F6 Biofertilizer + Ammonium sulphate 300 kg /fed + 2ton compost/fed
F7 Biofertilizer + 10 m^3Biogas manure/fed.
F8 Biofertilizer + Ammonium sulphate 300 kg /fed +10 m^3Biogas manure/fed.

Additionally, treated the plants with F_7 or F_8 succeeded in

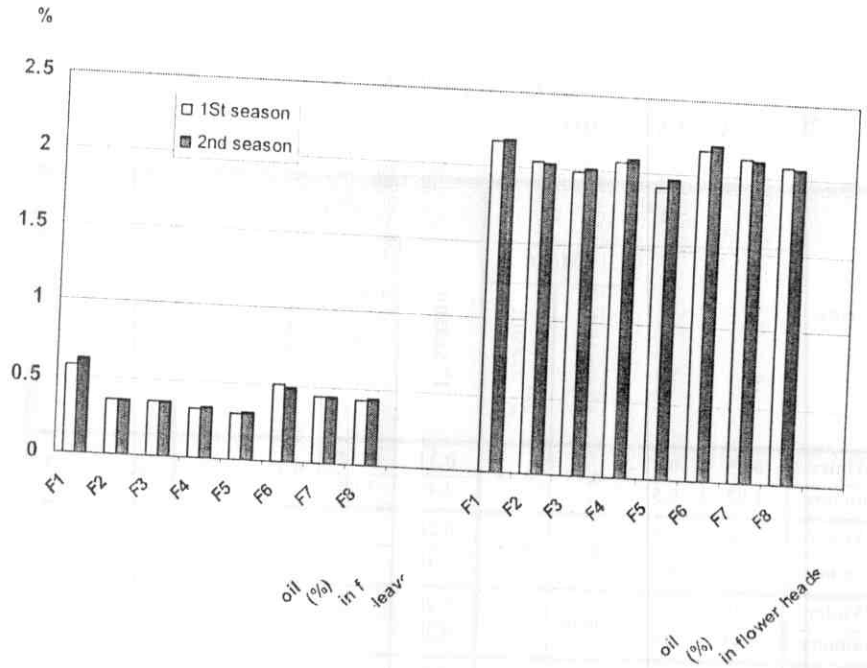


Fig (6-a): Effect of fertilization treatments on essential oil (%) in fresh leaves and flower heads of *Tanacetum vulgare* plants during 2002/2003–2003/2004 seasons.

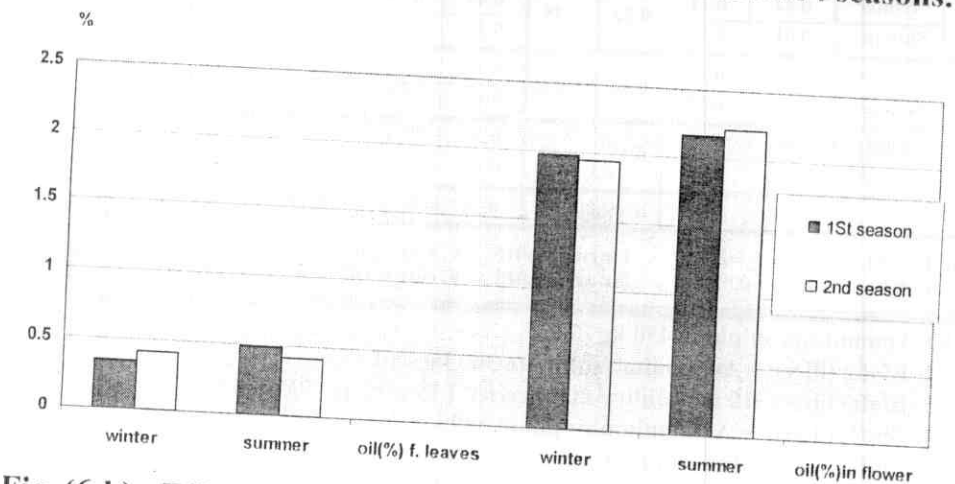


Fig (6-b): Effect of sowing dates on essential oil (%) in fresh leaves and flower heads of *T. vulgare* plants during 2002/2003–2003/2004 seasons.

ammonium sulphate/fed.) showed its superiority for increasing the

Additionally, treated the plants with F_7 or F_8 succeeded in increasing the oil percentage in fresh leaves when compared with the other treatments as they gave (0.44 and 0.43) in the first season and (0.44and 0.44) in the second one, respectively. On the opposite, the least oil percentage in fresh leaves of Tansy plants was obtained by treated the plants with F_5 (Biofertilizer+2ton compost/fed) which produced the lowest values as the percentages of decreases were (47.12% and 49.19%) lower than F1 (450 kg ammonium sulphate/fed.) followed descendingly by using F_4 (Biofertilizer + ammonium sulphate 300 kg /fed +10 m^3 poultry manure). which recorded the percentages of decreases (42.78%) and (46.29%) in the first and second seasons, respectively. However the rest treatments occupied intermediate place between the aforesaid treatments.

Concerning the specific effect of sowing date, it is clear from the present data showed in Table (19) and Fig (6-b) that the best effect in this respect was obtained by summer planting of *Tanacetum vulgare* plants which recorded (0.49 and 0.42%) for the means of oil percentages in fresh leaves in the two seasons, respectively. compared with winter planting as it gave (0.35 and 0.24) in the two seasons, respectively. Similar results were obtained on oil percentage in fresh leaves in the two seasons in both cuts.

Referring to the interaction effect between fertilizers and cuts (regardless sowing date) data presented in Table (8) cleared that the highest value of oil percentage of fresh leaves was produced in the second cut of the second season when the plants of *Tanacetum vulgare* treated with F_1 (450 kg ammonium sulphate / fed) which gave (0.76) while in the first one using F_1 (450 kg

ammonium sulphate/fed.) showed its superiority for increasing the essential oil percentage, in the fresh weight of *Tanacetum vulgare* leaves as it gave (0.74%) followed by using F_6 in both cuts which gave (0.53% and 0.50%) in the first season , followed descendingly by using F_6 which recorded the same value in the first and second cut (0.48%). This trend was true only in the second season. On the contrary, the lowest mean value of this parameter was registered in the second cut by using F5 which gave (0.26 and 0.29%) in the first and second seasons, respectively. Additionally, irrespective the abovementioned treatments, using the treatments of F_7 and F_8 for the first cut succeeded in increasing the oil percentage in the fresh leaves of Tansy plants when compared with the other treatments as they gave (0.46 and 0.46%) in the first season and (0.47 and 0.44%) in the second one, respectively. On the other hand, the least oil percentage of fresh leaves was obtained in the second cut when the plants of *Tanacetum vulgare* treated with F_5 (Biofertilizer+2ton compost/fed.) and F_4 (Biofertilizer + ammonium sulphate 300 kg /fed +10 m^3 poultry manure) as they gave (0.26 and 0.28%) in the first season and (0.29 and 0.31%) in the second one, respectively.

As for the interaction effect between fertilizers, cuts and sowing date, data in Table (8) declared that the highest oil percentage in the fresh leaves of *Tanacetum vulgare* was obtained in the first cut when the plants sown in the summer and fertilized with F_1 (450 kg ammonium sulphate/fed.) as it produced (1.02%). This trend was true only in the first season, while in the second cut, the richest leaves oil percentages of *Tanacetum vulgare* was recorded in the plants which sown in the summer and treated with F_1 (450 kg ammonium sulphate/fed) which gave (1.00%) in the

second season, followed descendingly by summer grown plants treated with F_6 in the first cut which gave (0.61% and 0.55%) in the first and second seasons, respectively. Also summer grown plants treated with F_7 succeeded in increasing the essential oil percentage in the leaves of *Tanacetum vulgare* in the first cut as it gave (0.51 and 0.52%) in the first and second seasons, respectively. On contrary, the least mean value of this parameter was obtained in the second cut by sown *Tanacetum vulgare* plants in the winter and received F_5 as it gave (0.18%) in the first season while in the second one winter grown plant treated with F_4 produced the lowest mean value of this parameter in the second cut as it gave (0.19%). However the rest treatments occupied intermediate place between the aforesaid treatments.

IV-3-2- Essential oil percentage % in flower heads:-

Data in Table (9) and Fig (6-a) indicated that fertilized *Tanacetum vulgar* plants with F6 (Biofertilizer + ammonium sulphate 300 kg /fed + 2ton compost/fed) showed its superiority for increasing the oil percentage in flower heads as it gave (2.178 and 2.21 %) in the first and second seasons, respectively followed descendingly by using F_1 (450 kg ammonium sulphate/fed) which recorded (2.17and 2.19%) in the first and second seasons, respectively. Additionally, irrespective the abovementioned treatments, using the treatments of F_7 (Biofertilizer + 10 m^3Biogas manure/fed) and F_8 (Biofertilizer + ammonium sulphate 300 kg /fed +10 m^3 Biogas manure/fed) succeeded in increasing the oil percentage in flower heads when compared with the other treatments as they gave (2.13 and 2.09 %) in the first season and

Table (9): Effect of fertilization treatments and sowing date on essential oil percentages (%) in flower heads of *Tanacetum vulgare* plants during 2002/2003–2003/2004 seasons.

Treatments		1st cut				2nd cut				Mean	
				Mean				Mean			
		1st season	2nd season	1st season	2nd season	1st season	2nd season	1st season	2nd season	1st season	2nd season
F1	Winter	2.16	2.12	2.22	2.18	2.03	1.97	2.11	2.18	2.16	2.18
	Summer	2.28	2.25			2.20	2.40				
F2	Winter	1.96	1.92	2.08	2.07	1.90	1.84	2.01	1.99	2.04	2.03
	Summer	2.20	2.22			2.13	2.15				
F3	Winter	1.91	1.93	2.04	2.05	1.82	1.81	1.95	1.98	1.99	2.01
	Summer	2.17	2.18			2.08	2.15				
F4	Winter	2.07	2.00	2.14	2.11	1.79	1.83	2.00	2.07	2.07	2.09
	Summer	2.22	2.22			2.22	2.31				
F5	Winter	1.90	1.96	2.02	2.07	1.71	1.70	1.81	1.87	1.91	1.97
	Summer	2.14	2.18			1.91	2.04				
F6	Winter	2.24	2.36	2.24	2.32	1.94	1.90	2.11	2.10	2.17	2.21
	Summer	2.25	2.28			2.28	2.30				
F7	Winter	2.12	2.08	2.17	2.15	2.02	1.95	2.09	2.07	2.13	2.11
	Summer	2.22	2.23			2.16	2.20				
F8	Winter	2.11	1.99	2.14	2.10	1.91	1.90	2.02	2.04	2.08	2.07
	Summer	2.18	2.21			2.14	2.19				
Mean		2.13	2.13	2.13	2.13	2.01	2.04	2.01	2.04	2.07	2.08

1st L.S.D.1 at 5% for F =0.022 for cuts =0.011 F.cuts=0.031 F.s,cuts.=0.044
2nd LSD2 at 5% for F =0.044 for cuts =0.022 F.cuts = 0.062 F.s,cuts =0.088

F1 Ammonium sulphate 450 kg /fed.
F2 Biofertilizer + Ammonium sulphate 300 kg /fed
F3 Biofertilizer+10 m^3 poultry manure/fed (Bio+10 m^3 PM/fed.)
F4 Biofertilizer + Ammonium sulphate 300 kg /fed +10 m^3 poultry manure.
F5 Biofertilizer+2ton compost/fed
F6 Biofertilizer + Ammonium sulphate 300 kg /fed + 2ton compost/fed
F7 Biofertilizer + 10 m^3Biogas manure/fed.
F8 Biofertilizer + Ammonium sulphate 300 kg /fed +10 m^3Biogas manure/fed.

(2.12and 2.07%) in the second one respectively. followed descendingly by F_4 (Biofertilizer + ammonium sulphate 300kg/fed +10 m^3 poultry manure) which gave (2.075 and 2.090%) in the first and second seasons, respectively. On the other hand, the least oil percentage in the flower heads was obtained by treated the plants with F_5 (Biofertilizer +2 ton compost/fed.) which produced the lowest values as the percentages of decreases were (11.67 and 9.84%) lower than F1 (450 kg ammonium sulphate/fed) followed descendingly by using F_3 (Biofertilizer+10 m^3 poultry manure/fed) which recorded the percentages of decreases (7.98 and 7.64%) in the first and second seasons, respectively. However the rest treatments occupied intermediate place between the aforesaid treatments.

With regard to the specific effect of sowing date on essential oil percentage % in flower heads of Tansy plants. The results recorded in Table (19) and Fig (6-b) show that summer planting had generally favourable effect on Essential oil percentage % in flower heads than winter planting the percentages of increases in the oil percentage of flower heads / plant of summer sown plants were (9.60% and 13.85 %) over winter planting in the first and second seasons, respectively.

Concerning the interaction effect between fertilizers and cuts (regardless sowing date) it is clear to be noticed that using the treatment of F_6 (Biofertilizer + ammonium sulphate 300 kg /fed + 2ton compost/fed) produced the highest oil percentage of flower heads in the first cut as it gave (2.25 and 2.32%) followed descendingly by fertilized the plant with F1 (450 kg ammonium sulphate/fed). which gave in the first cut (2.22 and 2.19%) in the

first and second seasons, respectively. Besides, treated *Tanacetum vulgare* plants with F_7 and F_8 resulted in highly significant increment in this parameter in the first cut as they gave (2.17 and 2.15%) in the first season and (2.16 and 2.10%) in the second season, respectively. On the reverse, the least oil percentage of flower heads was obtained in the second cut by using F_5 (Biofertilizer + 2ton compost/fed) and F_3 (Biofertilizer+10m3 poultry manure/fed) in both seasons of this investigation as they gave (1.81 and 1.95%) in the first season, (1.87 and 1.98%) in the second one, respectively.

Regarding the interaction effect between fertilizers, sowing date and cuts, data in Table (9) pointed out that summer grown plants treated with F_1 produced the richest essential oil percentage (%) in flower heads as it gave (2.28%) in the first season for the first cut and (2.40%) in the second season for the second cut. Sown *Tanacetum vulgare* plants in the summer and fertilized with F_6 showed to be the most effective treatment for producing the greatest oil percentage of flower heads (%) in the first and second cuts as they gave (2.25 and 2.28%) in the first cut and (2.28 and 2.30%) in the second cut, respectively. followed descendingly by sown the plants in summer and treated with F_4 and F_7 which gave (2.22 and 2.22%) for F_4 and (2.22 and 2.23) for F_7 in the first cut and (2.22 and 2.31%) for F_4 and (2.16 and 2.20%) for F_7 in the second cut for the first and second seasons, respectively. Also sown Tansy plants in the winter and received F_6 succeeded in increasing the oil percentage compared with the other treatments as it gave (2.24 and 2.36%) in the first and second season of the first cut, respectively. On the opposite, the least oil percentage was recorded with sowing tansy plants in the winter and fertilized with F_5 as it

gave in the second cut (1.71 and 1.70%) followed descendingly by sowing the plants in the winter and received F_4 as it gave (1.79 and 1.83%) in the first and second seasons, respectively.

These results were in harmony with those found by **Kandeel (1982)** on *Matricaria chamomilla* who showed that, yearly yield of oil content per plant increased with the increase in the nitrogen dose. But, there was also no significant difference in applying phosphorus on the oil percentages. While raising the potassium level caused evident increasees of oil percentage. Also, **Al-Badawy and Abdalla (1984)** found that, the volatile oil percentage in *Achillea millefolium* plants was increased as a result of nitrogen and phosphorus fertilization. **Afify *et al.* (1993)** on *Salvia officinalis* applied nitrogen fertilization at 0, 50, 100 and 150 kg urea/fed. They noticed that essential oil yield/plant improved as a result of increasing N- fertilization level. The best results were obtained by using the highest N-level (150 kg/fed.).

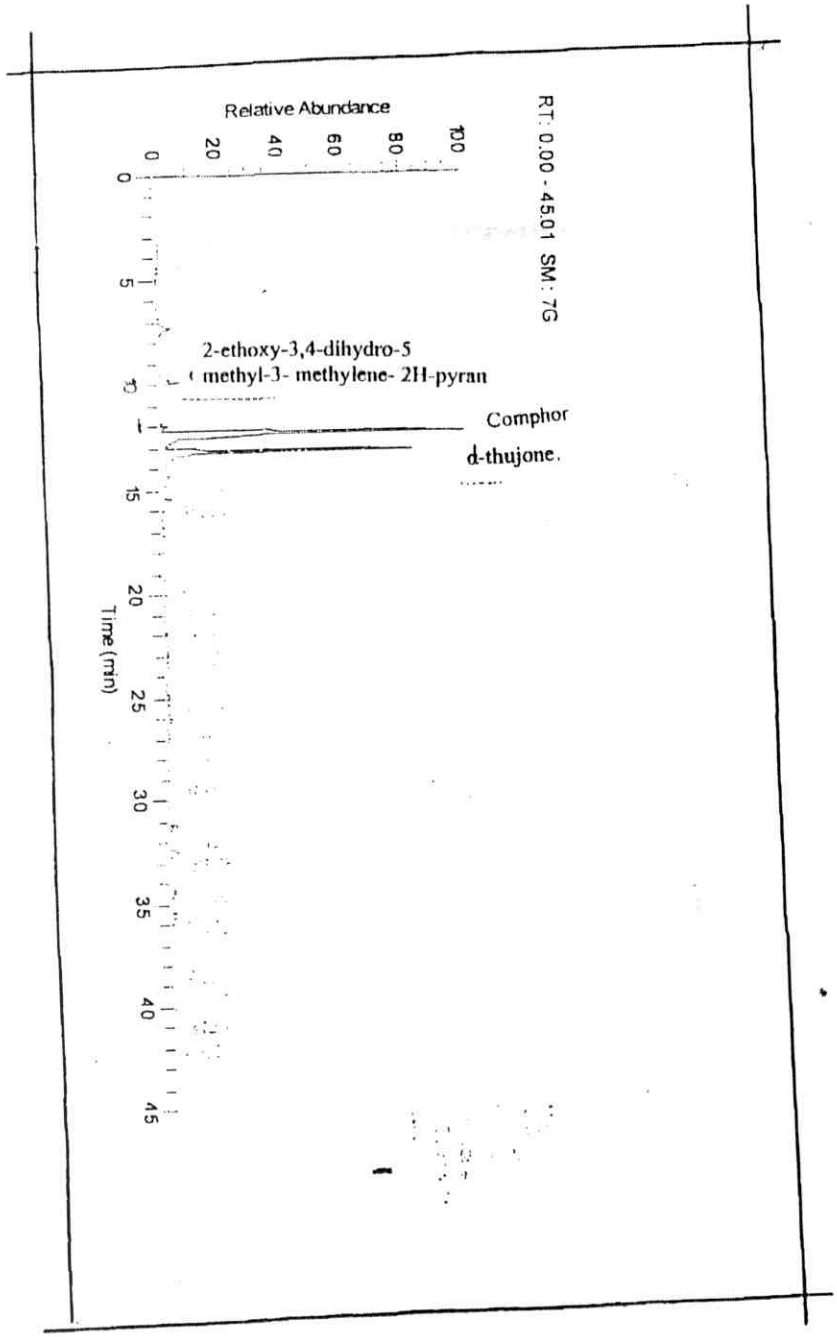
IV-3-3-Main component of the volatile oil:

Analyzing the volatile oil of Tansy plants using G-C Mass spectrometry picnics revealed there were differences in the main components of the oil, according to the treatments used in this investigation, as shown in Table (10) and chromatography (1, 2, 3, 4, 5, 6, 7, 8, 9)

The oil of the flower heads reduction at room temperature may be produced camphene or Borneol. gathered in summer were illustrated in chromatography (1). The main component detected was camphor (47.84%) followed descendingly by 2-ethoxy-3-4-dihydro-5-methyl-3-methylene-2H-pyran (32.38%) then d-thujone (2.98%).

Table (10): Effect of fertilization treatments and sowing date on main component volatile oil of *Tanacetum vulgare* plants during 2002/2003–2003/2004 seasons.

Treatments	Component (1)	%	Component (2)	%	Component (3)	%
Summer gathered flowers heads	Comphor	47.84	2-ethoxy-3,4-dihydro-5-methyl 3-methylene-2H-pyran	32.38	d-Thujone	2.98
Winter flowers heads	Comphor	41.55	-(2-ethoxy-3,4-dihydro-5-methyl 3-methylene-2H-pyran	6.16	camphene	5.38
Summer gathered floherb	Chrysanthenyl Acetate	41.96	Comphor	36.39	d-isoThujone	4.53
Winter gathered herb	Chrysanthenyl Acetate	57.60	Comphor	22.18	(+)-(ir,4.5,ss)-1-isopropyl-endo-4-methylbicytlo [3.1.0]hexan-3-one	10.07
F1-(Ammonium sulphate 450 kg/fed)	Chrysanthenyl Acetate	40.93	Comphor	27.52	d-Thujone	9.43
F3 (Bio+10m PM/fed)	Comphor	13.99	Cis-2-ethyl-3-methyl-6-[(2)-4-methylpent-2-en-2-yl]-5,6-dihydro-2H-pyran	13.50	2-cyclopenten-1-one,2-(2-butenyl)-4-hydroxy-3-methyl-, (z)-(CAS)	6.97
F5 (bio+2ton Compost)	Comphor	25.51	α-Thujone	18.42	d-iso Thujone	12.59
F6(Bio fertilizer + Ammonium sulphate 450 kg/fed + 2ton compost/fed)	Chrysanthenyl Acetate	39.73	Comphor	3026	d-iso thujone	9.90
F 7 (Bio +10m3 BgM/fed)	Chrysanthenyl Acetate	42.18	Comphor	22.64	d-Thujone	5.45



Chromatography (1) - Main component of the volatile oil in the flower heads of *Tanacetum vulgare*. Plants cut in summer of 2003/2004 seasons.

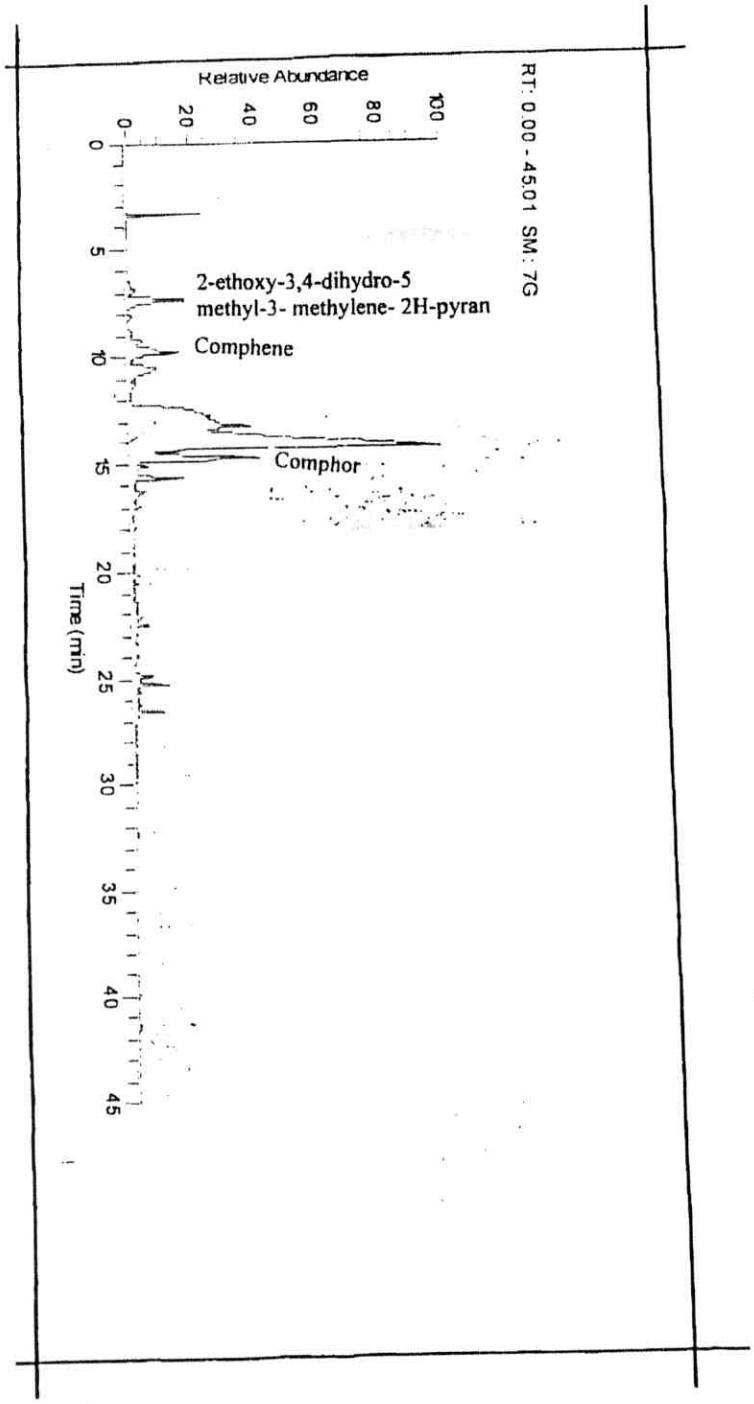
Referring to, the oil of the flower heads cut in winter and were illustrated in chromatography (2). Contained camphor as the main component (41.55%) this percentage was less than that of the flowers in summer followed descendingly by (2-ethoxy-3,4-dihydro-5-methyl 3-methylene-2H-pyran (6.16%) then camphene (5.38%).

Analysis of the essential oil samples taken from flowering herb of *Tanacetum vulgare* gathered in summer are presented in Table (10) and chromatography (3) the data revealed that Tansy oil contain chrysanthenyl acetate as main component giving (41.96%). Also, essential oils have number of components in a small quantity such as camphor giving (36.39%) and d -thujone (giving 4.53%) which considered important constituents.

Regarding the oil of the flowering herbs gathered in winter. the main components were calculated and presented in Table (10) chromatography (4) The percentage was chrysanthenyl acetate (57.60%) followed descendingly by camphor (22.18"%) then [(+)-(ir,4.s,ss)-1-isopropyl-endo-4-methyl bicycle (sub statute of thujone) [3.1.0] hexan-3-one] which gave (10.07%).

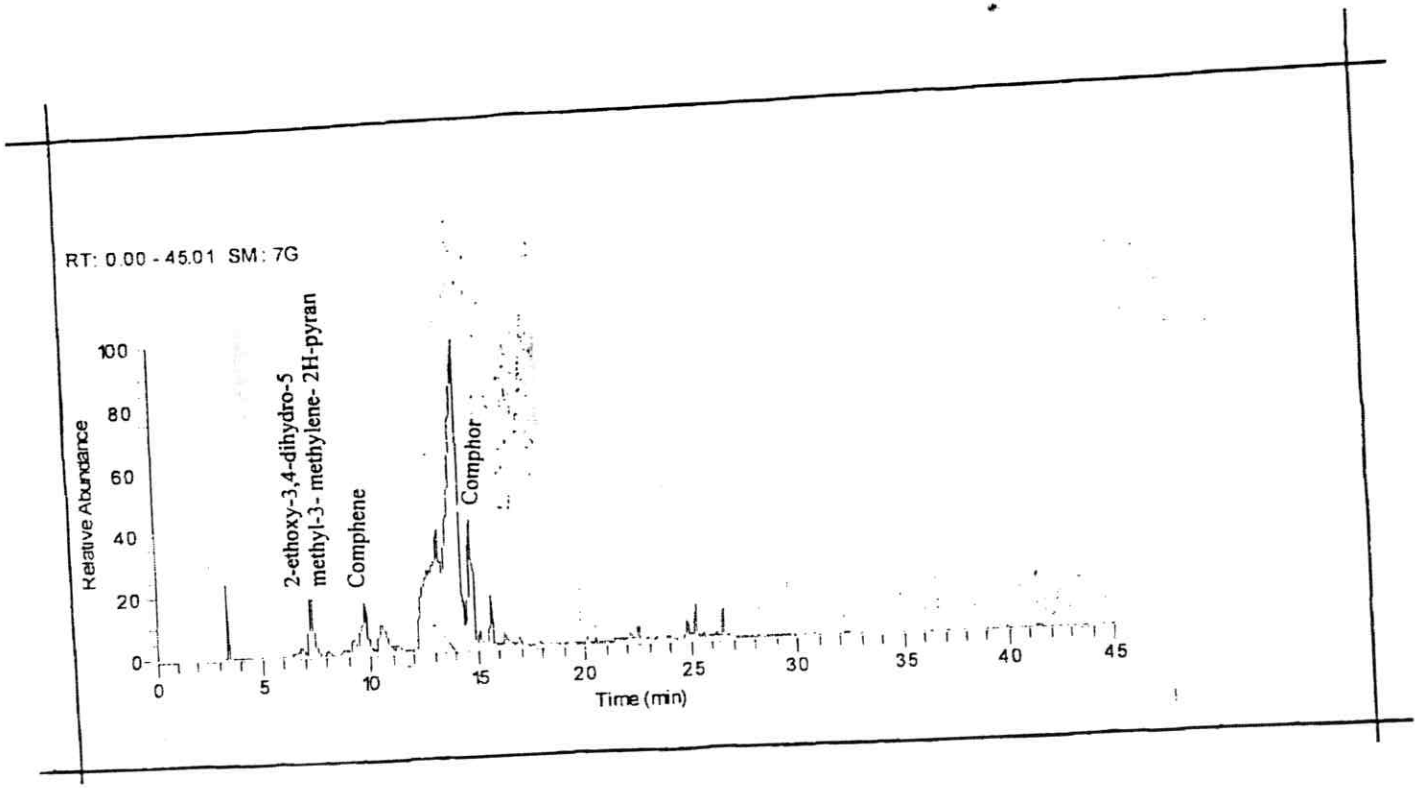
Regarding to the main compounds in the oil of the plants supplied with F_1 (ammonium sulphate 450kg/fed.) and were illustrated in chromatography (5) it was chrysamthenyl acetate (40.93%) followed descendingly by camphor (27.52%) then α-thujone (9.43%).

Concerning the main component in the flowers of the plants received F3 (Biofertilizer+10 m^3 poultry manure/fed) and were illustrated in chromatography (6) it was camphor also, however it

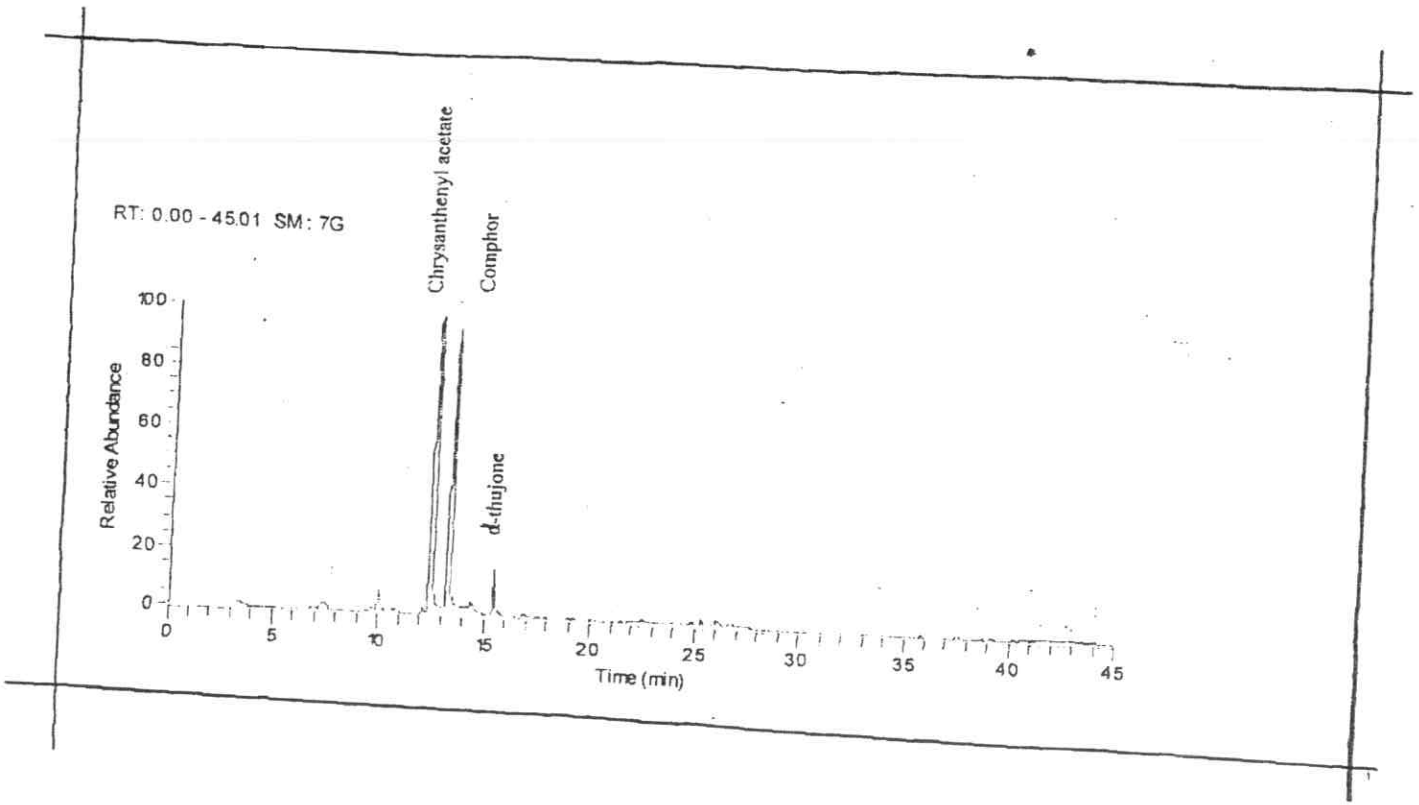


Chromatography (2) - Main component of the volatile oil in the flower heads of *Tanacetum vulgare*. Plants cut in winter of 2003/2004 season.

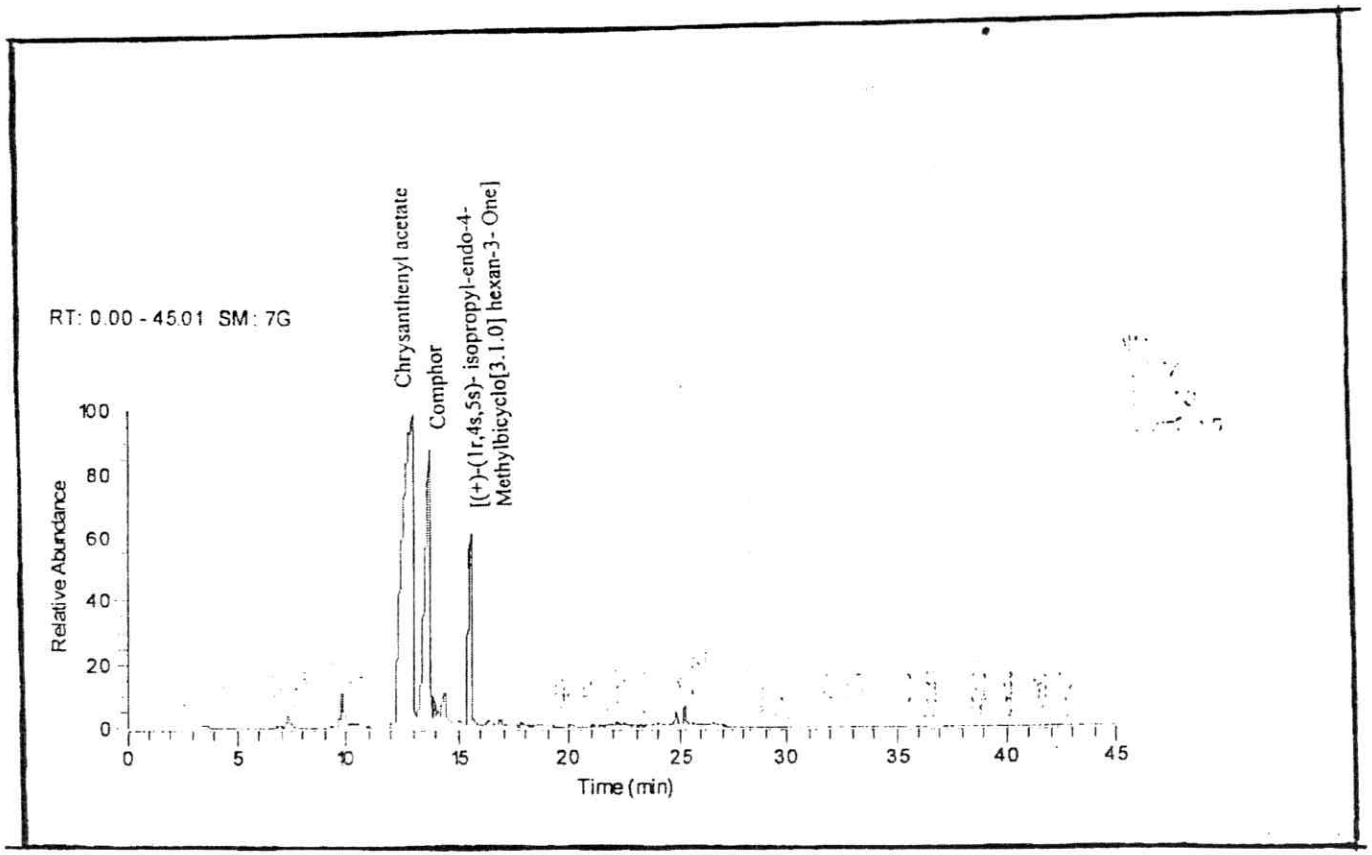
Chromatography (2) - Main component of the volatile oil in the flower heads of *Tanacetum vulgare*. Plants cut in winter of 2003/2004 season.



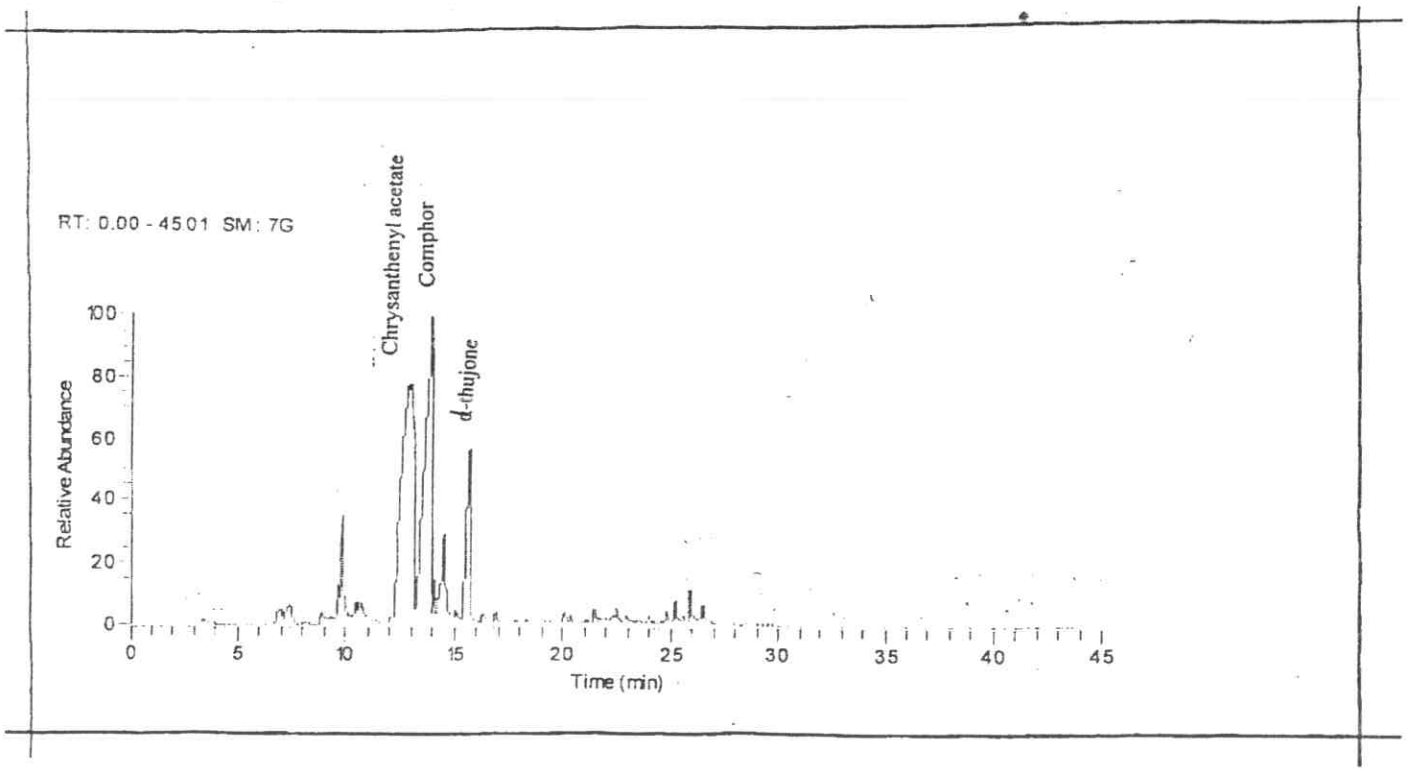
Chromatography (3) - Main component of the volatile oil in the flowering herbs of *Tanacetum vulgare* plants gathered in summer of 2003/2004 season

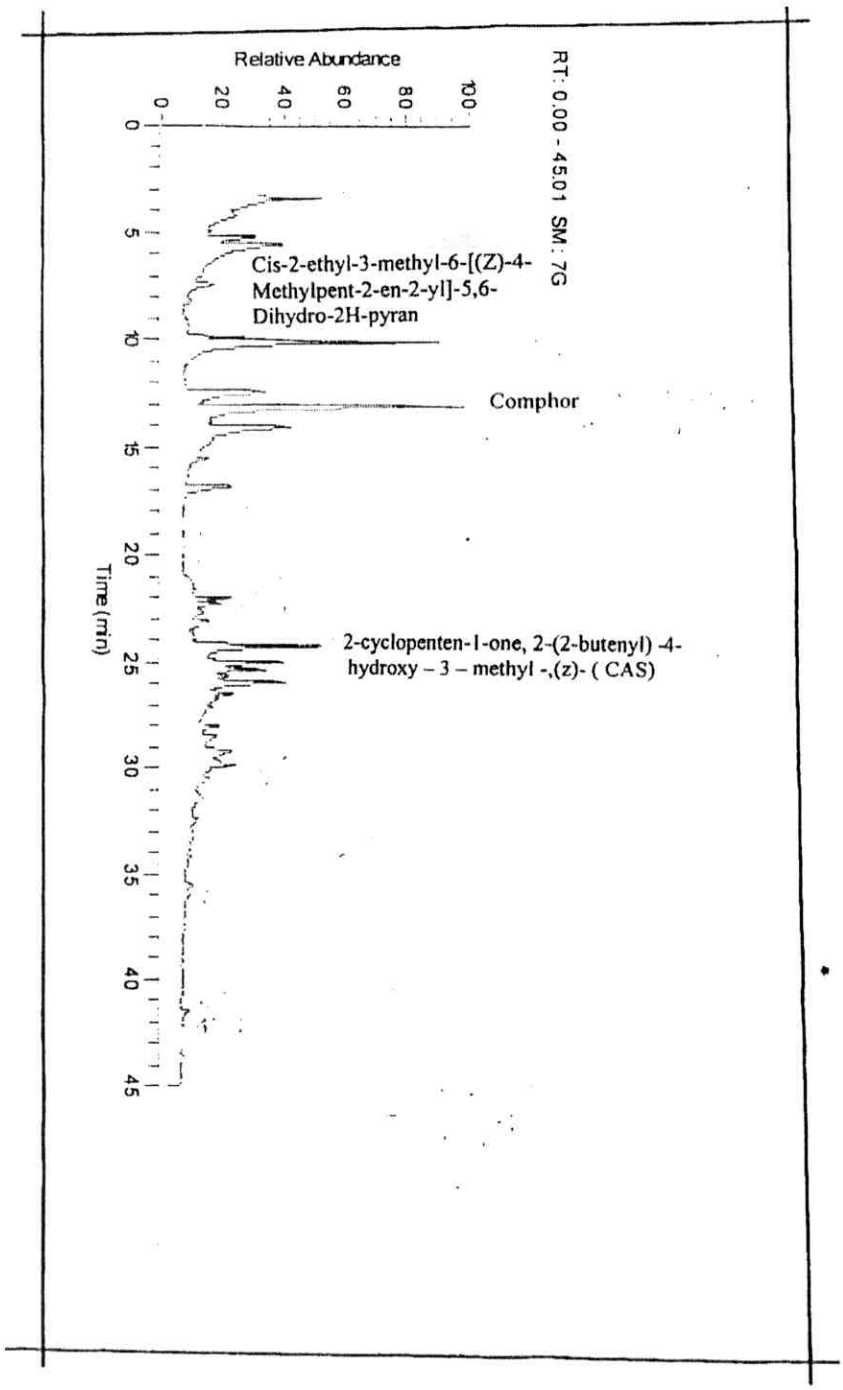


Chromatography (4) - Main component of the volatile oil in the flowering herbs of *Tanacetum vulgare* plants. gathered in winter of 2003/2004 season



Chromatography (5) - Main component of the volatile oil in the flower heads of *Tanacetum vulgare* plants treated with ammonium sulphate 450 kg /fed of 2003/2004 seasons .





Chromatography (6) - Main component of the volatile oil in the flower heads of *Tanacetum vulgare* plants treated with Biofertilizer+ 10m3 poultry manure/fed of 2003/2004 seasons .

was very low (13.99%) followed descendingly by (cis-2-ethyl-3-methyl-6-[(2)-4-methyleent-2-en-2-yl]-5,6-dihydro-2H-pyran). the percentage was (13.50%) followed descendingly by 2-cyclopenten-1-one, 2-(2-butenyl) 14-hydroxy-3-methyl-, (z)- (CAS) the percentage was (6.97%) known as Cinerolon or Pyrethrolone.

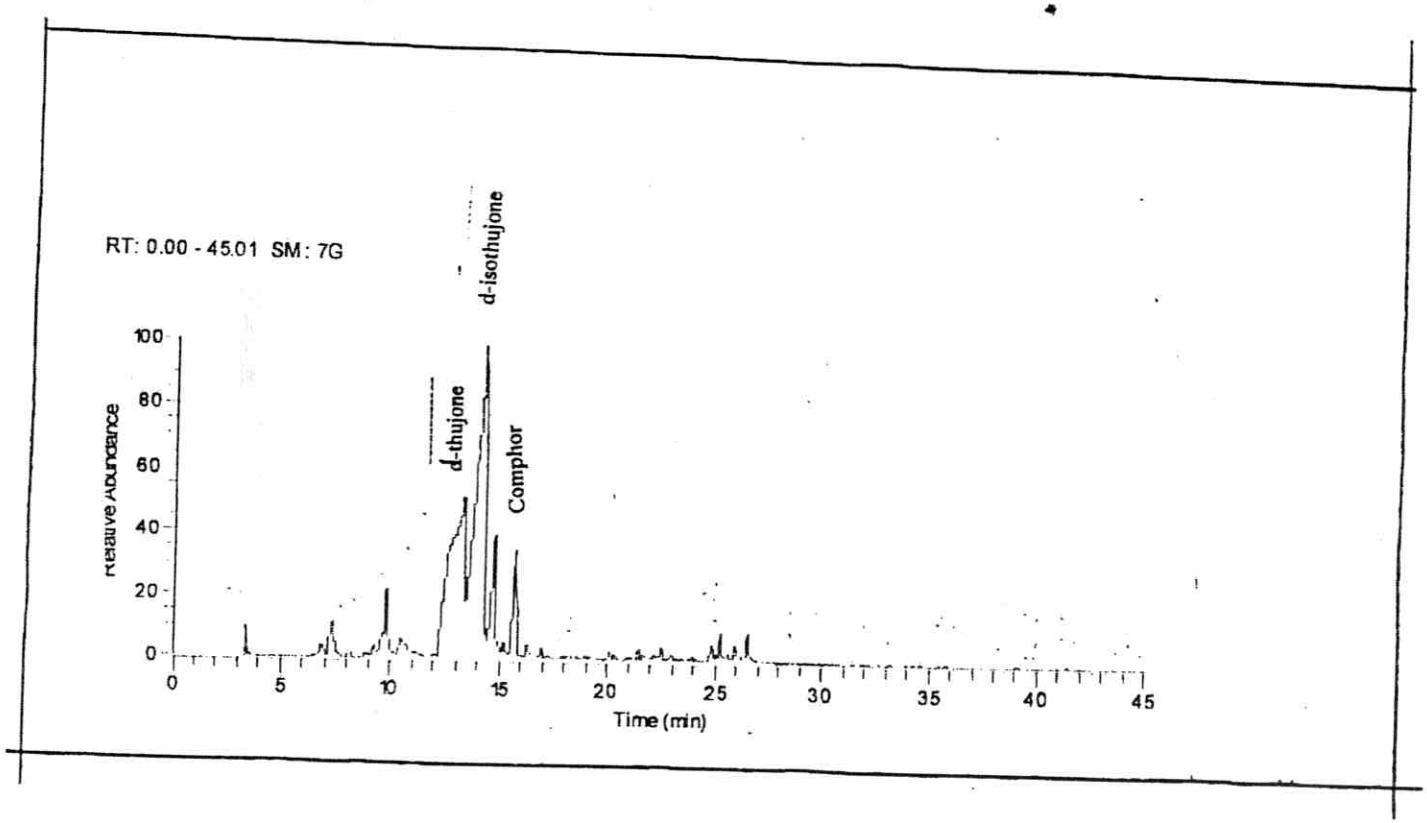
As far as the oil yield obtained from the flower heads of the plants treated with F5 (Biofertilizer+2ton compost/fed) and were illustrated in chromatography (7) the main component was camphor, same as the abovementioned but its percentage was less (25.51%) followed descendingly by (α-thujone). The percentage (18.42%) then the abovementioned component but the percentage was (12.59%).

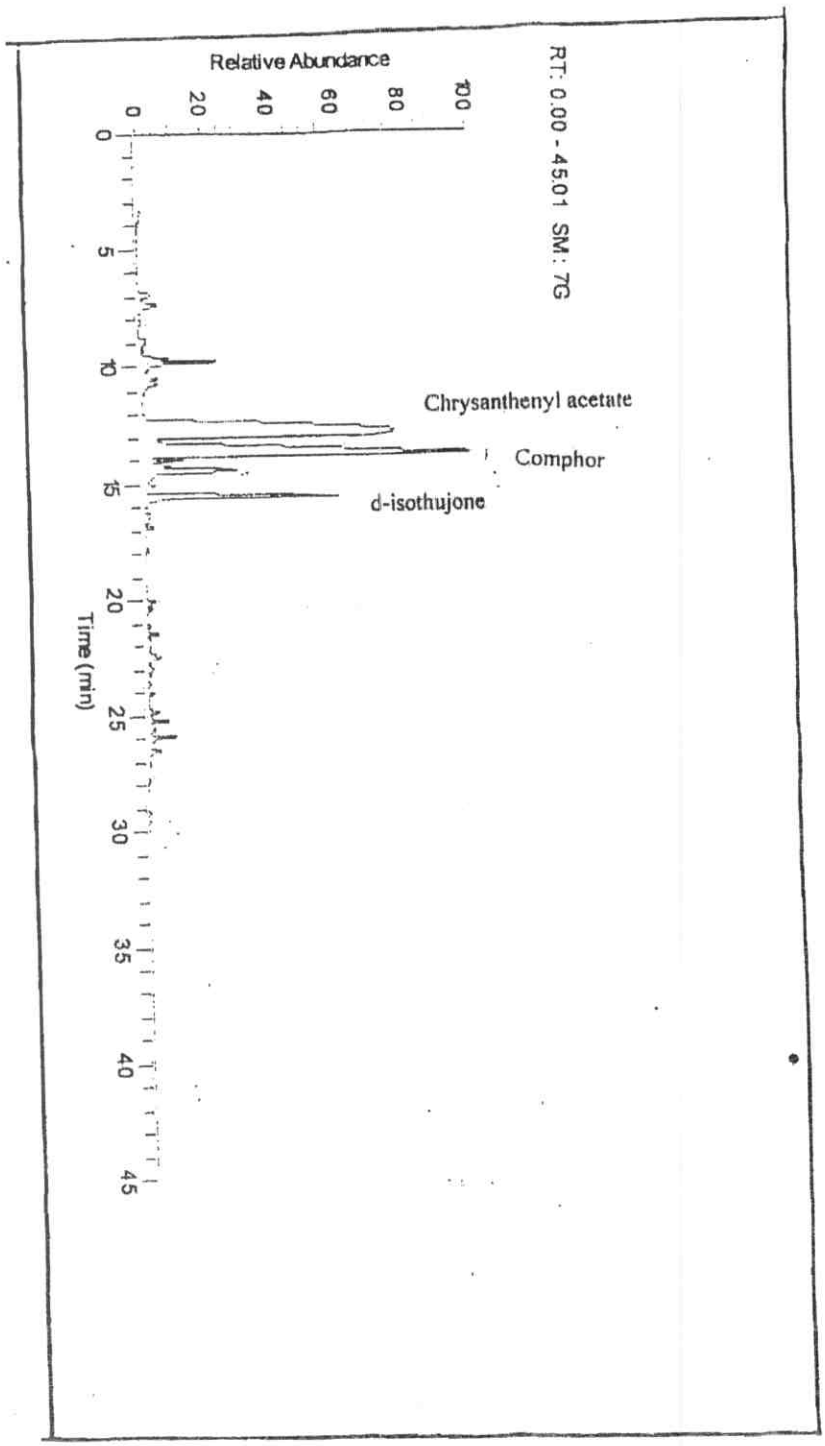
As far as the oil obtained from the flower heads of the plants treated with F6 (Biofertilizer + ammonium sulphate 300kg + 2ton compost/fed) chromatography (8) recorded the highest chrysanthenyl acetate percentage (39.73%) followed descendingly by camphor, the percentage (30.26) followed descendingly by (d-isothujone). The percentage (9.90%).

The oil samples obtained from treated plants with F7 (Biofertilizer + 10 m^3Biogas manure/fed) were subjected to GCM analysis. For estimation the percentage of the main components and presented in Table (10) and chromatography (9) These data may be discussed as follows: chrysanthenol acetate giving (42.18%), camphor (22.64%) and α-thujone α-(5.45%).

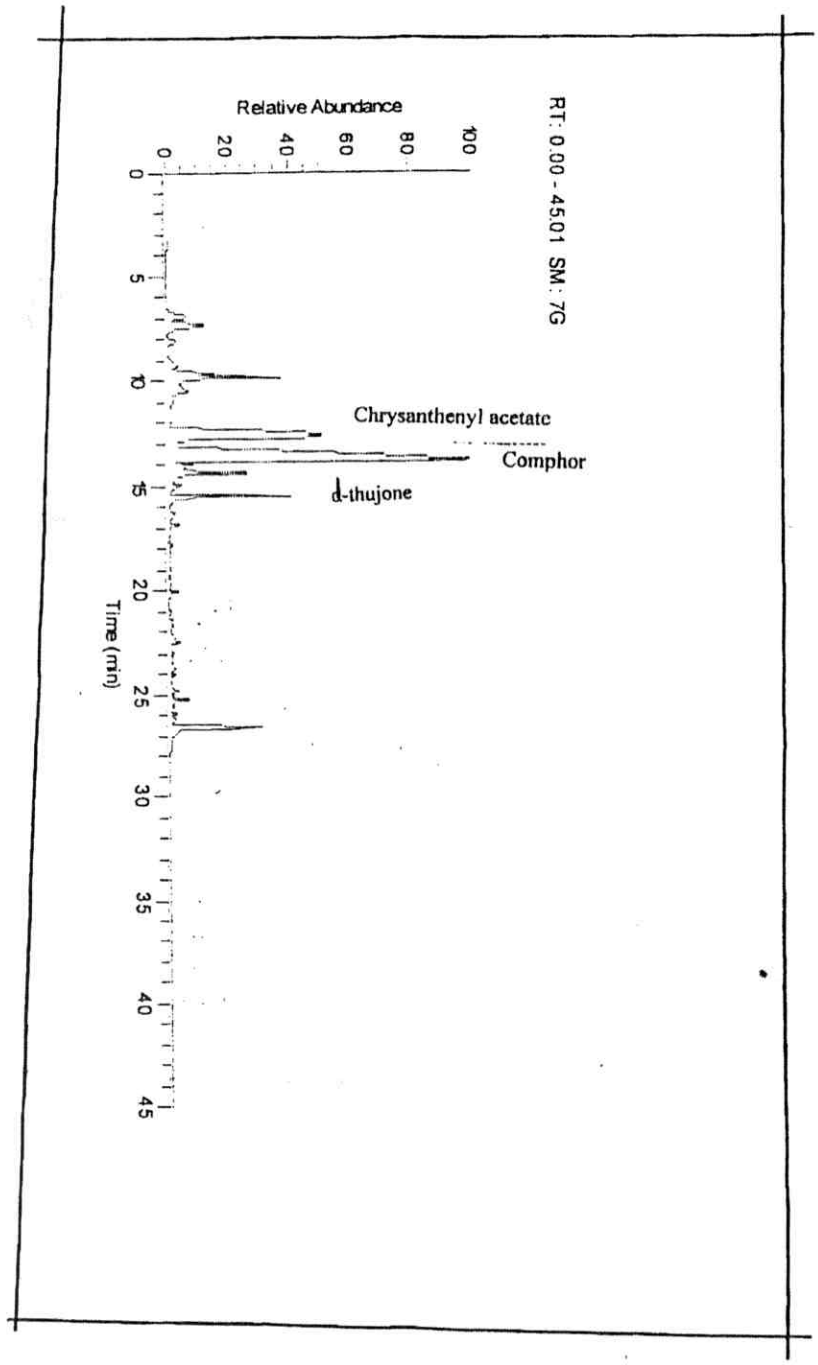
These results coincided with those obtained by: **Jacoub (1995)** who used N at 5, 10, 15 and 20 g/plant, (N_1, N_2, N_3 and N_4), P and K at 10 and 5 g/plant, respectively, on sweet basil (*Ocimum basilicum*) plants. They found that N treatments had no significant

Chromatography (7) - Main component of the volatile oil in the flower heads of the plants treated with Biofertilizer+2ton compost/fed. of *Tanacetum vulgare* plants of 2003/2004 seasons .





Chromatography (8) - Main component of the volatile oil in the flower heads of *Tanacetum vulgare* plants treated with Biofertilizer + ammonium sulphate 300 kg /fed + 2ton compost/fed.



Chromatography (9) - Main component of the volatile oil in the flower heads of *Tanacetum vulgare* plants treated with Biofertilizer + 10m3Biogas manure/fed. of 2003/2004 seasons.

effect on oil percentage, whereas, oil yield/plant was increased. N_2 P_1 K_1 and N_3 P_1 K_1 levels increased linalool, while methyl chavicol percentage was decreased. **Alvarez *et al* (2003)** studied a group of nine *Chrysanthemum coronarium* L. (Asteraceae) populations which were cultivated in southeastern Spain in 1998 to study the effect of fertilizer application on yield of flower heads and essential oil composition. A flower heads yield increase was obtained in fertilized plots although this was not the case for essential oil content. Camphor was the main compound identified in this oil (13.9–26.9%) and it was contained in higher amount (2.32–5.47% more) when the flower heads came from fertilized plants. The accumulation of germacrene D in the oil, on the other hand, was negatively affected by the fertilization treatment whereas, **Mockute and Judzentiene (2004)** on the essential oils of the inflorescences and leaves of *Tanacetum vulgare L.* var *vulgare* collected at full flowering in 10 habitats in Vilnius district were investigated. Forty-one constituents were identified. The oils were distributed among four chemotypes. The major constituents of the camphor chemotype (10 samples) were camphor (22.3-41.4%) and 1,8-cineole (10.6-26.4%); the α-thujonechemotype (six samples) was found to be dominated by α-thujone(25.7-71.5%) and 1,8-cineole (11.3-22.3%); the major constituents of the 1,8-cineole-chemotype (three samples) was dominated by 1,8-cineole (24.5-32.7%) and camphor (8.3-23.8%); the artemisia ketonechemotype (one sample of inflorescences) predominantly featured Artemisia ketone (30.5%) and camphor (23.0%). The oil from inflorescences of the above chemotypes contained higher amounts of the first major component and oxygenated monoterpenes (mean 83.6%) than the leaf oils (mean 73.7%). An opposite correlation was noticed for

mono- and sesquiterpenes hydrocarbons and oxygenated sesquiterpenes. The oils of the inflorescences and leaves were of the same chemo type in eight habitats, but they contained different amounts of the main components.

IV.3.4. Effect on chlorophyll "a" :

The data presented in Table (11). Show that the different fertilization treatments had a marked effect on the average chlorophyll "a" content (mg/g F.W) of *Tanacetum vulgare* plants in both seasons.

It was appeared from Table (11) that the greatest content of chlorophyll "a" content in Tansy leaves was obtained with the treatment of F6 (Biofertilizer + ammonium sulphate 300 kg /fed + 2ton compost/fed) as it gave (1.82 and 1.72 mg/g F.W) followed descendingly by using F7 (Biofertilizer + 10 m^3 Biogas manure/fed) which recorded (1.74 mg/g F.W) in the first season followed by F1 (450 kg ammonium sulphate/fed). which gave (1.61and1.78 mg/g F.W) in the first and second seasons, respectively.

Additionally, irrespective the abovementioned treatments, using the treatments of F8 (Biofertilizer + ammonium sulphate 300 kg /fed +10 m^3 Biogas manure/fed) and F2 (Biofertilizer + ammonium sulphate 300 kg /fed) Succeeded in increasing chlorophyll "a" content (mg/g F.W) when compared with the other treatments as it gave (1.45 and 1.41mg/g F.W) in the first season and (1.41 and 1.22- mg/g F.W) in the second season, respectively.

On the opposite, the least chlorophyll "a" content was obtained by treating the plants with F5 (Biofertilizer + 2ton compost/fed) which produced the lowest values as the percentages

Table (11): Effect of fertilization treatments and sowing date on chlorophyll a contents (mg/g F/W) of *Tanacetum vulgare* plants during 2002/2003–2003/2004 seasons.

Treatments		1st cut				2nd cut				Mean	
				Mean				Mean			
		1st season	2nd season	1st season	2nd season	1st season	2nd season	1st season	2nd season	1st season	2nd season
F1	Winter	1.66	1.82	1.60	1.88	1.55	1.65	1.61	1.66	1.61	1.77
	Summer	1.54	1.95			1.67	1.66				
F2	Winter	1.28	1.13	1.29	1.14	1.43	1.09	1.52	1.30	1.41	1.22
	Summer	1.31	1.16			1.60	1.50				
F3	Winter	1.27	1.21	1.27	1.17	1.18	1.17	1.29	1.40	1.28	1.29
	Summer	1.28	1.13			1.40	1.63				
F4	Winter	1.34	1.27	1.33	1.40	1.07	0.95	1.10	0.96	1.21	1.18
	Summer	1.31	1.54			1.13	0.98				
F5	Winter	0.61	0.78	0.84	0.89	0.61	0.89	0.77	1.00	0.80	0.95
	Summer	1.06	1.01			0.93	1.11				
F6	Winter	1.89	1.71	1.92	1.83	1.17	1.53	1.71	1.60	1.82	1.71
	Summer	1.94	1.94			1.66	1.68				
F7	Winter	1.67	1.23	1.67	1.45	1.86	1.39	1.79	1.53	1.73	1.49
	Summer	1.68	1.67			1.72	1.67				
F8	Winter	1.33	1.24	1.45	1.37	1.20	1.18	1.43	1.43	1.44	1.40
	Summer	1.57	1.50			1.67	1.69				
Mean		1.42	1.39	1.42	1.39	1.40	1.36	1.40	1.36	1.41	1.38

F1 Ammonium sulphate 450 kg /fed.
F2 Biofertilizer + Ammonium sulphate 300 kg /fed
F3 Biofertilizer+10 m^3 poultry manure/fed (Bio+10 m^3 PM/fed.)
F4 Biofertilizer + Ammonium sulphate 300 kg /fed +10 m^3 poultry manure.
F5 Biofertilizer+2ton compost/fed
F6 Biofertilizer + Ammonium sulphate 300 kg /fed + 2ton compost/fed
F7 Biofertilizer + 10 m^3Biogas manure/fed.
F8 Biofertilizer + Ammonium sulphate 300 kg /fed +10 m^3Biogas manure/fed.

of decreases were (99.75 and 86.45%) lower than F1 (450 kg ammonium sulphate/fed). However, F3 (Biofertilizer+10 m^3 poultry manure/fed) which recorded (1.29 and 1.29 mg/g F.W) occupied intermediate place between the aforesaid treatments.

With regard to the specific effects of sowing date (regardless fertilizers and cuts). Results revealed that the greatest content of chlorophylls "a" in Tansy leaves was registered in Table (19). Show that summer planting had generally favourable effect on chlorophylls "a" content in Tansy leaves the means recorded 1.33 and 1.49mg/g. F.W.) in the two seasons respectively. compared with winter planting as it gave 1.33 and 1.27mg/g. F.W.) in the first and second seasons, respectively.

Referring to the interaction effect between fertilizers and cuts. (regardless sowing date) data presented in Table (11) cleared that the highest content of chlorophyll "a" (mg/g. F.W.) was recorded by using F_6 in both cuts as it gave (1.92 mg/g. F.W.) in the first cut and (1.718 mg/g. F.W.) in the second one followed descendingly by using the treatment of F_7 (Biofertilizer + 10 m^3Biogas manure/fed)which gave (1.67 mg/g. F.W.) in the first cut and (1.79 mg/g. F.W.) in the second one. Also, treated *Tanacetum vulgare* plants with F1 (450 kg ammonium sulphate/fed). resulted in highly significant increases in this parameter as it gave (1.60 and 1.62 mg/g. F.W.) in the first and second cuts, respectively. This trend was true only in the first season, while in the second one, the highest content of chlorophyll "a" (mg/g. F.W.) was registered by using F1 (450 kg ammonium sulphate/fed). which gave(1.89 mg/g. F.W.). in the first cut of the 2^{nd} season Additionally, using F_6 resulted in highly increment in this parameter as it gave (1.83 and

1.60 mg/g.. F.W) in the first and second cuts, respectively. On the contrary the lowest content of chlorophyll "a" (mg/g F.W.) was obtained by using F_7 in both seasons.

As for the interaction effect between fertilizers, sowing date and cuts, data in Table (11) declared that the highest content of chlorophyll "a" in Tansy leaves was obtained in the first cut when the plants sown in the summer and fertilized with F_6 as it produced (1.94 ``mg/g. F.W) in the first season, Similar result was obtained on content of chlorophyll "a" in the second season.

Also, winter grown plants treated with F6 (Biofertilizer + ammonium sulphate 300 kg /fed + 2ton compost/fed) gave high increments in this parameter in the first cut as it gave (1.90 mg/g. F.W) and (1.71 mg/g. F.W) in the first and second seasons, respectively. Besides, summer or winter grown plants treated with F1 (450 kg ammonium sulphate/fed.) resulted in highly increases in this parameter as it gave (1.95 and 1.82 mg/g. F.W.). in the first cut of the second season respectively. Moreover, winter grown plants treated with F7 (Biofertilizer + 10 m^3Biogas manure/fed.) succeeded in increasing content of chlorophyll "a" (mg/g. F.W.) in the first season of the second cut as compared with the other treatments in both seasons. In the reverse, the lowest leaf chlorophyll "a" content (mg/g. F.W.) of *Tanacetum vulgare* plants was gained by winter sown plants treated with F_5 in both seasons.

IV-3-5- Effect on chlorophyll "b":

It is quite clear from data presented in Table (12). That chlorophyll "b" content was markedly effected by fertilization treatments F6 (Biofertilizer + ammonium sulphate 300 kg/fed 2ton

Table (12): Effect of fertilization treatments and sowing date on chlorophyll b contents (mg/g F/W) of *Tanacetum vulgare* plants during 2002/2003–2003/2004 seasons.

Treatments		1st cut				2nd cut				Mean	
				Mean				Mean			
		1st season	2nd season	1st season	2nd season	1st season	2nd season	1st season	2nd season	1st season	2nd season
F1	Winter	1.11	1.22	1.33	1.33	1.17	1.25	1.27	1.30	1.30	1.31
	Summer	1.55	1.44			1.37	1.36				
F2	Winter	1.29	1.13	1.21	1.14	1.22	0.93	1.24	1.05	1.27	1.10
	Summer	1.13	1.16			1.26	1.18				
F3	Winter	0.96	0.92	1.01	0.92	0.79	0.78	0.97	1.06	0.98	0.99
	Summer	1.05	0.93			1.15	1.34				
F4	Winter	0.90	0.85	0.96	1.03	0.88	0.65	1.00	0.87	0.98	0.95
	Summer	1.03	1.21			1.13	0.98				
F5	Winter	0.50	0.64	0.71	0.75	0.44	0.65	0.53	0.69	0.61	0.72
	Summer	0.91	0.86			0.62	0.74				
F6	Winter	1.26	1.14	1.36	1.30	1.39	1.20	1.52	1.44	1.44	1.37
	Summer	1.47	1.47			1.66	1.68				
F7	Winter	1.37	1.01	1.52	1.34	1.24	1.43	1.35	1.28	1.44	1.31
	Summer	1.68	1.67			1.46	1.43				
F8	Winter	1.18	1.10	1.23	1.16	0.91	0.96	1.06	1.04	1.14	1.10
	Summer	1.29	1.23			1.21	1.12				
Mean		1.17	1.12	1.17	1.12	1.12	1.09	1.12	1.09	1.15	1.11

F1 Ammonium sulphate 450 kg /fed.
F2 Biofertilizer + Ammonium sulphate 300 kg /fed
F3 Biofertilizer+10 m^3 poultry manure/fed (Bio+10 m^3 PM/fed.)
F4 Biofertilizer + Ammonium sulphate 300 kg /fed +10 m^3 poultry manure.
F5 Biofertilizer+2ton compost/fed
F6 Biofertilizer + Ammonium sulphate 300 kg /fed + 2ton compost/fed
F7 Biofertilizer + 10 m^3Biogas manure/fed.
F8 Biofertilizer + Ammonium sulphate 300 kg /fed +10 m^3Biogas manure/fed.

compost/fed) and F7 (Biofertilizer + 10 m^3Biogas manure/ fed.) produced the maximum chlorophyll "b" content (1.45 and 1.44 mg/g F.W) in the first season, respectively. Meanwhile the values were 1.38 and 1.32in the second season, respectively. While F1 treatment (450 kg ammonium sulphate/fed.) seems its superiority stimulative effect of N fertilization on chlorophyll "b" took place and produced the next highest values in chlorophyll "b" content as it gave (1.30 and 1.32 mg/g F.W) in the first and second seasons respectively.

Additionally, irrespective the abovementioned treatments, using the treatments of F8 (Biofertilizer + ammonium sulphate 300 kg /fed +10 m^3 Biogas manure/fed) and F2 (Biofertilizer + ammonium sulphate 300 kg /fed) Succeeded in increasing chlorophyll "b" content (mg/g F.W) when compared with the other treatments as it gave (1.15 and 1.27 mg/g F.W) in the first season and (1.11 and 1.10mg/g F.W) in the second season, respectively.

Regarding the effect of sowing date on chlorophyll "b" content Table (19) it was observed that summer planting was most effective treatment in hastening and increasing chlorophyll "b" content than winter planting. Generally the percentages of increases for summer sowing were (20.31 and 24.80%) chlorophyll "b" content over winter sowing plants.

As for the interaction effect between fertilizers and cuts. (regardless sowing date) data presented in Table (16) cleared that the highest content of chlorophyll "b" (mg/g. F.W.) was recorded by using F_6in 2^{nd} cut as it gave (1.53 and 1.44 mg/g. F.W.) in the first and second seasons, respectively. Followed descendingly by using the treatment of F7 (Biofertilizer + 10 m^3Biogas manure/fed) which gave (1.52 and 1.34 mg/g. F.W.) in the first cut, in the first and second seasons, respectively. Also, treated *Tanacetum vulgare*

plants with F1 (450 kg ammonium sulphate/fed) resulted in highly significant increases in this parameter as it gave (1.32 and 1.32 mg/g. F.W.) in the first and second seasons, respectively. This trend was true only in the first cut while, in the second one the highest leaf chlorophyll "b" content (mg/g. F.W.) was registered by using F1 (450 kg ammonium sulphate/fed) which gave (1.27 and 1.30 mg/g. F.W.). in the 2nd cut of the two seasons. Additionally, using F_7 resulted in highly increment in this parameter as it gave (1.355 and 1.287 mg/g. F.W.) in the second cut, respectively. On the contrary the lowest leaf chlorophyll "b" content (mg/g. F.W.) was obtained by using F_5 in both seasons.

As for the interaction effect between fertilizers, sowing date and cuts, data in Table (16) declared that the highest content of chlorophylls "b" in Tansy leaves was obtained in the first cut when the plants sown in the summer and fertilized with F_7 as it produced (1.68and 1.67mg/g. F.W.) in the first and second seasons, respectively. Also, summer grown plants treated with F6 (Biofertilizer + 300 kg ammonium sulphate + 2ton compost/fed) gave high increments in this parameter in the second cut as it gave (1.66 and 1.68 mg/g. F.W.) in the first and second seasons, respectively. Besides, summer grown plants treated with F1 (450 kg ammonium sulphate/fed.) resulted in highly increases in this parameter as it gave (1.54 and 1.44 mg/g. F.W.). in the first cut of the first and second seasons, respectively. Moreover, summer grown plants treated with F7 (Biofertilizer + 10 m^3 Biogas manure/fed) succeeded in increasing content of chlorophyll "b" (mg/g. F.W.) in the second cut as compared with the other treatments in both seasons. In the reverse, the lowest leaf chlorophyll "b" content (mg/g. F.W.) of *Tanacetum vulgare* plants was gained by winter sown plants treated with F_5 in both seasons.

IV-3-6- Effect on Total chlorophyll content:

The recorded data in Table (13) and Fig (7-a) indicated that the greatest content of total chlorophyll in Tansy leaves was obtained with the treatment of F_6 (Biofertilizer + 300 kg ammonium sulphate + 2ton compost/fed) as it gave (3.26 and 3.09 mg/g. F.W.) followed descendingly by using F_7 (Biofertilizer + 10 m^3 biogas/fed.) which recorded (3.17 and 2.81 mg/g. F.W.) and 450 kg ammonium sulphate/fed. which gave (2.91 and 3.09 mg/g. F.W.) in the first and second seasons, respectively.

Additionally irrespective the abovementioned treatments, using the treatments of F_2 (Biofertilizer + 300 kg ammonium sulphate + 2ton compost/fed) and F_8 (Biofertilizer + 300 kg ammonium sulphate +10 m^3Biogas manure/fed) succeeded in increasing the total chlorophyll of leaf when compared with the other treatments as they gave(2.68 and 2.59 mg/g. F.W.) in the first season and (2.32and 2.51 mg/g. F.W.) in the second one, respectively. On the other hand, the least total chlorophyll content was obtained by treating the plants with F_5 (Biofertilizer +2ton compost/fed.) which produced the lowest values as the percentages of decreases were (51.03 and 45.79mg/g. F.W.) lower than F1(450 kg ammonium sulphate/fed) followed ascendingly by using F_4 (Biofertilizer + 300 kg ammonium sulphate +10 m^3 poultry manure) which recorded the percentages of (24.22mg/g. F.W.) and (26.46 mg/g. F.W.) in the first and second seasons, respectively. However, F_3 (Biofertilizer + 10 m^3 PM/fed.) which gave (2.27 and 2.28 mg/g. F.W.) occupied intermediate place between the aforesaid treatments.

Table (13): Effect of fertilization treatments and sowing date on total chlorophyll contents (mg/g f.w) of *Tanacetum vulgare* plants during 2002/2003–2003/2004 seasons.

Treatments		1st cut				2nd cut				Mean	
				Mean				Mean			
		1st season	2nd season	1st season	2nd season	1st season	2nd season	1st season	2nd season	1st season	2nd season
F1	Winter	2.77	3.04	2.93	3.21	2.73	2.91	2.890	2.97	2.91	3.09
	Summer	3.09	3.39			3.05	3.03				
F2	Winter	2.57	2.26	2.59	2.29	2.660	2.03	2.76	2.36	2.68	2.32
	Summer	2.62	2.32			2.87	2.69				
F3	Winter	2.23	2.13	2.28	2.10	1.98	1.95	2.26	2.46	2.27	2.28
	Summer	2.34	2.07			2.55	2.98				
F4	Winter	2.24	2.13	2.29	2.44	1.96	1.73	2.11	1.84	2.20	2.14
	Summer	2.35	2.75			2.27	1.96				
F5	Winter	1.11	1.42	1.54	1.64	1.06	1.55	1.30	1.70	1.42	1.67
	Summer	1.98	1.87			1.55	1.86				
F6	Winter	3.16	2.85	3.29	3.13	3.16	2.74	3.24	3.05	3.27	3.09
	Summer	3.42	3.42			3.33	3.36				
F7	Winter	3.05	2.24	3.20	2.79	3.11	2.54	3.15	2.82	3.18	2.81
	Summer	3.36	3.35			3.19	3.11				
F8	Winter	2.52	2.34	2.69	2.54	2.12	2.15	2.50	2.48	2.60	2.51
	Summer	2.87	2.74			2.88	2.82				
Mean		2.61	2.52	2.61	2.52	2.530	2.46	2.53	2.46	2.57	2.49

F1 Ammonium sulphate 450 kg /fed.
F2 Biofertilizer + Ammonium sulphate 300 kg /fed
F3 Biofertilizer+10 m^3 poultry manure/fed (Bio+10 m^3 PM/fed.)
F4 Biofertilizer + Ammonium sulphate 300 kg /fed +10 m^3 poultry manure.
F5 Biofertilizer+2ton compost/fed
F6 Biofertilizer + Ammonium sulphate 300 kg /fed + 2ton compost/fed
F7 Biofertilizer + 10 m^3Biogas manure/fed.
F8 Biofertilizer + Ammonium sulphate 300 kg /fed +10 m^3Biogas manure/fed.

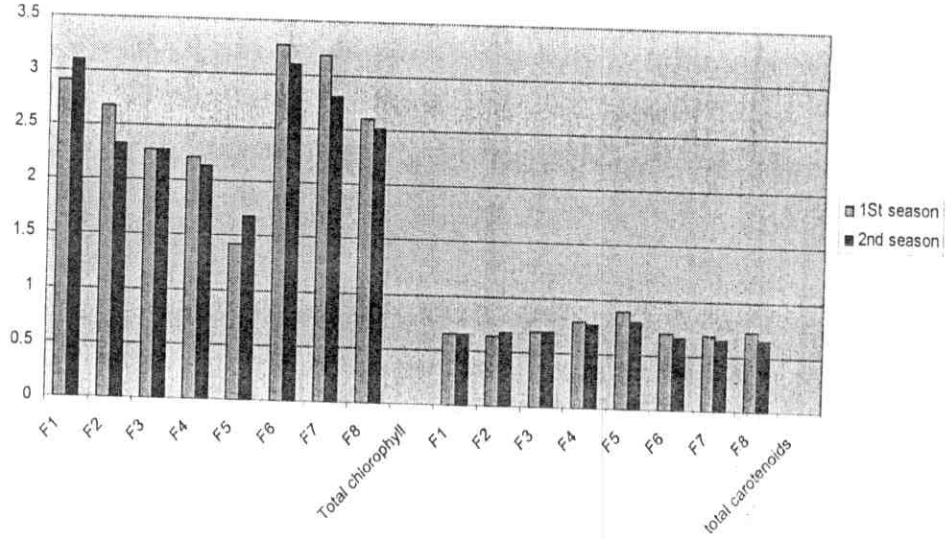


Fig (7-a): Effect of fertilization treatments on total chlorophyll and carotenoids contents (mg/g f.w) of *Tanacetum vulgare* plants during 2002/2003– 2003/2004 seasons.

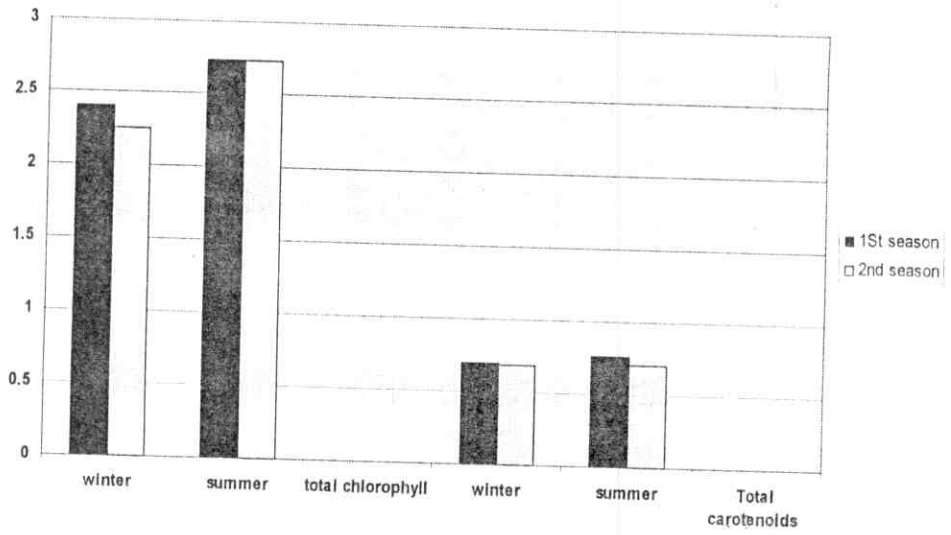


Fig (7-b): Effect of sowing dates on total chlorophyll and carotenoids contents (mg/g f.w) of *Tanacetum vulgare* plants during 2002/2003– 2003/2004 seasons.

With regard to the specific effects of sowing date (regardless fertilizers and cuts) it is worthy to notice that the greatest content of total chlorophyll in tansy leaves was recorded in Table (19) and Fig (7-b) show that summer planting had generally favourable effect on content of total chlorophyll in Tansy leaves which recorded (2.73mg/g. F.W.) in both seasons in the two cuts compared with winter planting as it gave (2.40 and 2.25mg/g. F.W.) in the two seasons, respectively.

Referring to the interaction effect between fertilizers and cuts. (regardless sowing date) data presented in Table (13) cleared that the greatest leaf total chlorophyll content (mg/g. F.W.) was recorded by using F_6 in both cuts as it gave (3.29 mg/g. F.W.) in the first cut and (3.24 mg/g. F.W.) in the second one followed descendingly by using the treatment of F_7 (Biofertilizer + 10 m^3Biogas manure/fed)which gave (3.20 mg/g. F.W.) in the first cut and (3.15 mg/g. F.W.) in the second one. Also, treated *Tanacetum vulgare* plants with F1 (450 kg ammonium sulphate/fed) resulted in highly increases in this parameter as it gave (2.93 and 2.89 mg/g. F.W.) in the first and second cuts, respectively. This trend was true only in the first season, while in the second one, the highest leaf total chlorophyll content (mg/g. F.W.) was registered by using F1 (450 kg ammonium sulphate/fed) which gave (3.21 mg/g. F.W.). Additionally, using F_6 resulted in highly increment in this parameter as it gave (3.13 and 3.05 mg/g. F.W.) in the first and second cuts, respectively. On the contrary the lowest leaf total chlorophyll content (mg/g. F.W.) was obtained by using F_7 in both seasons.

As for the interaction effect between fertilizers, sowing date and cuts, data in Table (13) declared that the highest content of total chlorophyll in Tansy leaves was obtained in the first cut when the plants were sown in the summer and fertilized with F_6 as it produced (3.42 and 3.42 mg/g. F.W.) in the first and second seasons, respectively.

Also, summer grown plants treated with F_7, gave high increments in this parameter in the first cut as it gave (3.36 mg/g. F.W.) and (3.35 mg/g. F.W.) in the first and second seasons, respectively. Besides, summer grown plants treated with F_6 resulted in highly increases in this parameter in the second cut as it gave (3.33 and 3.36 mg/g. F.W.) in the first and second seasons, respectively. Moreover, summer grown plants treated with F1 (450 kg ammonium sulphate/fed) succeeded in increasing leaf total chlorophyll content (mg/g. F.W.) in the first and second cuts as compared with the other treatments in both seasons. In the reverse, the lowest leaf total chlorophyll content (mg/g. F.W.) of *Tanacetum vulgare* plants was gained by winter sown plants treated with F_5 in both seasons.

From the results discussed in Tables (13, 15 and 18.)it may be concluded that carbohydrates content was related to the increase in both total chlorophylls and K content, this can be interpreted the role of chlorophyll in photosynthesis as well as K function in swing, building, translocation and storage of carbohydrates.

These results are in agreement with those reported by **Hammam (1996)** on *Pimpinella anisum*, who found that the highest content of chlorophyll (a) and (b) was produced by nitrogen fertilization at 80 kg/fed. **Mohsen (2002)** found that treating

Ocimum basilicum plants with NPK (600 kg/fed.) with ratio of 25 : 10 : 10 N : P_2O_5 : K_2O caused an increase in the leaf content of chlorophyll a, b and carotenoids.

IV-3-7- Carotenoids content:

According to data presented in Table (14) and Fig (7-A). It could be concluded that fertilized Tansy plants with F_5 (bio+2ton compost/fed.) (regardless cuts and sowing date) approved to be the most effective treatment for increasing carotenoids content as it recorded (0.90 and 0.81 mg/gm F.W.) followed descendingly by using F_4 (Biofertilizer + 300 kg ammonium sulphate +10 m^3 poultry manure) which gave (0.80 and 0.76 mg/gm F.W.) in the first and second seasons, respectively. Moreover, treated *Tanacetum* plants with F_8 (Biofertilizer + 300 kg ammonium sulphate +10 m^3Biogas manure/fed) or F_3 (Biofertilizer+10 m^3 poultry manure/fed) resulted in high increases in this parameter as they gave (0.73 and 0.70 mg/gm F.W.) in the first season, (0.65 and 0.70 mg/gm F.W.) in the second one, when compared with F_2 (Biofertilizer + 300 kg ammonium sulphate) or F_1(450 kg ammonium sulphate/fed.) treatments which gave the least values this concern as they gave (0.64 and 0.68 mg/gm F.W) for F_2 and (0.66and 0.66 mg/gm F.W.) for F_1 in the first and second seasons, respectively. The other treatments took intermediate place compared with the aforesaid treatments in both seasons of this work.

In respect to the effect of sowing date (regardless fertilizers and cuts) it is worthy to notice that the greatest content of carotenoids content in Tansy leaves was recorded in Table (19) and

Table (14): Effect of fertilization treatments and sowing date on total carotenoids content (mg/g f w) of *Tanacetum vulgare* plants during 2002/2003–2003/2004 seasons.

Treatments		1st cut				2nd cut				Mean	
				Mean				Mean			
		1st season	2nd season	1st season	2nd season	1st season	2nd season	1st season	2nd season	1st season	2nd season
F1	Winter	0.77	0.65	0.70	0.64	0.62	0.62	0.62	0.67	0.66	0.66
	Summer	0.63	0.64			0.63	0.73				
F2	Winter	0.67	0.68	0.65	0.67	0.62	0.64	0.63	0.69	0.64	0.68
	Summer	0.64	0.66			0.64	0.74				
F3	Winter	0.64	0.70	0.70	0.66	0.64	0.60	0.70	0.74	0.70	0.70
	Summer	0.76	0.63			0.76	0.88				
F4	Winter	0.64	0.74	0.77	0.73	0.74	0.73	0.82	0.79	0.80	0.76
	Summer	0.91	0.73			0.91	0.86				
F5	Winter	0.83	0.82	0.89	0.82	0.86	0.85	0.91	0.80	0.90	0.81
	Summer	0.96	0.82			0.96	0.76				
F6	Winter	0.72	0.63	0.70	0.64	0.72	0.74	0.70	0.70	0.70	0.67
	Summer	0.69	0.65			0.69	0.66				
F7	Winter	0.66	0.65	0.67	0.64	0.74	0.71	0.71	0.67	0.69	0.66
	Summer	0.69	0.64			0.69	0.64				
F8	Winter	0.67	0.64	0.73	0.64	0.67	0.65	0.73	0.67	0.73	0.65
	Summer	0.80	0.64			0.80	0.69				
Mean		0.73	0.68	0.73	0.68	0.73	0.72	0.73	0.72	0.73	0.70

F1 Ammonium sulphate 450 kg /fed.
F2 Biofertilizer + Ammonium sulphate 300 kg /fed
F3 Biofertilizer+10 m^3 poultry manure/fed (Bio+10 m^3 PM/fed.)
F4 Biofertilizer + Ammonium sulphate 300 kg /fed +10 m^3 poultry manure.
F5 Biofertilizer+2ton compost/fed
F6 Biofertilizer + Ammonium sulphate 300 kg /fed + 2ton compost/fed
F7 Biofertilizer + 10 m^3Biogas manure/fed.
F8 Biofertilizer + Ammonium sulphate 300 kg /fed +10 m^3Biogas manure/fed.

Fig (7-B) show that summer planting had generally favourable effect on content of carotenoids in Tansy leaves the mean recorded (0.760 and 0.71 mg/g. F.W.) in the first and second seasons, respectively. compared with winter planting as it gave (0.70 and 0.69 mg/g. F.W.) in the two seasons, respectively.

Respecting, the interaction effect between fertilizers and cuts (regardless sowing date), it is clear to be noticed that using the treatment of F_5 (Biofertilizer + 2 ton compost/fed.) produced the highest carotenoids content as it gave (0.89 and 0.82 mg/g. F.W.) in the first cut and gave (0.910 and 0.805 mg/g. F.W.) in the second one in the first and second seasons, respectively, followed by using F_4 which recorded (0.77 and 0.73 mg/g. F.W.) in the first cut and recorded (0.82and 0.79 mg/g. F.W.) in the second one in the first and second seasons, respectively. Moreover, treated *Tanacetum vulgare* with F_8 resulted in highly increases of this parameter as it gave the same value in the first and second cuts (0.73 mg/g. F.W.) in the first season while, in the second one using F_3 and F_6 succeeded in increasing this parameter as it gave in the second cut (0.74 and 0.70 mg/g. F.W.), respectively. On the contrary, the lowest leaf total carotenoids content (mg/g. F.W.) in the first season was obtained in the second cut by using F_1 and F_2 as they gave (0.62 and 0.63 mg/g. F.W.), respectively, while in the second one, the lowest mean value of this parameter was recorded by using F_6 (Biofertilizer + 300 kg ammonium sulphate + 2ton compost/fed) and F_8 (Biofertilizer + 300 kg ammonium sulphate +10 m^3Biogas manure/fed) as they gave the same value (0.640 mg/g. F.W.).

Regarding the interaction effect between fertilizers, sowing date, and cuts data in Table (14) pointed out that, Summer grown plants treated with F_5 showed to be the most effective treatment for producing the greatest leaf total carotenoids content (mg/g. F.W.) as they gave the same value in both cuts (0.96 m/g. F.W.) followed by summer grown plants treated with F4 which recorded the same value in both cuts (0.91 mg/g. F.W.). Also, winter grown plants treated with F_5 resulted in highly increases in this parameter when compared with the other treatments as it gave (0.86 mg/g. F.W.) in the second cut and (0.83 mg/g. F.W.) in the first cut. Moreover, summer grown plants treated with F_8 succeeded in increasing leaf total carotenoids contents of **T**ansy plants as it gave the same value in both cuts (0.80 mg/g. F.W.).

This trend was true only in first season while, in the second one, the highest mean value of this parameter was registered in the second cut when the plants of tansy were sown in the summer and fertilized with F_3 as it gave (0.88 mg/g. F.W) followed descendingly by summer grown plants treated with F_4 and winter grown plants treated with F_5 as they gave in the second cut (0.86 and 0.85 mg/g. F.W.), respectively. Moreover, treated *Tanacetum vulgare* with F_5 and grown in the summer or in the winter succeeded in increasing this parameter as they gave the same value in the first cut (0.82 mg/g. F.W.). On the opposite, the lowest value of this parameter was gained in the second cut when the plants of *Tanacetum vulgare* were sown in the winter and treated with the 450 kg ammonium sulphate/fed. (F_1) as it gave the same value in both seasons (0.62 mg/g. F.W.).

These results are in agreement with those reported by **Mohamed (2000)** who found that the treatment of ammonium sulphate at 150 kg/fed increased leaf pigments content on coriander plants. **Mohsen (2002)** who found that treating *Ocimum basilicum* plants with NPK (600 kg/fed.) with ratio of 25: 10 : 10 N : P_2O_5 : K_2O caused an increase in the leaf content of carotenoids.

IV-3-8- Total carbohydrates content in herb:

According to data presented in Table (15) and Fig (8-a) it could be concluded that fertilized *Tanacetum vulgare* plants with F1 (450 kg ammonium sulphate/fed.) approved to be the most effective treatment led to the greatest carbohydrates content (24.20and 23.63 %) followed descendingly by using the treatment F_6 (Biofertilizer + ammonium sulphate 300 kg /fed + 2ton compost/fed) which recorded (23.60 and 23.55 %) in the first and second seasons, respectively. Moreover, treated *Tanacetum vulgare* plants with F_2 or F_3 resulted in highly content of carbohydrates as they gave (21.78 and 22.63 %) in the first season, (22.24 and 21.80 %) in the second season.

Also, treatments of F_4, F_7 and F_8 all succeeded in increasing total carbohydrates content as compared with F_5. On the other side, the treatment of F5 caused the least total carbohydrates % which produced the lowest values as the percentages of decreases were (18.84 and 18.74%). lower than the F1 (450 kg ammonium sulphate/fed).

Concerning the effect of sowing date on total carbohydrates percentage % of *Tanacetum vulgare* plants. The results recorded in Table (19) and Fig (8-b) show that summer planting had

Table (15): Effect of fertilization treatments and sowing date on Total carbohydrates percentages (%) of *Tanacetum vulgare* plants during 2002/2003–2003/2004 seasons.

Treatments		1st cut				2nd cut				Mean	
				Mean				Mean			
		1st season	2nd season	1st season	2nd season	1st season	2nd season	1st season	2nd season	1st season	2nd season
F1	Winter	24.19	23.66	24.59	23.99	21.98	21.98	23.80	23.26	24.20	23.63
	Summer	24.99	24.33			25.63	24.54				
F2	Winter	22.08	22.66	21.94	22.66	20.08	20.08	21.61	21.81	21.77	22.24
	Summer	21.80	22.67			23.14	23.55				
F3	Winter	22.28	20.16	22.71	21.37	21.08	21.08	22.54	22.23	22.63	21.80
	Summer	23.15	22.58			24.01	23.39				
F4	Winter	21.42	19.92	21.54	20.89	19.85	19.85	21.54	21.50	21.54	21.20
	Summer	21.67	21.86			23.24	23.16				
F5	Winter	18.65	18.63	19.58	18.85	18.33	18.33	19.69	19.54	19.64	19.20
	Summer	20.51	19.08			21.06	20.76				
F6	Winter	23.65	23.83	23.67	24.16	21.39	21.39	23.53	22.92	23.60	23.54
	Summer	23.70	24.50			25.65	24.46				
F7	Winter	21.89	21.50	22.21	22.15	19.23	19.23	21.20	21.39	21.71	21.77
	Summer	22.54	22.80			23.18	23.55				
F8	Winter	20.57	21.47	20.65	21.38	19.15	19.15	20.76	21.00	20.71	21.19
	Summer	20.74	21.29			22.38	22.86				
Mean		22.11	21.93	22.11	21.93	21.84	21.71	21.84	21.71	21.98	21.82

F1 Ammonium sulphate 450 kg /fed.
F2 Biofertilizer + Ammonium sulphate 300 kg /fed
F3 Biofertilizer+10 m^3 poultry manure/fed (Bio+10 m^3 PM/fed.)
F4 Biofertilizer + Ammonium sulphate 300 kg /fed +10 m^3 poultry manure.
F5 Biofertilizer+2ton compost/fed
F6 Biofertilizer + Ammonium sulphate 300 kg /fed + 2ton compost/fed
F7 Biofertilizer + 10 m^3Biogas manure/fed.
F8 Biofertilizer + Ammonium sulphate 300 kg /fed +10 m^3Biogas manure/fed.

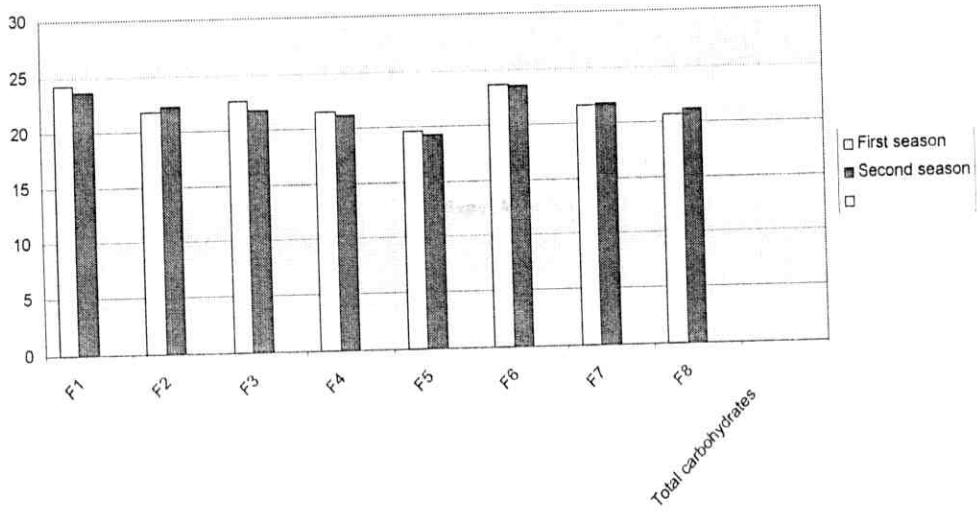


Fig (8-a): Effect of fertilization treatments on total carbohydrates (%) of *Tanacetum vulgare*. plants during 2002/2003–2003/2004 seasons.

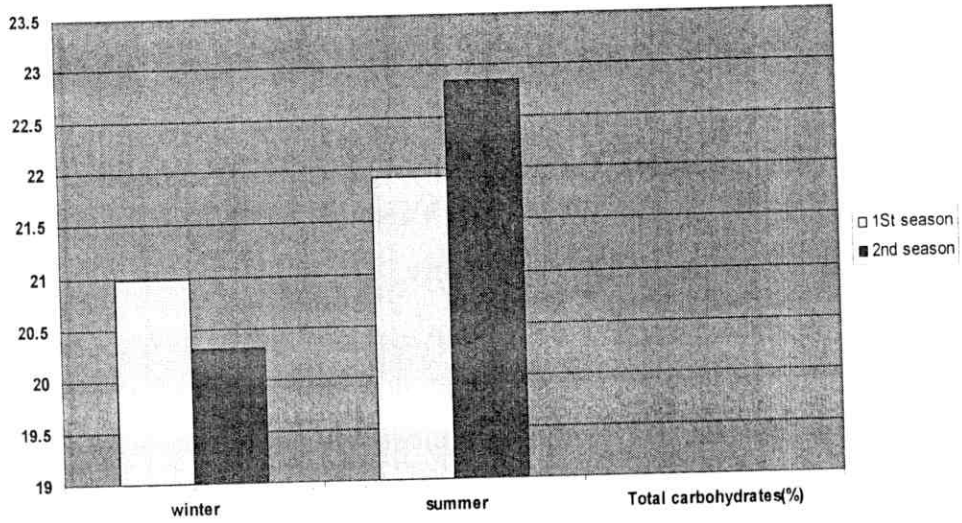


Fig (8-b): Effect of sowing dates on total carbohydrates (%) of *Tanacetum vulgare* plants during 2002/2003–2003/2004 seasons.

generally favourable effect on total carbohydrates percentage % than winter planting the percentages of increases of summer sown plants were (4.28% and 11.07 %) over winter planting in the first and second season, respectively.

Referring to the interaction effect between fertilizers and cuts (regardless sowing date) data presented in Table (15) cleared that The treatments of F_1 and F_6 led to produce the greatest leaf total carbohydrates content (%) of *Tanacetum vulgare* plants in the first cut as they gave (24.59 and 23.68%) in the first season and (23.99 and 24.16%) in the second one, respectively. Also, the abovementioned two treatments succeeded in increasing this parameter in the second cut as they gave (23.81 and 23.53%) in the first season and (23.26 and 22.93%) in the second season, respectively. Moreover, using F_3 resulted in highly increments in this parameter as it gave in the first cut (22.72 and 21.37% & 22.55 and 22.24%) in the second cut, in the first and second seasons, respectively. On the contrary, the lowest mean values of this parameter was recorded by using F5 which gave (19.58 and 18.86%) in the first cut and (19.70and 19.55 %) in the second cut in the first and second seasons, respectively.

As for the interaction effect between fertilizers, sowing date and cuts, data in Table (15) declared that summer grown plants treated with F_6 showed to be the most effective treatment for producing the greatest leaf total carbohydrates content (%) in the second cut as it gave 25.65% followed descendingly by summer grown plants treated with F1 (450 kg ammonium sulphate/fed) as it gave (25.63%) in the second cut and (24.99%) in the first cut. Moreover, winter grown plants treated with F_1 in the first cut and

fertilization level. **Ali (2002)** on *Foeniculum vulgare* Mill found that100, 200, 300 kg ammonium sulfate/feddan cased increases in the carbohydrates content in the fruts.

Hamed (2004) studied the effect of biofertilization on *Salvia officinalis* using a mixture of 5 strains namely: *Azotobacter chroococcum*, *Azospirillum lipoferum*, *Bacillus polymixa*, *Bacillus megatherium* and *Pseudomonas fluorescence* in the presence of full dose of NPK (600 kg ammonium sulfate + 200 kg calcium super phosphate + 100 kg potassium sulfate/fed./ year). He mentioned that the highest values of total carbohydrates in the herb were recorded at the treatment of biofertilizer plus full dose of N and P than the other treatments and control plants.

IV-3-9- Nitrogen percentage:

Data presented in Table (16) and Fig (9-a) show that, fertilized *Tanacetum vulgare* plants with F_6 (Biofertilizer + ammonium sulphate 300 kg /fed + 2ton compost/fed) showed its superiority for increasing nitrogen percentage in there tissues as it gave (3.09 and 3.11 N%) followed descendingly by using F1 (450 kg ammonium sulphate/fed) which recorded (3.07 and 3.09 N%) in the first and second seasons, respectively. Additionally, irrespective the abovementioned treatments, using the treatments of F_7 and F_8 succeeded in increasing N content in the tissues when compared with the other treatments as they gave (2.96 and 2.83N%) in the first season and (2.99 and 2.97 %) in the second one, respectively. On the opposite the lowest value was obtained from plants received F_5 (bio+2ton compost/fed.) which produced the lowest values as the percentages of decreases lower than the 450 kg ammonium sulphate/fed. were (31.87%) in the first season and (31.28%) in the

summer grown plants treated with F_3 in the second cut resulted in highly increases of this parameter as they recorded (24.19 and 24.01%) respectively.

This trend was true only in the first season while, in the second season on summer grown plants treated with F_1 showed its superiority for increasing leaf total carbohydrates content (%) in the second cut as it gave (24.54%) followed descendingly by summer grown plants treated with F_6 as it gave (24.50%) in the first cut and (24.46%) in the second cut. Furthermore, summer grown plants treated with F_1 and winter grown plants treated with F_6 succeeded in increasing leaf total carbohydrates content (%) as they registered in the first cut (24.33) and (23.83%) respectively.

On the contrary, the least mean values of this parameter was obtained in the second cut by sowing Tansy plants in the winter and received F_5 as it gave (18.33 and 18.33 %) followed descendingly by sowing the plants in the winter and fertilized with F_5 as it gave (18.65 and 18.63 %) in the first cut in the first and second seasons, respectively. All other treatments had no clear trend on total carbohydrates content, which varied from one season to another and from cut to other. From the results discussed in Tables (13, 15 and 18).it may be concluded that the increases in carbohydrates content due to F6 and F1 were attributed to the similar increases in both chlorophylls and potassium contents. This can be interpreted by the role of chlorophylls in photosynthesis as well as K function in swiftness, translocation and storage of carbohydrates.

These results are in agreement with those reported by **El-Ghawwas (1988)** who showed that in chamomile the highest total carbohydrates percentage obtained from the highest

Table (16): Effect of fertilization treatments and sowing date on nitrogen (%) of *Tanacetum vulgare* plants during 2002/2003–2003/2004 seasons.

Treatments		1st cut				2nd cut				Mean	
				Mean				Mean			
		1st season	2nd season	1st season	2nd season	1st season	2nd season	1st season	2nd season	1st season	2nd season
F1	Winter	3.12	3.12	3.12	3.13	2.96	2.96	3.01	3.04	3.06	3.08
	Summer	3.12	3.14			3.06	3.12				
F2	Winter	2.75	2.77	2.76	2.80	2.66	2.66	2.67	2.70	2.72	2.75
	Summer	2.77	2.83			2.69	2.74				
F3	Winter	2.38	2.36	2.37	2.51	2.26	2.26	2.29	2.33	2.33	2.42
	Summer	2.36	2.66			2.33	2.40				
F4	Winter	2.52	2.41	2.46	2.49	2.28	2.28	2.37	2.38	2.42	2.44
	Summer	2.41	2.58			2.46	2.48				
F5	Winter	2.23	2.08	2.14	2.16	1.90	1.90	2.03	2.07	2.09	2.12
	Summer	2.05	2.25			2.17	2.24				
F6	Winter	3.14	3.15	3.13	3.14	2.99	2.99	3.04	3.07	3.09	3.11
	Summer	3.13	3.13			3.09	3.16				
F7	Winter	3.03	3.00	3.01	3.03	2.85	2.85	2.90	2.94	2.96	2.99
	Summer	3.00	3.07			2.95	3.04				
F8	Winter	2.90	3.12	2.89	3.02	2.71	2.71	2.77	2.91	2.83	2.97
	Summer	2.89	2.92			2.83	3.12				
Mean		2.74	2.79	2.74	2.79	2.64	2.68	2.64	2.68	2.69	2.73

F1 Ammonium sulphate 450 kg /fed.
F2 Biofertilizer + Ammonium sulphate 300 kg /fed
F3 Biofertilizer+10 m^3 poultry manure/fed (Bio+10 m^3 PM/fed.)
F4 Biofertilizer + Ammonium sulphate 300 kg /fed +10 m^3 poultry manure.
F5 Biofertilizer+2ton compost/fed
F6 Biofertilizer + Ammonium sulphate 300 kg /fed + 2ton compost/fed
F7 Biofertilizer + 10 m^3Biogas manure/fed.
F8 Biofertilizer + Ammonium sulphate 300 kg /fed +10 m^3Biogas manure/fed.

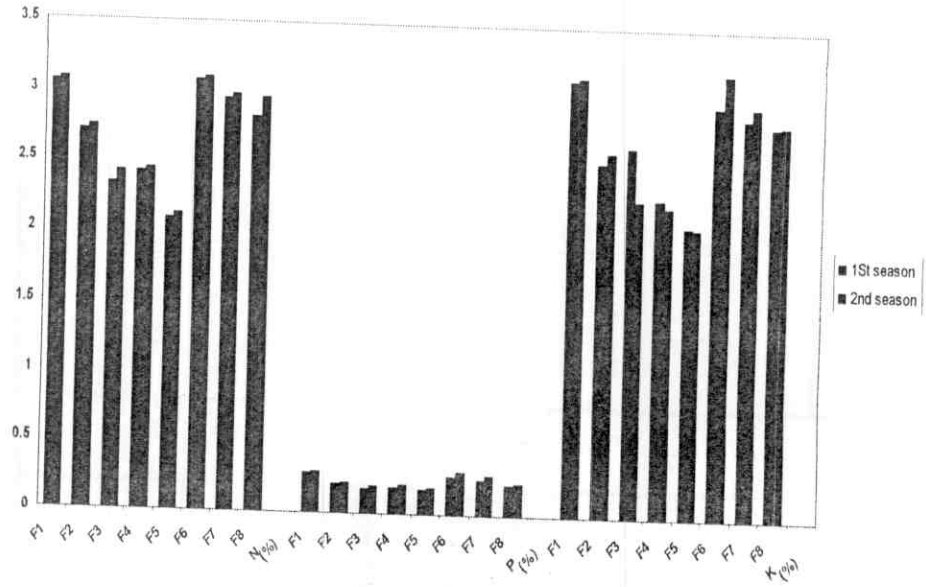


Fig (9-a): Effect of fertilization treatments on nitrogen, phosphorus and potassium (%) of *T. vulgare* plants during 2002/2003–2003/2004 seasons.

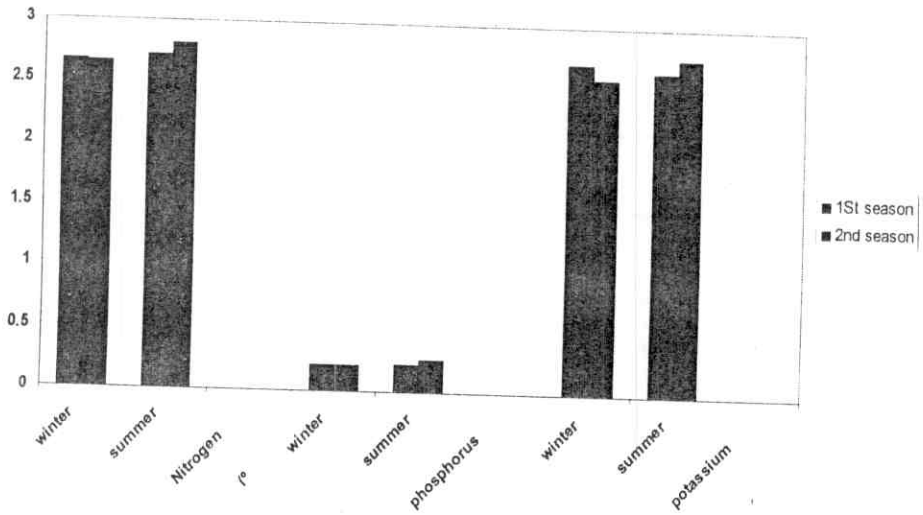


Fig (9-b): Effect of sowing dates on nitrogen, phosphorus and potassium (%) of *Tanacetum vulgare* plants during 2002/2003–2003/2004 seasons.

second season, followed descendingly by using F_2 (Biofertilizer + ammonium sulphate 300 kg /fed) which recorded the percentages of decreases (12.76 %) and (12.18 %) in the first and second seasons, respectively. However, the rest treatments occupied intermediate place between the aforesaid treatments.

Concerning the specific effect of sowing date on nitrogen percentage % of *Tanacetum vulgare* plants. The results recorded in Table (19) and Fig (9-b) show that summer planting had generally favourable effect on nitrogen percentage % than winter planting the percentages of increases of summer sown plants were (1.50% and 5.64%) over winter planting in the first and second seasons, respectively.

Referring to the interaction effect between fertilizers and cuts (regardless sowing date) data presented in Table (16) cleared that the highest values of nitrogen percentage was produced in the first cut when the plants of Tansy treated with F_6 (Biofertilizer + ammonium sulphate 300 kg /fed + 2ton compost/fed) which gave (3.13 and 3.14 %) followed descendingly by using F1 (450 kg ammonium sulphate/fed) which registered (3.12 and 3.13 %) in the first and second seasons, respectively. Furthermore, fertilized Tansy plants with F_7 or F_8 resulted in highly increases in this parameters in the first cut as it gave (3.02 and 2.90 %) in the first season and (3.04and 3.02 %) in the second season, respectively.

As for interaction effect between fertilizers, sowing date and cuts, data in Table (16) declared that the highest leaf nitrogen content (%) was obtained by sowing Tansy plants in the winter and treated with F_6 as they recorded in the first cut (3.14 and 3.15 %) in the first and second seasons, respectively followed by sowing the

plants in the summer and fertilized with F_1 as they gave (3.14 %) in the first cut this trend was true only in the second season, Also, summer sown plants treated with F_6 resulted in highly increases in this parameter in the second cut as they gave (3.16). This trend was true only in the second season while, the greatest leaf nitrogen content (%) of *Tanacetum vulgare* was registered in the first cut when the plants was sown in the summer and treated with F_6 as it gave (3.13%) followed descendingly by winter sown plants treated with F1 (ammonium sulphate 450 kg /fed) as it gave in the first cut (3.12%) the same value was registered in both seasons. On the reverse, the lowest mean value of this parameter was registered by winter grown plants treated with F_5 in the second cut as it gave the same exact value (1.90%) in both seasons of this study.

This increment may be due to the availability of nitrogen for plant absorption. In this respect **Afify *et al.*** (1993) on *Salvia officinalis* applied nitrogen fertilization at 0, 50, 100 and 150 kg urea/fed. They noticed that essential oil yield/plant improved as a result of increasing N- fertilization level. The best results were obtained by using the highest N-level (150 kg/fed.), **Rohricht *et al.* (1997)** on yield and composition of *Chamomilla recutita* found that, essential oil concentration also increased with N application. N content of flowers and plants increased with increasing N fertilizer. Flower essential oil concentration was highest if harvested when 70% of plants were in full flower. **Badawi (2000)** on roselle found that, the highest increases of N in leaves, seeds and sepals were recorded from the treatment of 300 kg N + 200 kg P + 100 kg K + biofertilizers. and **Hamed (2004)** studied the effect of biofertilization on *Salvia officinalis* using a mixture of 5 strains

namely: *Azotobacter chroococcum*, *Azospirillum lipoferum*, *Bacillus polymixa*, *Bacillus megatherium* and *Pseudomonas fluorescence* in the presence of full dose of NPK (600 kg ammonium sulfate + 200 kg calcium super phosphate + 100 kg potassium sulfate/fed./ year). He mentioned that the highest values of N in the herb were recorded at the treatment of biofertilizer plus full dose of N and P than the other treatments and control plants.

IV-3-10- Phosphorus content:

Data recorded in Table (17) and Fig (9-a) emphasized that, generally the high value was obtained from plants fertilized with F_6 (regardless cuts and sowing date) which gave (0.28 and 0.31%) in the first and second seasons, respectively, followed descendingly by using F1 (450 kg ammonium sulphate/fed) which recorded (0.28 and 0.30%) in the first and second seasons. Moreover, F_7 (Biofertilizer + 10 m^3 biogas/fed.) succeeded in increasing phosphorus content in the leaves in both seasons, the values were (0.29 and 0.29 %) in the first and second seasons, respectively. Also the plants treated with F_8 gave high value in the leaves but the values were less than the 450 kg ammonium sulphate/fed. (0.22 and 0.24 %) in the first and second seasons, respectively.

On the other side, the lowest values of this parameter was obtained by treating plants with F_3 (Biofertilizer+10 m^3 poultry manure/fed) the percentages of decreases were (37.102 and 32.881%) lower than F1 (450 kg ammonium sulphate/fed) followed descendingly by using F_5 which recorded the percentages of decreases (36.40 and 36.27 %) in the first and second seasons, respectively. However, the rest treatment F_4 occupied intermediate place between the aforesaid treatments.

Table (17 fresh): Effect of fertilization treatments and sowing date on phosphorus (%) of *Tanacetum vulgare* plants during 2002/2003–2003/2004 seasons.

Treatments		1st cut				2nd cut				Mean	
		1st season	2nd season	Mean		1st season	2nd season	Mean		1st season	2nd season
				1st season	2nd season			1st season	2nd season		
F1	Winter	0.32	0.30	0.30	0.31	0.24	0.24	0.26	0.28	0.28	0.29
	Summer	0.28	0.32			0.29	0.32				
F2	Winter	0.25	0.24	0.24	0.24	0.16	0.16	0.19	0.21	0.21	0.22
	Summer	0.23	0.25			0.22	0.26				
F3	Winter	0.22	0.22	0.21	0.22	0.12	0.12	0.14	0.17	0.17	0.19
	Summer	0.20	0.23			0.17	0.22				
F4	Winter	0.23	0.22	0.22	0.23	0.14	0.14	0.16	0.18	0.19	0.20
	Summer	0.21	0.25			0.19	0.22				
F5	Winter	0.24	0.20	0.21	0.20	0.13	0.13	0.15	0.17	0.18	0.19
	Summer	0.18	0.21			0.17	0.21				
F6	Winter	0.34	0.32	0.28	0.32	0.24	0.24	0.26	0.29	0.27	0.31
	Summer	0.23	0.33			0.29	0.35				
F7	Winter	0.30	0.31	0.29	0.31	0.20	0.20	0.22	0.26	0.25	0.28
	Summer	0.28	0.32			0.25	0.32				
F8	Winter	0.26	0.25	0.24	0.25	0.17	0.17	0.19	0.21	0.21	0.23
	Summer	0.22	0.26			0.22	0.26				
Mean		0.24	0.26	0.24	0.26	0.20	0.22	0.20	0.22	0.22	0.24

F1 Ammonium sulphate 450 kg /fed.
F2 Biofertilizer + Ammonium sulphate 300 kg /fed
F3 Biofertilizer+10 m^3 poultry manure/fed (Bio+10 m^3 PM/fed.)
F4 Biofertilizer + Ammonium sulphate 300 kg /fed +10 m^3 poultry manure.
F5 Biofertilizer+2ton compost/fed
F6 Biofertilizer + Ammonium sulphate 300 kg /fed + 2ton compost/fed
F7 Biofertilizer + 10 m^3Biogas manure/fed.
F8 Biofertilizer + Ammonium sulphate 300 kg /fed +10 m^3Biogas manure/fed.

In respect to the effect of sowing date (regardless fertilizers and cuts) it is worthy to notice that the greatest content of phosphorus in Tansy leaves was recorded (Tables 19 and Fig 9-b) in summer planting which had generally favourable effect on increasing phosphorus content in Tansy leaves the mean recorded (0.23 and 0.27%) in the first and second seasons, respectively. compared with winter planting as it gave (0.22%) in both seasons, respectively.

Concerning to the interaction effect between fertilizers and cut (regardless sowing date) data presented in Table (17) cleared that fertilized *Tanacetum vulgare* plants with F_1 (450 kg ammonium sulphate/fed) showed to be the most effective treatment in the first cut for inducing the highest leaf phosphorus content (%) as it gave (0.30%) followed descendingly by using F_7 which gave in the first cut (0.29%). Moreover, using F_6 in the first cut and F_1 in the second cut resulted in highly increases in this parameter when compared with the other treatments as they gave (0.29 and 0.27%), respectively. This trend was true only in the first season, while in the second one, using F6 in the first cut showed its superiority for producing the greatest leaf phosphorus content (%) as it gave (0.33%) followed descendingly by using F_7 and F_1 in the first cut, as they gave (0.32 and 0.31%), respectively. Also, using F_1 succeeded in increasing leaf phosphorus content (%) in the second cut as it gave (0.27%).

On the reverse, the lowest phosphorus percentage in the leaves obtained in the second cut when the plants of *Tanacetum vulgare* treated with F_3 and F_5 as they gave (0.15 and 0.15 %) in the

first season and (0.17 and 0.17 %) in the second season, respectively.

As for the interaction effect between fertilizers, sowing date and cut, data in Table (17) emphasized that, in the first season winter sown plants treated with F_6 showed to be the most effective treatment for increasing leaf phosphorus content (%) in the first cut as it gave 0.34% followed descendingly by winter grown plant treated with F_1 and F_7 in the first cut as they gave (0.32 and 0.30%), respectively. Furthermore, summer grown plant treated with F_6 or F_1 succeeded in increasing this parameter in the second cut as they gave the same exact value (0.29%). While, in the second season, summer grown plants treated with F6 exhibited to be the most effective treatment for producing the highest leaf phosphorus content (%) of *Tanacetum vulgare* as it gave (0.35%) in the second cut and (0.33%) in the first cut. Besides, summer grown plants treated with F_7 or F_1 succeeded in increasing this parameter as they gave the same exact values in both cuts (0.32%). On the contrary, the lowest leaf phosphorus content (%) of *Tanacetum vulgare* was obtained in the second cut with winter grown plant treated with F_3 (0.12% in both seasons) and F_5 (0.13% in both seasons).

Regarding the two seasons it may be concluded that the treatment by F_7 in winter as well as summer to the first and second cuts, respectively in addition to F1 (450 kg ammonium sulphate/fed) resulted in the best phosphorus content in the leaves. The increase in phosphorus content in the leaves of Tansy as a result of chemical fertilization may be due to the increase in phosphorus absorption and its role in production of nucleic acids and coenzymes as NAD (Nicotinamide Adinozine Dinuceleotide),

NADP, FAD (Flavine Adenine Dinucelotide) and ATP as mentioned by **Omer (1998)**. These results may be due to the effect of biofertilizers , biofertilizers possess the ability to bring insoluble phosphorus in soil into soluble forms by secreting organic acids such as formic, acetic, propionic, lactic, glycolic, fumaric and succinic acids. These acids lower the pH and bring about the dissolvation of bound forms of phosphate. Some of the hydroxyl acids may chelate with calcium and iron resulting in effective solubilization and utilization of phosphate **(Gaur and Ostwal (1972)**. These results are in the same trend with those obtained by **Guerrero-Trivino and Johnson (2000)** and **Arun Prasad *et al.* (1997)** on chamomile they found that, N fertilization significantly increased uptake of P. **Badawi (2000)** on roselle found that, the highest increases of P in leaves, seeds and sepals were recorded from the treatment of 300 kg N + 200 kg P + 100 kg K + biofertilizers.

IV-3-11- Potassium percentage:-

Data of the effect of fertilizer treatments and sowing date on percentage of potassium *Tanacetum vulgare* Leaves in the two cuts during the two seasons of this study are shown in Table (18) and Fig (9-a).It is evident from data that fertilized *Tanacetum vulgare* plants with F6(regardless cuts and sowing date) showed to be the most effective treatment for producing the richest leaf potassium content (%) as it gave (3.19%) in the second season followed descendingly by using F_1 (450 kg ammonium sulphate/fed.) which showed its superiority for producing the greatest leaf potassium content (%) as it gave (3.15 %) in the second season and (3.130 %)

Table (18): Effect of fertilization treatments and sowing date on potassium (%) of *Tanacetum vulgare* plants during 2002/2003–2003/2004 seasons.

Treatments		1st cut				2nd cut				Mean	
				Mean				Mean			
		1st season	2nd season	1st season	2nd season	1st season	2nd season	1st season	2nd season	1st season	2nd season
F1	Winter	3.18	3.16	3.16	3.17	3.03	3.03	3.10	3.13	3.13	3.15
	Summer	3.14	3.19			3.17	3.23				
F2	Winter	2.54	2.53	2.57	2.65	2.45	2.45	2.50	2.56	2.53	2.60
	Summer	2.60	2.78			2.56	2.67				
F3	Winter	3.99	2.22	2.13	2.35	2.07	2.07	2.17	2.19	2.65	2.27
	Summer	2.28	2.49			2.27	2.31				
F4	Winter	2.34	2.15	2.34	2.25	2.10	2.10	2.22	2.21	2.28	2.23
	Summer	2.34	2.35			2.34	2.33				
F5	Winter	2.12	2.02	2.15	2.08	1.92	1.92	2.03	2.07	2.09	2.07
	Summer	2.18	2.15			2.15	2.22				
F6	Winter	3.22	3.08	2.75	3.16	3.08	3.08	3.16	3.21	2.95	3.19
	Summer	2.28	3.25			3.24	3.35				
F7	Winter	2.92	3.04	2.91	3.01	2.75	2.75	2.82	2.90	2.87	2.95
	Summer	2.91	2.99			2.90	3.05				
F8	Winter	2.75	2.96	2.94	2.88	2.68	2.68	2.70	2.78	2.82	2.83
	Summer	3.14	2.81			2.72	2.89				
Mean		2.74	2.69	2.74	2.69	2.58	2.63	2.58	2.63	2.66	2.66

F1 Ammonium sulphate 450 kg /fed.
F2 Biofertilizer + Ammonium sulphate 300 kg /fed
F3 Biofertilizer+10 m^3 poultry manure/fed (Bio+10 m^3 PM/fed.)
F4 Biofertilizer + Ammonium sulphate 300 kg /fed +10 m^3 poultry manure.
F5 Biofertilizer+2ton compost/fed
F6 Biofertilizer + Ammonium sulphate 300 kg /fed + 2ton compost/fed
F7 Biofertilizer + 10 m^3Biogas manure/fed.
F8 Biofertilizer + Ammonium sulphate 300 kg /fed +10 m^3Biogas manure/fed.

in the first season Furthermore, fertilized Tansy plants with F_6 or F_7 resulted in highly increases in this parameters in the first season as they gave (2.96 and 2.87%), respectively. Moreover, using F_8 succeeded in increasing leaf potassium content (%) as it recorded (2.82%). This trend was true only in the first season, Besides, using F_7 and F_8 resulted in highly increment in this parameter in the second season when compared with the other treatments as they gave (2.96 and 2.84%) respectively. On the contrary, the lowest mean value of this parameter was obtained by using F_5 (2.09and 2.07 %) in the first and second seasons, respectively.

In respect to the specific effects of sowing date (regardless fertilizers and cuts) it is obvious that the greatest content of potassium content in Tansy leaves was recorded (Table 19 and Fig 9-b) in summer planting which had generally favourable effect on potassium content in Tansy leaves the mean recorded (2.64 and 2.75%.) in the first and second seasons, respectively. compared with winter planting as it gave (2.70 and 2.58%) in both seasons, respectively.

Concerning to the interaction effect between fertilizers and cuts (regardless sowing date) data presented in Table (18) cleared that the highest mean values of leaf potassium content (%) was gained in the second season of the second cut the value was (3.215) followed descendingly by using F_1 in the second season of the first cut which gave (3.175) Moreover, treated *Tanacetum vulgare* plants with F6 was recorded (3.17 %) in the first season of the first cut, Besides, treated with F_1 or F_6 succeeded in increasing this parameter the corresponding values were (3.160) in both seasons and both cuts . Moreover, using F_1 (in the second cut) and F_7 (in the

Table (19): Effect of sowing date on vegetative growth, flowering, chemical composition and essential oil productivity of *Tanacetum vulgare* plants during 2002/2003 and 2003/2004.

Sowing date / Parameters	Winter		Summer	
	1St season	2nd season	1St season	2nd season
Plant height cm	86.02	87.13	94.70	97.98
Number of branches	9.52	10.25	12.53	14.73
Fresh weight/plant gm	450.72	438.86	719.03	1270.38
dry weight/plant gm	96.88	100.26	193.29	208.71
Number of flower heads	144.27	139.95	158.72	166.40
Fresh weight of flower heads gm	304.01	296.29	421.52	447.52
dry weight of flower heads gm	90.59	96.80	214.14	150.65
oil percentages (%) fresh leaves	0.35	0.42	0.49	0.42
oil percentages (%) in flower heads	1.98	1.95	2.17	2.22
nitrogen (%)	2.67	2.66	2.71	2.81
phosphorus (%)	0.22	0.22	0.23	0.27
potassium (%)	2.70	2.58	2.64	2.75
Total carbohydrates (%)	20.99	20.31	21.93	22.84
chlorophyll a contents (mg/g f.w)	1.32	1.27	1.47	1.49
chlorophyll b contents (mg/g f.w)	1.039	0.992	1.250	1.2380
total chlorophyll contents (mg/g f.w)	2.400	2.250	2.730	2.730
total carotenoids content (mg/g f.w)	0.700	0.690	0.760	0.710

first cut) resulted in highly increases in this parameter as they gave (3.10 and 3.13%) for F_1 and (2.92 and 3.02%) for F_7 in the first and second seasons, respectively. However, the lowest mean values of this parameter was recorded in the second cut by using F_5 as it gave (2.04 and 2.07%) in the first and second seasons, respectively.

Regarding the interaction effect between fertilizers, sowing date and cuts, data in Table (18) declared that the best potassium content of Tansy plant was obtained in the first cut when the plants were sown in winter and fertilized with F_3 as it produced (3.99 %) in the first season of the first cut such result was much better than the second season of the first cut which recorded (2.22 %) followed by using the treatment of F_6 when the plants were sown in summer as it gave (3.24 and 3.35 %) in the first and second seasons of the second cut, respectively.

Also the abovementioned treatment of F_6 succeeded in increasing the potassium percentage in the first cut when the plants were sown in winter and summer. This treatment induced highly increments in this parameter as it gave (3.22 and 3.08 %) in the winter and (2.28 and 3.25 %) in the summer in the first and second seasons of the first cut, respectively. Additionally, irrespective the abovementioned treatments using F1 (450 kg ammonium sulphate/ fed) succeeded in increasing the potassium percentage of leaves when compared with the other treatments as it gave in winter (3.18 and 3.16 %) while it gave in summer (3.14 and 3.19 %) in the first and second seasons of the first cut, respectively. The same trend was observed in the second cut. On the contrary, the least mean values of this parameter was obtained by sowing *Tanacetum vulgare* plants in the winter and received F_5 as it gave (1.92 and

1.92 %) followed dscendingly by sown the plants in the winter and fertilized with F_3 (2.070 and 2.070 %) in the second cut in the first and second seasons, respectively.

These results are in agreement with those of **El-Ghawwas (1988)** who showed that, the percentages of potassium in chamomile plant tissues gradually increased during January and February and there were much greater increases during March and April there was little influence of the higher fertilization levels on potassium percentages at all sampling dates. **Arun Prasad *et al.* (1997)** on chamomile found that, N fertilization significantly increased uptake of K, **Badawi (2000)** on roselle found that, the highest increases of K percentage in leaves, seeds and sepals were recorded from the treatment of 300 kg N + 200 kg P + 100 kg K + biofertilizers.

Hamed (2004) studied the effect of biofertilization on *Salvia officinalis* using a mixture of 5 strains namely: *Azotobacter chroococcum*, *Azospirillum lipoferum*, *Bacillus polymixa*, *Bacillus megatherium* and *Pseudomonas fluorescence* in the presence of full dose of NPK (600 kg ammonium sulfate + 200 kg calcium super phosphate + 100 kg potassium sulfate/fed./ year). The highest values of K in the herb were recorded at the treatment of biofertilizer plus full dose of N and P than the other treatments and control plants.