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Effect of Intercropping of Thompson Seedless Grapevines with some Medicinal Plants on Vine Nutritional Status, Yield, Berry Quality and the Microbiological Activity of the Soil

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ABSTRACT

This study was carried out during two successive seasons (2015 & 2016) in a private vineyard farm at Boktares village, Aga, Dakahlia Governorate, Egypt. The experiment was conducted on 12 years old Thompson seedless grapevines cultivar in a clay soil under surface irrigation system. The vines were trained on three vertical wires system and cane-pruned. Seeds of four medicinal plants; fenugreek, anise, black cumin and parsley were planted in rows between the vines rows in the fourth week of September 2014 and 2015 seasons. At the same time different plots were cultivated by different medicinal plants as sole crops to compare growth characters and medicinal plants yield under intercropping conditions with individual cultivation of medicinal plants without intercropping. The aim of this study was to evaluate the efficacy of intercropping of Thompson seedless grapevines with some medicinal on vines nutritional status, yield, berry quality and the microbiological activity of the soil. Obtained results revealed that intercropping of Thompson seedless grapevines with all used medicinal plants increased N, P , K and organic matter (O M) in the soil, which enhanced vines nutritional status, vegetative growth, yield and berry quality. Vines intercropped with fenugreek plant significantly increased shoot length, leaf area and total chlorophyll content in the leaves as well as yield per vine, soluble solids content and total sugar, while reduced the total acidity in berries. In addition, increased total microbial count, dehydrogenase and phosphatase enzymes activity in the rhizosphere. The economical study indicated that intercropping Thompson seedless with fenugreek gave the highest net profit/ feddan followed by intercropping Thompson seedless with black cumin, parsley and anise, respectively.

Keywords: Grape, Thompson seedless, Intercropping, Medicinal plants, Fenugreek, Anise, Black cumin and Parsley.

INTRODUCTION

Grape (*Vitis vinifera,* L.) is ranked number one of fruit crops in the world. In Egypt, it is the second fruit crop after citrus. The total cultivated area of grape in Egypt reached about 196993 feddans with 178323 feddans fruitful area, the total production recorded 1686706 tons Ministry of Agriculture (2016). Thompson seedless grape is an important table grape cultivar grown in Egypt.

Grape orchard provides an opportunity for utilizing the land space to its maximum during dormant period in the winter season. Due to wider spacing and developing root patterns, the large unutilized inter-space of about 60 to 70 % can be exploited for growing mixed crops successfully.

Intercropping is the growing of two or more crops simultaneously on the same field (Sangakkara *et al.,* 2003 and Belel *et al.,* 2014). Intercropping can be used by smallholder farmers to increase the diversity of their product and the stability of their annual output through effective use of land and other resources Okonji *et al. (*2012).

Benefits of intercropping include providing organic matter, reduce fertilizer costs, optimal use of resources, stabilization of yield, weed suppression, improve soil fertility conservation, and higher economic returns (Blaser *et al.,* 2007 and Kabura *et al.,* 2008). Moreover cover crops can provide multiple benefits in vineyard management such as reduce soil erosion, improve soil structure, suppression of weed growth, increase water infiltration, reduce ground water pollution, reduce sunburn of fruit, reduce input costs and increase farm profitability (Miller *et al.,* 1989, Smith, 1993 and Amjad *et al.,*2015) Also, when the prices of the grapes are down in the out break of a disease or when the vines are still not producing a companion crop can provide another source of income (Abd El-Samad, 2006 and Rizk, 2012). In addation, the negative effects of intercropping winter season were not found during dormant period. On the other hand by giving irrigation water to these crops during winter, the vines would continue to get some growth which affects very badly in the next cropping. Shoeib (2012).

For solving the problem of lack in drugs, high price and reduce drugs importation in Egypt, more attention should be given to expansion the cultivation of medicinal plants through intercropping with fruit crops, especially grapes. Medicinal plants have many medicinal properties, which employed in drug industry. Fenugreek (*Trigonella foenum-graecum* L.) is known to have hypoglycemic and hypocholesterolaemic, anti-inflammatory effects. Recent research has identified fenugreek as a valuable medicinal plant with potential for curing diseases and also as a source for preparing raw materials of pharmaceutical industry, like in steroidal hormones Snehlata and Payal (2011). Anise (*Pimpinella anisum*, L) is used as carminative, antiseptic, antispasmodic, expectorant, stimulant, and stomachic. In addition, it has been used to promote lactation in nursing mothers and as a medicine against bronchitis and indigestion Muller-Schwarze (2006). Additionally, the various extracts and essential oils of anise seeds have antimicrobial, antioxidative and antifungal activities (Gulcin *et al.,* 2003 and Kosalec *et al.,* 2005). Black cumin (*Nigella sativa* L.) is grown for its seeds which are used dried in foods, pickles, baked goods and confectionery and in the perfumery and medicinal industries. It has antifungal, antibacterial, antiparasitic, anti-inflammatory, antioxidant and several other immunological activities Malhotra (2012). Parsley (*Petroselinum sativum* L.) is an annual culinary herb widely used for its medicinal value as diuretic, carminative,

antipyretic, antiviral, antibacterial, anti-inflammatory, anticancer and antioxidant properties Charles (2012)

Today cover cropping is common practice that is being used in Dakahlia Governorate vineyards by using field crops, such as clover and vegetable crops, such as pea, onion and bean with neglecting the cultivation of medicinal plants. Therefore, the objective of this study was to evaluate the efficacy of intercropping of Thompson seedless grapevines with different medicinal plants, i.e. fenugreek, anise, black cumin and parsley on vine nutritional status, yield, berry quality and the microbiological activity of the soil.

MATERIALS AND METHODS

This investigation was carried out during two successive seasons (2015 and 2016) in a private vineyard farm at Boktares village, Aga, Dakahlia Governorate, Egypt. The experiment was conducted on 12 years old Thompson seedless grapevines. Vines were cultivated at 2 x 2 m. in a clay soil under flood irrigation system. The vines were trained on three vertical wires system. During January of each season, the tested vines were pruned to 6 canes with 12 buds each along with 6 renewal spurs, two buds each. The total bud load was 84 buds. Sixty uniform vines in vigor as possible were chosen for this study, all vines received the same cultural managements recommended by Ministry of Agriculture.

The experiment consisted of five treatments arranged in a randomized complete block design, each treatment include three replicates, five vines each. Applied treatments were as follow:

1- Thompson seedless alone (control)
2- Thompson seedless + fenugreek
3- Thompson seedless + anise
4- Thompson seedless + black cumin
5- Thompson seedless + parsley

Seeds of four medicinal plants fenugreek (Trigonella foenum-graecum, L.), anise (Pimpinella anisum, L.), black cumin (Nigella sativa, L.) and parsley (Petroselinum sativum, L.) were planted in rows between the vines rows in the fourth week of September 2014 and 2015 seasons. At the same time different plots were cultivated by different medicinal plants as sole crops to determine their vegetative growth characters and medicinal plants yield under intercropping conditions with individual cultivation of medicinal plants without intercropping. All intercropped medicinal plants received cultural managements as recommended by the Egyptian Ministry of Agriculture and half dose of recommended fertilizers, while the sole medicinal plants plots received the full dose of fertilizers.

After 90 days from planting of medicinal plants, five random plants per replicate were taken from each treatment to estimate vegetative growth parameters (in terms of plant height (cm), number of branches per plant, number of leaves per plant and plant fresh and dry weights).

Two harvested were obtained from parsley as leaf yield then plants were left and harvested at end of April for seed yield while fenugreek, anise and black cumin were harvested at the end of April 2015and 2016 to evaluate seed yield /m2

Chemical properties of the soil at (0 - 60 cm soil depth) were determined in the second season after harvesting intercropping crops (Table 1) according to the methods described by Wilde *et al.* (1985)

The following characteristics were determined for grapes:

Vegetative growth parameters (shoot length and leaf area):

Vegetative growth parameters were taken from non bearing shoots and determined at fruit set as follows:

- Average shoots length (cm).
- Average leaf area (cm^2): Sixth and seventh leaves from the tip of the growing shoot were used for leaf area measurement Montero *et al.* (2000).

Total Chlorophyll content in the leaves:

Sixth and seventh leaves from the tip of the growing shoots were used for the determination of total chlorophyll content in the leaves at fruit set according to the methods described by Mackinny (1941) total chlorophyll was calculated as mg/g fresh weight.

N, P, K and Mg content in the leaves:-

At full bloom, samples of 20 leaf petioles per replicate were taken from leaves opposite to cluster to determine N, P, K and Mg content according to the methods described by Cottenie *et al.* (1982).

Yield / vine, cluster weight and 100 berry weight

Harvesting was carried out when the total soluble solid percentage reached about 16-17 % in the berries of control vines Sabry *et al.* (2009), then six clusters /vine were weighted and the average cluster weight was multiplied by number of clusters/ vine to calculate yield/vine, also, weight of 100 berries was considered.

Chemical properties:

- Soluble solids content (SSC %) was determined by using hand refractometer.
- Total acidity (%) was determined according to A O A C (1980).
- Total sugars (%) were determined in berries according to the methods described by Sadasivam and Manickam (1996)

Microbiological studies:

Samples of the soil were taken after harvesting each medicinal plant to determine:

- Total microbial count (-$x10^6$ colony forming unit (cfu)/g soil) Esher and Jensen (1972).
- Dehydrogenase enzyme activity (µgTPF/g/ D.W.s oil/day) Ping Dong (1997).
- Phosphatase enzyme activity (IP/g/D.W.soil/day) Drobnikova (1961).

Statistical Analysis

The statistical analysis of the present data was carried out according to the methods described by Snedecor and Chocran (1980). Treatments means were compared using the new LSD at 5% of probality

RESULTS AND DISCUSSION

Data in Table 1 revealed soil nutritional status in the second season after harvesting intercropping crops, which showed that intercropping vines with fenugreek, anise, parsley and black cumin increased nutrient elements N, P , K and O.M, while decreased pH and EC in the soil than control and that improve soil fertility properties may be

through the decompose of intercropping crops roots and secrete acids into the soil and put P into a more soluble as mentioned by Rizk (2012) on Thompson seedless grapevines and Shoeib (2012) on Flame seedless grapevines, where intercropping vines with Fenugreek gave the best results in this concern. Fenugreek has the ability to symbiotically associate with certain soil microbial such as rhizobia, which fix atmospheric nitrogen Chambliss *et al.* (2003). Fenugreek *(Trigonella foenum-graecum),* black cumin (*Nigella sativa)* and parsley *(Petroselinum sativum)* rhizosphere showed more positive rhizosphere effect on Azotobacter and Azospirillum than those of non-rhizosphere soil, which reflected in increasing N in the soil Heba (2008).

Table 1. Effect of intercropping of Thompson seedless grapevines with some medicinal plants on Chemical characteristics in the roots rhizosphere in the second season after harvesting intercropping crops

Characteristics / Treatments	N (ppm)	P (ppm)	K (ppm)	OM (%)	pH (1: 2.5)	EC (1:5) dS/m^{-1}
Thompson seedless alone (control)	14.26	12.8	251	1.37	8.37	0.876
Thompson seedless + Fenugreek	28.3	15.4	315	2.08	8.22	0.748
Thompson seedless + Anise	24.18	20.6	298	1.78	8.35	0.768
Thompson seedless + Black cumin	17.25	12.6	263	1.45	8.33	0.853
Thompson seedless + Parsley	19.2	13.3	311	1.53	8.37	0.888
New L S D at 5%	1.82	1.40	8.0	0.02	0.04	0.010

Shoot length, leaf area and total chlorophyll in leaves

It is evident from the obtained data in Table 2 that intercropping Thompson seedless grapevines with fenugreek and anise plants significantly increased shoot length and leaf area, while the effect of black cumin on leaf area and parsley on shoot length was insignificant as compared with control. Maximum values in shoot length 135 and 142 cm and leaf area 128 and 132 cm2 in the first season and the second season respectively, were due to intercropping Thompson seedless grapevines with fenugreek as compared with other treatments. Black comin treatment gave the lowest values of shoot length and leaf area in both seasons. These effects are due to decompose of intercropping crops roots and that increase nutrients and OM as shown in Table 1 especially in the second season, while in the first season as a result of adding dose of mineral fertilizers with intercropping crops. In addition, increased potassium concentration in leaf as shown in Table 3 may increase the number of chloroplast per cell, number of cells per leaf and consequently leaf area Taiz and Zeiger (1991).

Total chlorophyll content was significantly increased in the leaf of Thompson seedless grapevines especially with fenugreek. Total chlorophyll content in the leaves was 12.28 and 12.81 mg/g FW in both seasons. Data showed insignificant difference between intercropping parsley, black cumin and control in the first season, while in the second season the difference was significant. The promoting effect of fenugreek on increasing total chlorophyll may be due to more uptake of nutrients such as N and Mg as shown in Table 3, which involved in chlorophyll formation. Legume cover crops such as fenugreek have the ability to symbiotically associate with certain soil microbial such as rhizobia, which fix atmospheric nitrogen consequently increased N in the soil Chambliss *et al.* (2003).

Table 2. Effect of intercropping of Thompson seedless grapevines with some medicinal plants on Shoot length, leaf surface area and total chlorophyll during 2015 and 2016 seasons

Characteristics / Treatments	Shoot length (cm)		Leaf area (cm^2)		Total chlorophyll (mg/g FW)	
	2015	2016	2015	2016	2015	2016
Thompson seedless alone (control)	125	133	118	122	11.28	11.53
Thompson seedless + Fenugreek	135	142	128	132	12.28	12.81
Thompson seedless + Anise	133	139	126	130	12.12	12.45
Thompson seedless + Black cumin	112	122	115	122	11.47	11.88
Thompson seedless + Parsley	126	133	122	126	11.66	12.22
New L.S.D at 5%	7.0	6.0	5.0	5.0	0.41	0.30

N, P, K and Mg content in the leaves

Data presented in Table 3 showed that fenugreek significantly increased N 2.76 and 2.80 %, P 0.35 and 0.38%, K 1.72 and 1.78% and Mg 0.72 and 0.75% in leaf petiole of Thompson seedless grapevines in 2015 and 2016 seasons, respectively. Also, anise significantly increased N, P, K and Mg % as compared to control, where the effect between black cumin and parsley was insignificant in case of all studied leaf elements. On the other hand, the control vines (Thompson seedless grapevines alone) recorded the lower values for N, P, K and Mg in leaf petiole in 2015 and 2016 seasons. The enhancement effect of intercropping Thompson seedless grapevines with medicinal plants on improving nutritional status of the vine may be due to legume crops has the ability to fix nitrogen from the atmosphere consequently increased N in the soil and help bring other nutrients back into the upper soil profile from deeper soil layers Miller *et al.* (1989). Also, residual organic parts improving physical and chemical properties of the soil. Potassium is a macronutrient, which can be brought up from deeper soil layers by intercropping crop roots, then the nutrients are released back into the active organic matter when the intercropping crop dies and decomposes. The roots of legume cover crops are house of beneficial fungi known as mycorrhizae. The mycorrhizae fungi have efficient means to release P from the soil, which they pass into their plant host keeping phosphorus in an organic form. This is the most efficient way to keep its cycling in the soil (Rizk, 2012 and Shoeib, 2012). Also, Cover crops help retain P in the fields by reducing erosion. Sarrantonio (1989).

Table 3. Effect of intercropping of Thompson seedless grapevines with some medicinal plants on N, P, K and Mg content in the leaves during 2015 and 2016 seasons

Characteristics	N (%)		P (%)		K (%)		Mg (%)	
Treatments	2015	2016	2015	2016	2015	2016	2015	2016
Thompson seedless alone (control)	2.34	2.36	0.20	0.23	1.42	1.44	0.54	0.55
Thompson seedless + Fenugreek	2.76	2.80	0.35	0.38	1.72	1.78	0.72	0.75
Thompson seedless + Anise	2.47	2.56	0.28	0.30	1.58	1.60	0.64	0.70
Thompson seedless + Black cumin	2.38	2.42	0.22	0.25	1.46	1.52	0.58	0.66
Thompson seedless + Parsley	2.42	2.50	0.25	0.26	1.52	1.56	0.56	0.60
New L.S.D at 5%	0.11	0.09	0.06	0.05	0.07	0.08	0.10	0.08

Yield, cluster weight and 100 berry weight

The concerned data in Table 4 showed that the vines were intercropped with fenugreek crop recorded pronounced significant values of yield, cluster weight and 100 berry weight as compared with other treatments, which recorded 9.19 and 9.35 kg/vine for yield, 475 and 492 g for cluster weight and 224 and 232 g for 100 berry weight in 2015 and 2016 seasons, respectively, This significant effect was found to be true for anise concerning yield, cluster weight and 100 berry weight, whereas the difference between black cumin and parsley crops was insignificant. On the other hand, the control vines (Thompson seedless grapevines alone) recorded the lower values for yield, cluster weight and 100 berry weight in 2015 and 2016 seasons. The beneficial effects of intercropping Thompson seedless with medicinal plants especially fenugreek crop on increasing grapevine yield, cluster weight and 100 berry weights due to legume crops such as fenugreek fix atmospheric nitrogen in the soil Chambliss *et al.*(2003) consequently increased N in the soil. Also residual organic parts improving physical and chemical properties of the soil Nijjar (1985) as shown in Table 1 and increased microbial activity (dehydrogenase and phosphatase enzymes) of the soil as shown in Table 7 consequently improved roots growth and nutritional status of the vine and that increased shoot length and leaf area so enhancing berry weight and cluster weight finally increased yield.

Table 4. Effect of intercropping of Thompson seedless grapevines with some medicinal plants on Yield, cluster weight and 100 berry weights during 2015 and 2016 seasons

Characteristics	Yield (Kg/vine)		Cluster weight (g)		100 berry weight (g)	
Treatments	2015	2016	2015	2016	2015	2016
Thompson seedless alone (control)	8.28	8.63	430	445	185	196
Thompson seedless + Fenugreek	9.19	9.35	475	492	224	232
Thompson seedless + Anise	9.02	9.23	465	478	205	212
Thompson seedless + Black cumin	8.41	8.85	435	450	195	200
Thompson seedless + Parsley	8.73	9.17	445	466	202	212
New L.S.D at 5%	0.50	0.45	17.0	18.0	11.0	13.0

Chemical properties of the berries

The data presented in Table 5 demonstrated significant values of soluble solids and total sugars and significant decrease in total acidity as a result of intercropping with fenugreek and anise in the two seasons of study. The best results in this concern was achieved when vines were intercropped with fenugreek, which recorded 19.0 and 19.2 % for soluble solids content, 0.448 and 0.446 % for total acidity and 17.16 and 17.24 % for total sugars in 2015 and 2016 seasons, respectively. On the other hand, vines that were intercropped with parsley and black cumin showed insignificant effects concerning of soluble solids content and total acidity as compared with control. Intercropping Thompson seedless with medicinal plants improved chemical properties of the berries and that might be attributed to there effect on increasing leaf area and total chlorophyll as shown in Table 2 as a result of increasing N and Mg in the leaves as shown in Table 3, which reflected on increasing photosynthesis activity and hence increased soluble solids and total sugars in berries juice. These results are in agreement with those reported by Keller *et al.* (1998), they found that photosynthesis is the process for producing sugar, which means that more sugars are available for growth and fruit ripening. Also, increasing phosphorous content as shown in Table 3 plays an important role in the biosynthesis and translocation of carbohydrates and is necessary in stimulating cell division and the formation of nucleic acids Nijjar (1985).

Table 5. Effect of intercropping of Thompson seedless grapevines with some medicinal plants on Chemical properties of the berries during 2015 and 2016 seasons

Characteristics	SSC %		Acidity %		Total sugar %	
Treatments	2015	2016	2015	2016	2015	2016
Thompson seedless alone (control)	17.6	18.0	0.536	0.512	15.28	15.56
Thompson seedless + Fenugreek	19.0	19.2	0.448	0.446	17.16	17.24
Thompson seedless + Anise	18.8	19.0	0.474	0.464	16.65	16.95
Thompson seedless + Black cumin	17. 2	17.6	0. 558	0. 534	14.90	15.32
Thompson seedless + Parsley	18.0	18.2	0.514	0.494	15.74	15.90
New L.S.D at 5%	0.71	0.52	0.030	0.031	0.43	0.26

Vegetative growth and yield of different medicinal plants

It is clear from Table 6 that vegetative growth characters (in terms of plant height, No. of lateral branches, No. of leaves and fresh and dry weights per plant) of intercropped medicinal plants with Thompson seedless were decreased when compared to control medicinal plants as sole crops in the two successive seasons. In this respect, fenugreek plant intercropped with grapevine decreased in all parameters (decreasing from 10 to 15%) compared with its control. A significant decrease in leaves number per plant was obtained when anise plant intercropped with Thompson seedless 11 and 13.3 for the first and second

seasons respectively, compared with 17 and 19 when anise plants were cultivated alone. Regarding black cumin plant, it decreased in height compared with its sole plant. Plant height was 35.3 and 37.0 cm versus 37.7 and 40.7cm for intercropped plants when compared to black cumin as sole crop in the first and second seasons, respectively. Parsley had the same trend in its response to decreasing in vegetative growth as result to intercropping with Thompson seedless. Decreasing vegetative growth of medicinal plants intercropped with Thompson seedless plant may be due to the competition between plants on nutrients uptake and cluttering. Our results are agree with those of Maluleke *et al*. (2005), who reported that maize dry matter was reduced with increasing lablab population in intercropping.

Concerning seed yield, data presented in the same table reveal that all medicinal plants intercropped with grapevines had significantly lower seed yield compared with the same crops when planted as control in both seasons in general. The best intercropped plant was fenugreek which gave the highest value (reached to 80 % from control plants) followed by black cumin plant. Our results are in agreement with Ofori and Stern (1987) who reported that the yield of the legume component decline on normal by about 52% of the sole crop yield as a result to intercropping with cereals.

Table 6. Vegetative growth and yield of some medicinal plants as alone crop or intercropped with Thompson seedless during 2015 and 2016 seasons.

Characteristics / Treatments	Plant height (cm)		Number of branches/plant		Number of leaves/plant		Plant fresh weight (g)		Plant dry weight (g)		Seed yield (g/m^2)	
	2015	2016	2015	2016	2015	2016	2015	2016	2015	2016	2015	2016
Fenugreek alone	45.0	47.7	12.7	15.0	16.3	19.3	29.8	32.8	4.88	5.63	214.3	221.4
Fenugreek + Thompson seedless	38.7	42.3	11.7	13.0	14.7	17.3	26.2	29.3	4.04	4.56	166.7	176.2
F-Test	*	*	N.S.	*	N.S.	N.S.	*	*	N.S.	N.S.	*	*
Anise alone	37.7	35.3	10.3	11.0	17.0	19.0	22.3	26.5	2.67	3.20	114.3	119.0
Anise + Thompson seedless	33.3	31.0	6.70	7.30	11.0	13.3	12.5	16.1	1.33	1.78	74.3	81.0
F-Test	*	*	*	*	*	*	*	*	*	*	*	*
Black cumin alone	37.7	40.7	6.00	7.30	7.70	10.0	15.8	19.6	2.42	3.07	173.8	184.5
Black cumin + Thompson seedless	35.3	37.0	5.00	6.70	6.00	7.70	10.8	14.9	1.86	2.13	118.1	129.3
F-Test	N.S.	*	N.S.	N.S.	N.S.	*	*	*	N.S	N.S	*	*
Parsley alone	43.0	45.3	7.00	8.30	9.00	11.3	33.3	35.8	4.44	4.41	56.0	59.5
Parsley + Thompson seedless	36.7	41.0	4.00	5.00	7.00	9.00	20.5	22.5	2.79	2.65	36.4	40.5
F-Test	*	*	*	*	N.S.	*	*	*	*	*	*	*

*** = significant**

Microbiological studies

As regard to total microbial count as well as dehydrogenase and phosphatase enzymes activity, it was observed from data shown in Table 7 that an appreciable increase of total microbial count as well as dehydrogenase and phosphatase enzymes activity in all treatments as an indication of increasing microbial activity in the soil. The highest significant values over the control were obtained from the vines intercropped with fenugreek plant during the two seasons of study. Data also showed insignificant difference between the vines intercropped with anise and parsley and between the vines intercropped with black cumin and parsley on total microbial count, dehydrogenase and phosphatase enzymes activity in both seasons except dehydrogenase enzymes activity gave significant difference between the vines intercropped with black cumin and parsley in the second seasons only.

These results are in agreement with those reported by Mohamed (2013), who reported that intercropping pea with some medicinal plants could regulate soil microbial community such as actinomyces, bacteria and fungi effectively consequently soil rizosphere was improved.

These previous results are in agreement with those obtained by Abd El-Samad (2006) intercropping peach trees with wheat and clover; Rizk (2012) intercropped Thompson seedless with peas and clover; Shoeib (2012) intercropped Flame seedless with peas, clover, onion and Japanese turnip; Sawsan (2013) intercropped Flame seedless with peas and clover; Mohamed (2013) intercropped pea with some medicinal plants such as dill, caraway, cumin, fennel, anise and black cumin and Nagwa *et al* (2014) intercropped of sewy date palms with Egyptian clover, fenugreek and field bean.

Table 7. Effect of intercropping of Thompson seedless grapevines with some medicinal plants on Chemical characteristics in the rhizosphere of roots after experiment

Characteristics / Treatments	Total microbial count (-x10^6 cfu) /g soil)		Dehydrogenase Enzyme activity (µgTPF/g/DWsoil/day)		Phosphatase Enzyme activity (IP/g/DWsoil/day)	
	2015	2016	2015	2016	2015	2016
Thompson seedless alone (control)	12.12	18.46	164	171	62.4	63.3
Thompson seedless + Fenugreek	42.25	54.10	300	334	78.8	82.5
Thompson seedless + Anise	28.11	38.25	230	250	76.5	78.4
Thompson seedless + Black cumin	18.31	23.11	210	192	74.7	75.8
Thompson seedless + Parsley	22.08	33.42	225	232	75.6	76.9
New L.S.D at 5%	7.69	10.68	19.0	20.0	2.84	1.88

The economic study

It is clear from the obtained data in Table 8 that intercropping Thompson seedless with fenugreek, anise, black cumin and parsley increased net profit /feddan as compared with control (Thompson seedless alone). Intercropping Thompson seedless with fenugreek gave

the highest values of net profit / feddan which recorded 10660 L E over control as an average of two seasons followed by descending order intercropping Thompson seedless with black cumin, parsley and anise, respectively

Table 8. Economic study on costs and net profit /feddan of intercropping of Thompson seedless grapevines with some medicinal plants as average for two seasons (2015 and 2016)

Treatments	Costs of cultural Practices / fed. (L E)		Total costs / fed. (L E)	Yield/ fed. (Kg) of grape	Total income / fed. (L E) of grape	Seed yield/ fed. (Kg) of intercropping crops	Total income / fed. (L E) intercropping crops	Total income / fed.(L E) grape + intercropping crops	Net profit / fed. (L E)	Net profit /fed. over control (L E)
	grape	Intercropping crops								
Thompson seedless alone (control)	8000	-	8000	8455	33820	-	-	33820	25820	0
Thompson seedless + Fenugreek	8000	1960	9960	9270	37080	720	9360	46440	36480	10660
Thompson seedless + Anise	8000	1850	9850	9125	36500	326	8150	44650	34800	8980
Thompson seedless + Black cumin	8000	2000	10000	8630	34520	520	11440	45960	35960	10140
Thompson seedless + Parsley	8000	2000	10000	8950	35800	162+ 6000*	10050	45850	35850	10030

Price/1 kg from grapevine fruit (L E) = 4 **Price/1 kg from Black cumin seed (L E) = 22**
Price/1 kg from Fenugreek seed (L E) = 13 **Price/1 kg from Parsley seed (L E) = 25**
Price/1 kg from Anise seed (L E) = 25 **Price/1 kg from Parsley leaf (L E) =1**
*** Parsley plants were harvested 2 times as leaf yield x 3000 kg (weight of one harvest) = 6000 kg**

CONCLUSION

From the previous results, it can be recommended that intercropping Thompson seedless with some medicinal plants such as fenugreek, anise, black cumin and parsley gave a number of environmental benefits such as enhancing microbiological activity of the soil, promoting yield and increasing farmer income. Intercropping Thompson seedless with fenugreek gave the highest yield and net profit /feddan as compared with other treatments.

REFERENCES

A O A C (1980). Association of Official Analytical Chemists. 14th ed Published by A O A C., Washington D C, USA.

Abd El-Samad, G.A. (2006) Effects of interplanting wheat and clover on growth and productivity of peach trees. Egypt J. Hort., 33, pp: 59 – 71.

Amjad, A.A.; J. K. Theodore and V. H. Nguyen (2015) Effect of Intercropping Three Legume Species on Growth and Yield of Sweet Corn *(Zea mays)* in Hawaii. Journal of Crop Improvement, 29:370 –378

Belel, M.D.; R. A. Halim; M.Y. Rafii and H. M. Saud (2014). Intercropping of corn with some selected legumes for improved forage production: A review. J. Agric.Sci., 6(3): 48–62.

Blaser, B.C.; J.W. Singer and L.R. Gibson (2007) Winter cereal, seedling rate and intercrop seedling rate effect on red clover yield and quality. Agron. J., 99: 723- 729.

Chambliss, C.; R.M. Muchovej and J.J. Mullahey (2003) Cover Crops. Extension Service, Institute of Food and Agricultural Sciences, University of Florida, SS-AGR-66.

Charles, D. J. (2012) Parsley pp 430 in : Handbook of Herbs and Spices Volume 1, Ed by K. V. Peter, Second Edition, Woodhead Publishing Limited . UK.

Cottenie, A.; M. Verloo; L. Kiekens; G. Relgho and W. Camerlynuck (1982). Chemical Analysis of Plant and Soil. Lab. of Analytical and Agrochemistry State Univ. Gent, Belgium Crops: A Practical Tool for Vineyard Management Seminar. Am. Soc. Enol. Vitic. Tech. Projects Committee. pp: 16-25.

Drobnikova, V. (1961) Factors influencing the determination of phosphatase in soil. Folia Microbial, 6: 260

Esher, H.; and V. Jensen (1972) Aerobic chemo-organotrophic bacteria of Danish beech forest. OIKOS, 23: 248-260.

Gulcin, I.; M. Oktay; E. Kirecci and O. I. Kufrevioglu (2003) Screening of antioxidant and antimicrobial activities of anise (Pimpinella anisum L.) seed extracts. Food Chemistry, 83:371-382.

Heba, S. Soliman (2008) Studies on the Biological Activity of Nitrogen Fixing Bacteria in Rhizosphere of some Medicinal Plants. Ph.D Thesis, Faculty of Agriculture Minia University.

Kabura, B.H.; B. Musa and P.E. Odo (2008) Evaluation of the yield components and yield of onion (Allium cepa L.)- pepper (Capsicum annum L.) intercrop in the Sudan savanna. J. ARON., 7: 88-92.

Keller, M.; K.J. Arnink and G. Hrazdina, (1998) Interaction of nitrogen availability during bloom and light intensity during veraison. 1. Effect on grapevine growth, fruit development and ripening, Am. J. Enol. & Vitic., 49: 333-340.

Kosalec, I.; S. Pepeljnjak, and D. Kustrak (2005) Antifungal activity of fluid extract and essential oil from anise fruits (Pimpinella anisum L., Apiaceae) Acta Pharmaceutica-Zagreb, 55 (4): 377-385

Mackinny, G. (1941). Absorption of light by chlorophyll soluation. J. Bio. Chem., 140: 315-322.

Malhotra, S. K. (2012) Nigella pp 391 in : Handbook of Herbs and Spices Volume 2, Ed by K. V. Peter, Second Edition, Woodhead Publishing Limited . UK.

Maluleke, M.H.; A.A. Bediako and K.K. Ayisi (2005) Influence of maize-lablab intercropping on Lepidopterous stem borer infestation in maize. J. Entom., 98, 384-388.

Miller, P.R.; W.L. Graves, and W.A. Williams (1989) Cover crops for California agriculture. Univ. of Calif., Div. of Agric. And Nat. Resources Leaflet 21471.

Ministry of Agriculture and Land Reclamation (2016) Agriculture Economics vol.2 September. (In Arabic)

Mohamed, G.M. (2013) Effect of intercropping of pea with some medicinal plants on microbial community of soil, damping-off and downy mildew diseases, under beheira governorate conditions. J. Plant Prot. and Path., Mansoura Univ., 4 (7): 625 - 641

Montero, F. J.; J. A. De Juan; A. Cuesta and A. Brasa (2000) Non-destructive methods to estimated leaf area in (Vitis vinifera L.). Hort. Sci., 35:696 - 698.

Muller-Schwarze, D. (2006). Chemical Ecology of Vertebrates. Cambridge University Press. pp. 287.

Nagwa , R.A. ; F.F. Ahmed and A. S.A. Hamad (2014) Physiological Studies on Intercropping of Some Legumes on Sewy Date Palms. World Rural Observations; 6(4) 81-88.

Nijjar, G. S. (1985) Nutrition of fruit trees. Mrs. Msha Raj Kumar for Kalyani Publishers, New Delhi, pp :10 – 52.

Ofori, F.; and W.R. Stern (1987) Cereal-legume intercropping systems. Adv. Agron., 41, 41-90.

Okonji, C. J.; O. A. Emmanuel; K. A. Okeleye; A. A. Oyekanmi; O. S. Sakariyawo and S. G. Aderibigbe (2012) Upland rice based intercropping system among farmers in selected villages in Ogun State in South west of Nigeria. Agric. Biol. J. N. Am., 3(5): 225–232.

Ping Dong (1997) Dehydrogenase activity in soil: a comparison between the TTC and INT assays under their optimum conditions. Soil Biol. Biochem., 29 (2): 211-214

Rizk, M.H. (2012) Effect of some legume cover crops and organic fertilizer on petiole nutrient content, productivity and fruit composition of Thompson seedless grapevines. Acta Hort., 933 : 381-387

Sabry, G. H.; M. S. Rizk-Alla and M. A. Abd El-Wahab (2009). Influence of effective micro-organisms, seaweed extract and amino acids application on growth, yield and berry quality of Red Globe grapevines. J. Agric. Sci. Mansoura Univ., 34 (6):6617-6637.

Sadasivam, S. and A. Manickam (1996) Biochemical Method. Second Edition , New Age International, India.

Sangakkara, U. R.; W. Richner; M. K. Schnider and P. Stamp (2003) Impact of intercropping beans (Phaseolus vulgaris L.) and sunhemp (Crotalara junceaL.) on growth, yields, and nitrogen uptake of maize *(Zea mays L.)* grown in the humid topics during the minor rainy season. Maydica, 48:233–238.

Sarrantonio, M. (1989) Managing cover crop. Profitability A publication of the Sustainable Agriculture Network with funding by the Sustainable Agric. Rese. And Education program of the CEREES, U. S. Department of Agriculture.

Sawsan, A. Bondok (2013) Effect of some kinds of cover crops on yield fruit quality of King Ruby Grapevines J. Plant Production, Mansoura Univ., Vol. 4 (3): 471 – 484.

Shoeib, M. M. (2012) Effect of intercropping on fruiting and growth of Flame seedless grapevines. J. Plant Production, Mansoura Univ., 3 (1): 33 – 50.

Smith, R. J. (1993) Cultural management of vine row weeds in North Coast vineyards. Proc. Cover Crops: A Practical Tool for Vineyard Management Seminar. Am. Soc. Enol. Vitic. Tech. Projects Committee. pp:16-25.

Snedecor, G. W. and W.G. Cochran (1980). Statistical Methods. 7th ed., The Iowa State Univ. Press. Ames. , Iowa, U.S.A., pp. 593.

Snehlata, S.H. and R.D. Payal (2011) Fenugreek (*Trigonella foenum-graecum* L.): An Overview. International Journal of Current Pharmaceutical Review and Research, 2(4): 169-187.

Taiz, L and E. Zeiger (1991). Cytokinins. In: Plant Physiology. Benjamin/Cummings, Redwood City, CA., pp : 452-472.

Wilde S. A.; R. B. Coary; J. G. Layer and G. K. Voigt (1985) Soils and Plant Analysis for Tree Culture. Oxford, IBH New Delhi, India.

تأثير تحميل عنب الطومسون سيدليس ببعض النباتات الطبية على الحالة الغذائية للكرمات والمحصول وجودة الحبات والنشاط الحيوى فى التربة

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أجريت هذة الدراسة خلال مواسم2015 & 2016 فى مزرعة خاصة فى قرية بقطارس التابعة لمركز أجا محافظة الدقهلية على كرمات عنب طومسون سيدليس عمرها 12 سنة منزرعة فى تربة طينية وتروى بالغمر ومنزرعة على مسافة 2x2 م ومرباه بالطريقة القصبية بنظام تدعيم ثلاثة أسلاك رأسية. حيث تم زراعة بذور 4 نباتات طبية و هى الحلبة و اليانسون وحبة البركة والبقدونس على خطوط بين خطوط العنب فى الأسبوع الرابع من سبتمبر فى عامين 2014 و 2015 . كما تم فى نفس الوقت زراعة وحدات تجريبية من النباتات الطبية بمفردها و بدون تحميل مع العنب و ذلك لمقارنة نمو و محصول النباتات الطبية تحت ظروف التحميل مع الزراعة المنفردة للنباتات الطبية . وكان الهدف من هذة الدراسة هو دراسة تأثير تحميل عنب الطومسون سيدليس ببعض النباتات الطبية على الحالة الغذائية للكرمات والمحصول وجودة الحبات والنشاط الحيوى فى التربة. وقد أظهرت النتائج الاتى: أن تحميل عنب الطومسون سيدليس بالنباتات الطبية المذكورة كان لة تأثير كبير فى تحسين الصفات الكيميائية فى التربة مثل زيادة العناصر الغذائية والمادة العضوية وبالنسبة للنشاط الميكروبى فى منطقة إنتشار الجذور لوحظ أيضا زيادة فى العدد الكلى للميكروبات الكلية، وزيادة نشاط إنزيمات الديهيدروجينيز والفوسفاتيز وقد انعكس ذلك على تحسين فى الحالة الغذائية للكرمات وزيادة عناصر النتروجين والفوسفور والبوتاسيوم والماغنسيوم فى الاوراق وزيادة النمو الخضرى وأيضا المحتوى الكلى للكلوروفيل فى الاوراق وكذلك تحسين كمية المحصول ووزن العنقود وتحسين صفات الجودة فى الحبات مثل المواد الصلبة الذائبة والسكريات الكلية وخفض فى نسبة الحموضة مقارنة بالكنترول . وقد أشارت الدراسة الإقتصادية إلى أن تحميل عنب الطومسون سيدليس بالنباتات الطبية المذكورة أدى الى زيادة صافى ربح الفدان بالمقارنة بالكنترول حيث أعطت معاملة تحميل عنب الطومسون سيدليس بنبات الحلبة أفضل صافى ربح للفدان يليها التحميل بنبات حبة البركة ثم التحميل بالبقدونس وأخيرا التحميل باليانسون . ولذلك فانة لزيادة دخل المزارع وزيادة النشاط الحيوى فى التربة يوصى بتحميل عنب الطومسون سيدليس فى فصل الخريف بنبات الحلبة .