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EFFECT OF SOME LEGUME COVER CROPS AND ORGANIC FERTILIZER ON PETIOLE NUTRIENT CONTENT , PRODUCTIVITY AND FRUIT COMOSITION OF THOMPSON SEEDLESS GRAPEVINES.

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ABSTRACT

This investigation was undertaken for three seasons 2003, 2004 and 2005 on seven years old Thompson seedless grapevines grown in a clay loam soil at EL-Baramon Research station, Mansoura, Dakahlia Governorate. Treatments included in the experiment were : management of row middles (cultivated vs. perennial legume cover crops) and nitrogen fertilization (compost vs. mineral fertilizer). Leaf area, bud firility, vine nutritional status, yield, fruit composition weight of prunings were monitored each season (2003 – 2005)

.Conventional cultural practices (cultivation and mineral fertilizer) produced the highest yield, cluster weight ,fruit weight & diameter , TSS , TSS/acid ratio in the first season ,yet, the significant difference disappeared in the third season owing to that the legume cover crop had become fully established

Cover crop with mineral fertilizer treatment increased leaf area , weight of prunings and mineral content of leaf petioles in the first season whereas , cover crop + compost treatment gave the highest values in the third season .

The highest nitrate and nitrite residues in the berries were observed in mineral fertilization ,whereas the lowest values were gained from compost with peas or clover cover crop treatments.

INTRODUCTION

Fertilization and use of cover crops are cultural practices which are considerably important to agriculture sustainability in vineyards. Nitrogen is a major element in plant nutrition. Increasing nitrogen supply enhances photosynthesis which means that more sugar is available for growth and fruit quality (keller,2005)Mineral nitrogen fertilizer causes an accumulation of harmful residual substances i.e. nitrate and nitrite in berries and leaves of grapevines (Montasser et al ,2003). Organic fertilizers are used to avoid harmful effects caused by synthetic fertilizers (De-Ell & Prange , 1993). It improves soil condition (Yagodin, 1984) and it is considered as an important source of macro and micro nutrients (El- Haggar et al ,2004).

Cover crops can provide multiple benefits in vineyard management (Miller et al 1989).Some beneficial aspects of cover crop include : reduce soil erosion, improve soil structure, suppression of weed growth, increased water infiltration , reduce ground water pollution and reduce sunburn of fruit (Blake 1991, Folorunso *et al.* 1992, Gaffney & Van der Grinten 1991, Gulick *et al.* 1994, Louw & Bennie 1991, Miller *et al.* 1989, Smith 1993). In addition, cover crops can provide N and increase availability of other nutrients for the crop (Miller *et al.* 1989).

Today cover cropping is a common practice that is being used in Dakahlia governorate vineyards. More information in the area would benefit growers, consumers and environment. Therefore, the objectives of this experiment were to determine the effects of N fertilization and cover crop on growth, yield , fruit composition and vine nutritional status of Thompson seedless grape under Dakahlia governorate conditions

MATERIALS AND METHODS

This experiment was conducted for three seasons (2003 – 2005) in a Thompson seedless vineyard located at El – Baramon Research Station, Mansoura , Dakahlia Governorate. The vineyard was planted in 1997 in a clay loam soil . Row orientation was east to west and Vine spacing was 2m x 3m . Vines were cane pruned under double T trellis system . Vines were pruned at the first week of January leaving 72 buds/vine (6 canes x 12 buds each). Physical and chemical properties of the experimental soil (according to Jackson, (1958) are shown in table (1) .

Table (1): physical and chemical analysis of vineyard soil

Physical properties			Chemical properties		
Character	Depth		Character	Depth	
	0–20 cm	20-40 cm		0–20 cm	20-40 cm
Sand %	32.8	33.0	EC	0.61	0.64
Silt %	21.4	22.2	Soluble anions	Meg/100gsoil	
Clay %	39.5	40.2	$CO3^{--}$	0.0	0.0
Soil texture	Clay loam		$HCO3^{-}$	2.05	2.00
O.M. %	1.8	1.8	Cl^{-}	0.3	0.32
$CaCO_3$	2.1	2.5	SO4--	0.80	0.92
PH	7.8	7.9	Soluble anions	Meg/100gsoil	
Bulk density	1.19	1.16	Ca^{++}	2.15	2.19
Field capacity	43.6	42.7	Mg^{++}	0.35	0.38
Available water%	23.15	22.5	Na^{+}	0.34	0.37
Wilting point	20.53	20.22	K^{+}	0.30	0.32
			Available N ppm	35	30
			Available P ppm	13.2	12.7
			Available K ppm	381	325

The cultural variables under investigation were : nitrogen fertilization and use of cover crops . Compost (1.3%N & 0.67%P & 0.79%K) was used as an organic fertilizer , while ammonium sulphate (20.6%N) was applied as a mineral fertilizer . Vines were fertilized with the rate of 60 units/fed . according to N% in each source of nitrogen . Compost in cultivated plots was added once after winter pruning during normal row middle tillage operations , while cover crop plots was broadcasted and not incorporated. Mineral fertilizer was applied at three equal does (bud burst, after fruit set and after harvest) in both cultivated and cover crop plots.

Row middle was either cultivated or planted with pea (pisum sativum , L.) cv. Master B or Egyptian clover (Trifolium Alexandrinum). Cover crops were planted in October 2002 and replanted in October 2003 and 2004 .

The completely randomized block design was used. There were three replications of treatments and plots were composed of 36 vies in length down vine row and six vine rows wide. The treatment combinations (cover crop and nitrogen fertilizer) Were as follows :-

Cultivated + Mineral fertilization .
Cultivated + compost .
Peas cover crop + Mineral fertilization .
Peas cover crop + compost .
Clover cover crop + Mineral fertilization .
Clover cover crop + compost

The following determinations were carried out

Leaf area: Through collecting samples of matured leaves at full bloom stage using a planimeter.

Bud fertility coefficient: was carried out according to (Kamel *et al.*,1965)

Leaf mineral content : Leaf mineral content of (N, P, K , Fe , Zn and Mn) Was determined in the leaf petioles opposite to the clusters at full bloom. Nitrogen was determined by the microkjeldahl method as described by Cottenie *et al.*, 1982. Phosphorus content was colorimetrically estimated according to the method of Jackson (1958). Potassium and calcium were determined photometrically according to Cottenie *et al.* (1982). Zn and Mn were determined spectrophotometrically according to Chapman and Prutt (1978)

Yield and cluster characteristics :-

At harvest time (end of July) clusters were picked in each season. Number of clusters/vine , yield/vine, cluster& berry weight and berry diameter were determined . T.S.S (with hand refractometer); acidity (according to A.O.A.C,1980) and T.S.S/acid ratio was then calculated. Nitrate and nitrite in berries were determined according to Sing,1985. Weight of prunings was determined at winter pruning during the seasons of study. The Data obtained were statistically analyzed according to Snedecer and Cochran (1980) .

RESULTS AND DISCUSSION

Leaf area:

Data presented in table (2) revealed that peas or clover cover crops with mineral fertilizer treatments significantly increased leaf area than the other treatments during the three seasons of the study. Cultivated + compost treatment resulted in leaves with small area. These results reveal that legume cover crops have the ability to symbiotically associate with certain soil bacteria, rhizobia that fix atmospheric nitrogen (Chambliss et al, 2003). Mineral nitrogen is more effective in increasing leaf area than organic manures. This may be due to the higher availability of mineral nitrogen compared with organic forms (Omar, 2005). Yagodin (1984)found that No_3 is highly mobile in the soil. He added that in contrast to organic fertilizers, most of inorganic fertilizers are quick acting,which explain the effectiveness of mineral N in the short run while organic N acts in the long run. The results are in agreement with Elshennawy &Fayed (2005) and Belal 2006).

Table (2):Effect of cultural practices (cultivation , cover crop, mineral fertilizer and compost) on leaf area and weight of prunings in Thompson Seedless grapevines

Treatments	Leaf area (c m²)				Pruning weight (kg)			
	2003	2004	2005	mean	2003	2004	2005	Mean
Cultivated +mineral fertilization	149.2	154.1	163.3	155.5	2.6	2.5	3.2	2.8
Cultivated +compost	144.6	146.3	157.2	149.4	2.3	2.1	2.9	24
Peas cover crop + mineral fertilization	165.7	171.4	178.4	171.8	3.6	3.9	3.9	3.8
Peas cover crop +compost	143.0	158.2	165.6	155.6	2.4	3.2	3.6	2.8
Clover cover crop + mineral fertilization	164.6	168.6	175.2	169.5	3.3	3.5	3.8	3.5
Clover cover crop +compost	142.1	154.4	165.4	154.0	2.3	2.7	3.4	2.7
LSDat 5%	6.52	8.39	7.66		0.20	0.22	0.28	

Weight of prunings :

Concerning the effect on weight of prunings/vine , the data disclosed that the values of this estimate took a similar trend to that noticed in leaf area. The obtained results are in harmony with those reported by striegler et al (1997).

Bud fertility and number of bunches/vine:

From Table (3) it can be shown that bud fertility coefficient and number of clusters / vine were not affected by any of the treatments in the first season . This can be explained by the fact that the clusters have already been formed in the preceding season.

Table (3):Effect of cultural practices (cultivation , cover crop, mineral fertilizer and compost) on bud fertility and number of clusters /vine of Thompson Seedless grapevines

Treatments	Bud fertility				No. of bunches/vine			
	2003	2004	2005	Mean	2003	2004	2005	Mean
Cultivated +mineral fertilization	35.4	34.9	37.2	35.8	17.9	18.1	19.3	18.4
Cultivated +compost	35.6	34.3	36.2	35.4	17.8	15.8	17.8	17.1
Peas cover crop +mineral fertilization	35.9	32.7	35.8	34.8	17.8	17.9	19.0	18.2
Peas cover crop +compost	35.1	32.0	34.6	33.9	17.7	16.3	18.5	17.5
Clover cover crop +mineral fertilization	35.6	32.4	35.2	34.4	17.8	17.4	18.8	18.0
Clover cover crop +compost	35.5	31.6	34.1	33.7	17.7	15.9	18.3	17.3
LSDat 5%	N.S	0.974	0.948		N.S	0.93	0.91	

In the second and third seasons bud fertility coefficient and number of clusters / vine were higher in treatments including the mineral fertilizer than those with the organic fertilizer. The average of the three seasons revealed that the clover cover crop +compost treatments had the least effect on increasing bud fertility coefficient or number of clusters/vine compared with the other treatments. Furthermore, the highest bud fertility values were observed in cultivated + mineral fertilizer plots.

In this connection, Omar (2005) mentioned that the treatments including the mineral nitrogen achieved the highest bud fertility coefficient and number of cluster/vine as compared with the other treatments in Thompson Seedless grape .The results go in line with those obtained by Striegler *et al* .(1997) and Belal (2006) .

Yield and cluster characteristics :

From Table (4) it is apparent that mineral fertilizer treatment + cultivation treatments significantly increased yield/vine and cluster weight than compost with cover crops or with cultivation treatments in the first and second seasons . Cover crop treatment receiving mineral fertilizer did not differ significantly in yield from cultivated with mineral fertilization. In the third season, yield, cluster weight and number of clusters per vine were not affected by the culture practices. These results are in harmony with those reported by Striegler *et al* (1997), who mentioned that conventional cultural practices (cultivated and synthetic fertilizer) produced the highest yield of Thompson seedless grape during 1992 and 1993 seasons but in 1994 significant effects on yield were not observed, indicating that legume cover crop plots had become fully established. Similar results were observed by Dutshe *et al* (1997).

Table (4):Effect of cultural practices (cultivation , cover crop, mineral fertilizer and compost) on yield/vine and bunch weight of Thompson Seedless grapevines

Treatments	Yield/vine (kg)				Bunch weight (g)			
	2003	2004	2005	mean	2003	2004	2005	Mean
Cultivated +mineral fertilization	9.45	9.45	10.35	9.8	528	538	536	534.0
Cultivated +compost	8.05	7.32	8.28	7.9	452	463	465	460.0
Peas cover crop + mineral fertilization	8.78	9.18	9.94	9.3	493	513	523	509.7
Peas cover crop +compost	8.27	8.04	9.49	8.6	467	493	513	491.0
Clover cover crop + mineral fertilization	8.65	8.98	9.78	9.1	486	516	520	507.3
Clover cover crop +compost	8.14	7.50	9.22	8.3	460	472	504	478.7
LSDat 5%	0.84	1.02	1.16		32.67	33.79	42.01	

Table (5):Effect of cultural practices (cultivation , cover crop, mineral fertilizaer and compost) on Berry weight and diameter of Thompson Seedless grapevines

Treatments	Berry weight (g)				Berry diameter(mm)			
	2003	2004	2005	Mean	2003	2004	2005	Mean
Cultivated +mineral fertilization	2.43	2.37	2.41	2.40	14.7	14.6	14.9	14.7
Cultivated +compost	2.09	2.14	2.18	2.14	13.6	13.5	13.8	13.6
Peas cover crop +mineral fertilization	2.29	2.25	2.35	2.30	14.3	14.2	14.8	14.4
Peas cover crop +compost	2.17	2.18	2.25	2.20	13.9	13.8	14.1	13.9
Clover cover crop +mineral fertilization	2.22	2.23	2.31	2.25	14.1	14.0	14.5	14.2
Clover cover crop +compost	2.11	2.16	2.22	2.16	13.7	13.6	14.0	13.8
LSDat 5%	0.133	0.146	0.191		0.66	0.65	0.78	

Physical and chemical characteristics of berries :

a. Berry weight and diameter :

It is obvious from Table (5) that cultivated + mineral fertilizer treatment produced significantly higher berry weight and diameter than the other treatments during the first and second seasons. The significant difference disappeared in the third season. The average of the three seasons showed that mineral fertilizer with cultivated or with cover crop treatments gave a higher berry weight and diameter than cultivated or cover crop with compost treatments.

The application of thje mineral fertilizer was effective in increasing berry weight and diameter in the first and second seasons where, the use of organic manure (as slow release for nitrogen) induced further reduction in NO3- N accumulation in the plant compared with mineral nitrogen (as fast release for nitrogen). This could be attributed to the high available nitrogen release from the chemical fertilizer which increase the rate of nitrogen uptake by plant than its assimilation rate in plant cells (El-Sisy 2000). These results are in harmony with those obtained by Striegler et al (1997) and Mays et al (1995).

b. TSS, acidity and TSS/acid ratio :

It is clear from Table (6) that TSS percentage was higher as mineral nitrogen fertilization was applied with cultivated or cover crop plots in the first season. On the other hand, no significant differences could be detected between the tested treatments in the second and third season. This result may be attributed to vine nutritional status which was generally better for cultivated + synthetic fertilizer treatments especially in 2003. In 2005 when cover crop treatments had become fully established, there were no significant effect of the treatment on TSS. This result may be ascribed to that increasing nitrogen supply stimulates photosynthesis in leaves. Photosynthesis is the process by which the energy from sunlight is transformed into biochemical energy (ATP) which is used to fix carbon dioxide (CO_2) and water (H_2O) to produce sugar (glucose),which means that more sugars are available for growth and fruit ripening Keller *et al.*,(1998).

Table (6):Effect of cultural practices (cultivation , cover crop, mineral fertilizer and compost) on TSS , acidity and TSS/Acid ratio of Thompson Seedless grapevine

Treatments	TSS%			Acidity%			TSS/Acid ratio		
	2003	2004	2005	2003	2004	2005	2003	2004	2005
Cultivated +mineral fertilization	18.1	17.9	18.0	0.72	0.73	0.7	25.14	24.52	25.71
Cultivated +compost	17.2	17.5	17.8	0.75	0.76	0.73	22.93	23.03	24.38
Peas cover crop +mineral fertilization	17.8	17.8	17.9	0.74	0.72	0.71	24.05	24.72	25.21
Peas cover crop +compost	17.5	17.6	17.7	0.75	0.74	0.73	23.33	23.78	24.25
Clover cover crop +mineral fertilization	17.9	17.8	17.8	0.73	0.73	0.72	24.52	24.38	24.72
Clover cover crop +compost	17.3	17.5	17.7	0.74	0.74	0.73	23.38	23.65	24.25
LSD at 5%	0.457	N.S	N.S	N.S	N.S	N.S	1.263	N.S	N.S

Concerning the effect on total acidity of the juice the data showed no apparent effect in this respect during the three seasons of the study.

As for TSS/acid ratio it was found that cultivated + mineral fertilizer treatment significantly increased TSS/acid ratio than compost with cultivated or with cover crop treatments during the first season. Data showed no apparent effect in this connection in the second and third seasons. This seems not strange since this ratio took a similar trend to that noticed in case of the TSS.

c.Mineral content of leaf petioles :

It is evident from Table (7) that the level of nitrogen in petioles was significantly higher for clover or peas cover crop + mineral fertilizer treatment in comparison with the other treatments in the first season. However, petioles from cultivated with compost treatment produced a lower nitrogen content than the other treatments. In the second and third season cover crops with compost treatments significantly increased nitrogen content in leaf petioles than the other treatments .

The results in this respect go in line with those of Chambliss et al (2003) who reported that legumes have the ability to symbiotically associate with certain soil bacteria, rhizobia, that fix atmospheric nitrogen. They added that, legumes normally produce organic matter higher N content . As a result, organic matter originating from legumes usually decomposes at a faster rate than grasses. Alexander (1977)reported that the addition of organic materials to the soil resulted in a persistent increase in the counts of various groups of microorganisms, including the photosphere microflora,the presence of a rich microflora is not only responsible for the biological cycles of the various elements, but also make nutrients available for the plant.

Table (7):Effect of cultural practices (cultivation , cover crop, mineral fertilizer and compost) on N,Pand K content of petioles of Thompson Seedless grapevines

Treatments	N (%)			P (%)			K (%)		
	2003	2004	2005	2003	2004	2005	2003	2004	2005
Cultivated +mineral fertilization	2.56	2.58	2.55	0.22	0.21	0.22	1.53	1.57	1.47
Cultivated +compost	2.51	2.59	2.65	0.21	0.23	0.23	1.42	1.46	1.53
Peas cover crop +mineral fertilization	2.83	2.78	2.81	0.24	0.27	0.28	1.64	1.65	1.56
Peas cover crop +compost	2.55	2.85	2.89	0.27	0.29	0.3	1.65	1.74	1.64
Clover cover crop +mineral fertilization	2.79	2.77	2.8	0.25	0.27	0.26	1.58	1.66	1.55
Clover cover crop +compost	2.54	2.84	2.86	0.26	0.28	0.29	1.55	1.73	1.63
LSD at 5%	0.23	0.14	0.14	0.026	0.028	.029	0.1	0.145	0.069

Phosphorus and potassium in leaf petioles were increased by cover crop with compost as compared with cultivated or cover crops with mineral fertilizer plots. This is not astonishing since, cover crops help bring other nutrients back into the upper soil profile from deep soil layers. Potassium is a macronutrient which can be brought up from deeper soil layers by cover crop roots. The nutrients are then released back into the active organic matter when the cover crop dies and decomposes. Some cover crops are thought to secrete acids into the soil that put phosphorus into a more soluble plant – usable form. The roots of legume cover crops house beneficial fungi known as mycorrhizae. The mycorrhizae fungi have evolved efficient means of absorbing P from the soil, which they pass onto their plant host keeping phosphorus in an organic form .This is the most efficient way to keep its cycling in the soil. Cover crops help retain P in the fields by reducing erosion. (Sarrantonio ,1989) . The same results go in line with Mayes et al (1995), and Mc Vay, (1989).

Data presented in Table (8) revealed that compost with cover crop treatments gave the highest values of Fe, Zn and Mn content in leaf petioles as compared with the other treatments used during the three seasons of the investigation .

The increase in the micronutrients represented in Fe , Zn and Mn may be due to the effect of organic matter which makes the micro nutrients more efficient to be easily absorbed by the plant, (Ezz 1999). Also Alexander (1977) found that the decomposition of organic materials produced some organic acids such as folic and carbonic acid which caused lower soil ph values and consequently increased the availability of micronutrients in the soil.

Table (8):Effect of cultural practices (cultivation , cover crop, mineral fertilizer and compost) on Fe, Zn and Mn content of leaf petioles of Thompson Seedless grapevines

Treatments	Fe (ppm)			Zn (ppm)			Mn (ppm)		
	2003	2004	2005	2003	2004	2005	2003	2004	2005
Cultivated +mineral fertilization	42.5	46.1	45.1	23	21	25	118.2	123.9	121.3
Cultivated +compost	47.5	51.6	47.9	23	26	33	119.9	125.2	123.8
Peas cover crop +mineral fertilization	52.4	54.2	51.2	25	24	29	124.4	128.1	127.5
Peas cover crop +compost	58.6	61	58.9	27	28	39	128.7	132.5	131.4
Clover cover crop +mineral fertilization	53.4	55.6	54.3	24	25	32	122.9	127.7	125.8
Clover cover crop +compost	56.5	58.4	56.4	26	29	36	126.1	130.2	129.6
LSD at 5%	3.28	3.50	2.86	2.67	1.82	1.95	3.21	3.34	3.31

c. Nitrate and nitrite residues in berries :

It is clear form data in Table (9) that all mineral nitrogen fertilizer treatments resulted in higher values of nitrate and nitrite content in grape berries compared with the other treatments. It is obvious that the continues application of organic nitrogen source is important to reduce the nitrate and nitrite resides of Thompson Seedless grape.

Table (9):Effect of cultural practices (cultivation , cover crop, mineral fertilizer and compost) on Nitrate and nitrite residues in berries of Thompson Seedless grapevines

Treatments	Nitrate (ppm)				Nitrite (ppm)			
	2003	2004	2005	mean	2003	2004	2005	Mean
Cultivated +mineral fertilization	17.3	16.4	18.2	17.3	4.36	4.68	4.53	4.52
Cultivated +compost	12.5	9.3	9.1	10.3	0.81	0.6	0.34	0.58
Peas cover crop +mineral fertilization	15.4	13.7	12.6	13.9	3.68	3.32	3.13	3.38
Peas cover crop +compost	10.3	8.2	7.1	8.5	0.64	0.48	0.41	0.51
Clover cover crop +mineral fertilization	14.7	11.5	10.5	12.2	3.75	3.45	3.24	3.48
Clover cover crop +compost	11.6	8.4	8.2	9.4	0.7	0.52	0.48	0.57
LSDat 5%	0.75	0.76	0.82		0.19	0.21	0.20	

Berries from cultivated + mineral fertilizer treatment gave the highest values of nitrate and nitrite content which recorded 17.3 ,16.4 , 18.2 of nitrate and 4.36, 4.68 , 4.53 ppm of nitrite for 2003,2004 and 2005 seasons respectively. The other treatments from compost with cultivated or with cover crop treatment showed lower values in this respect. It is well known that nitrate is easily formed from mineral nitrogen whereas it is slowly formed from organic nitrogen (Ibrahim, 1994). It is healthy to consume grapes with lower nitrate and nitrite content. The acceptable daily intake (ADI) of nitrate and nitrite in the European countries which man can daily consume is 5 mgkg-1 and 0.07 mgkg-1 respectively, of his weight (Abdel hameed, 1999). These results go in line with those of Omar (2005) who found that mineral nitrogen fertilizer increased berry content of nitrate and values compared with compost or humic acid treatment of Thompson seedless grapevines.

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تأثير التحميل ببعض المحاصيل البقولية والتسميد العضوي على محتوى أعناق الأوراق من العناصر و المحصول و جودة الثمار في العنب البناتى

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أجرى هذا البحث خلال ثلاث سنوات متتالية ٢٠٠٣، ٢٠٠٤، ٢٠٠٥ لدراسة تسـب العمليـات الزراعية المستديمة في مزرعة العنب البناتي بمحطة بحوث البساتين بالبرامون محافظـة الدقهليـة. وقـد اشتملت معاملات البحث عل معاملات بين الصفوف وتشمل العز يق السطحي مقارنة بزراعـة محاصـيل بقولية حولية . بالإضافة الى معاملات التسميد وتشمل السماد المعدني مقارنة بالكمبوست وقد تـم دراسـة المساحة الورقية وخصوبة البراعم بالإضافة إلى محتوى الأوراق من العناصر الغذائية وكمية المحصـول وصفات الثمار ووزن خشب التقليم خلال مواسم التجربة الثلاث.

وقد أظهرت النتائج أن العمليات التقليدية التي تشمل العريق السطحي بالإضافة الى لتسميد المعدني أعطت أفضل النتائج بالنسبة لكمية والمحصول ووزن الحبات والنسبة المئوية للمواد الصلبة الكلية الذائبة في العصير وذلك في الموسم الأول فى حين لم تعط هذه للمعامله فرقا معنويا خلال الموسم الأخير من الدراسة – حيث أظهرت معاملات التحميل بمحاصيل البسلة والبرسيم تأثيرها الايجابي على هذه الصفات .

كما أظهرت النتائج أيضا إن معاملات التحميل التي أضيف إليها السماد المعدني أعطت زيادة فـي المساحة الو رقيه ووزن خشب التقليم و محتوى أعناق الأوراق من العناصر عن باقي المعاملات في حين لم تتأثر نسبة الحموضة معنويا بأي من تلك المعاملات وقد أدى التسميد الأزوتى المعدني إلى زيادة في نسبة النترات والنيترات في الحبات مقارنة بتلك الناتجة عن التسميد العضوي بالكمبوست ومن هنـا يتضـح ان التسميد بالسماد العضوىمع زراعة المحاصيل البقولية بين الصفوف قد ينتج عنها نقص فـي المحصـول وصفات الثمار إلا انها تعطى نتائج أفضل على المدى الطويل وينتج عنها ثمارا ذات محتوي منخفض مـن للنترات والنيتريت مما يجعلها أمنه صحيا .