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Biofertilization and Elemental Sulphur Effects on Growth and Fruiting of King's Ruby and Red Roomy Grapevines

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THE BENEFICIAL effect of biofertilization (microbin and phosphorene) and yeast as well as potassien and elemental sulphur on growth and nutritional status as well as yield and berry quality of King's Ruby and Red Roomy grapevines grown at the Experimental Orchard, Faculty of Agriculture, Assiut University, El-Ghorib, Egypt, were investigated during 2000, 2001 and 2002 seasons.

The obtained results can be summarized as follow:

1. Using biofertilizers and yeast as well as potassiun and elemental sulphur was effective in improving main shoot growth, leaf area, pruning wood weight and nutritional status of vines.
2. All treatments significantly increased the cluster numbers and weight and consequently yield/vine as well as they improved the berry quality compared with untreated ones.
3. Potassien, phosphorene and yeast applications increased carbohydrates and C/N ratio either by using mineral N only or combined with microbin.
4. There was a significant positive correlation between leaf nutrient contents on one side and each wood carbohydrates, nitrogen %, C/N ratio and yield/vine.

From the results, it is evident that using biofertilizers plus ½ RDF (recommended dose of fertilization) as well as potassien and elemental sulphur was sufficient to get high yield with good quality. Moreover, saving in fertilization cost and reducing pollution was also achieved.

Grape is considered as the most popular and favorite fruit crop in the world. It is the second fruit crop and preceded only by citrus in Egypt. Fertilization is one of the most important factos to improve soil fertility and increase crop yield. A major compensation to overcome the low soil fertility is to use expensive chemical fertilizers that it becomes more expensive item for orchard management and causes environmental pollution. So, bio-fertilization for fruit crops become a good alternative to chemical fertilization. In addition, bio-fertilization has the advantages of avoiding environmental pollution, increasing the availability of various nutrients and being cheap (Verna, 1990). As well as importance to plant production and soil fertility, it improves the biological, physical and chemical properties of soil (Kurtsidze, 1984; Abdel-Rahman, 2000 and Attia *et al.*, 2002).

Egyptian soil having alkaline pH are low in their available nutrients sulphur is frequently considered the most important amendment for soil reclamation and improvement. Sulphur is also a major element needed for increasing growth and yield (Hening *et al.*, 1991; Harhash & Abdel-Nasser, 2000 and El-Dsouky *et al.*, 2002).

Many investigators reported the importance of biofertilizers in increasing growth, yield and fruit quality of grapevines (Idso *et al.*, 1995; Karagiannidis *et al.*, 1995; Wange & Ranawade, 1997; Ahmed *et al.*, 1997; Mahmoud, 1999; Abdel-Ghany *et al.*, 2001 and Abdel-Galil *et al.*, 2003). They mentioned that supplying vines with biofertilizer namely active dry yeast, Rhizobacterine, Nitrobeine, Biogen and Phosphorene caused a great promotion on growth and nutritional status of vine, consequently improving the yield and berry quality. Also, Harhash & Abdel-Nasser (2000), Kassem (2002) and El-Dsouky *et al.* (2002)) founed that sulphur applied to the soil of some grapevine cvs. increased yield, fruit quality and leaf nutrient contents.

Therefore, this investigation aims to study the possibility of using some biofertilizers as partial replacement of the mineral fertilizers.

Material and Methods

This experiment was carried out during three successive seasons of 2000, 2001 and 2002 on King's Ruby and Red Roomy grapevine cvs. at the Experimental Orchard, Assiut University, El-Ghorib, Assiut Governorate, Egypt. Some physical and chemical properties of the soil are presented in Table 1.

TABLE 1. Some physical and chemical properties of a soil sample from the experimental site.

Soil property	Soil depth* (cm)	
	0-30	30-60
Sand (%)	91.38	91.11
Silt (%)	5.27	4.98
Clay (%)	3.35	3.91
Texture	Sandy	Sandy
Field capacity	15.95	16.17
$CaCO_3$ (%)	16.87	15.75
Organic matter (%)	0.083	0.067
pH (1:1 suspension)	8.44	8.38
ECe (dS/m^{-1})	1.64	1.59
CEC ($c\ mol^{+1}/kg$)	7.07	6.56
Total N (%)	0.03	0.02
$NaHCO_3$-extractable P (ppm)	4.77	4.16
NH_4OAC-extractable K (ppm)	152.06	178.32
NH_4OAC-extractable Ca (ppm)	729.6	748.8
NH_4OAC-extractable Mg (ppm)	304.1	315.6
DTPA extractable Fe (ppm)	3.43	3.89
DTPA extractable Mn (ppm)	1.91	1.76
DTPA extractable Zn (ppm)	0.27	0.21
DTPA extractable Cu (ppm)	1.05	0.97

* Each value represents the mean of 3 samples.

The vines were 6 years old, grown at 2x2 meters and trained according to head system by leaving total bud load of 49 & 62 buds/Red Roomy and King's Ruby vine (13 fruiting spurs x 3 or 4 buds plus 5 replacement spurs x 2 buds/vine), respectively. Forty-eight healthy vines were selected to be almost uniform in their vigour and divided into eight different treatments including the control for each cultivar.

The experiment was arranged in a complete randomized block design with three replicates per treatment, two vines each. The treatments were as follows:

1. The application of (80, 60 and 100 g/vine, NPK) in mineral source (Control T_1).
2. The application of 60 g N/vine in mineral N source + 30 g of microbin as N biofertilizer (T_2).
3. The application of 40 g N/vine in mineral N source + 30 g of microbin as N biofertilizer (T_3).
4. The application of 30 g P_2O_5/vine in mineral P source + 10 g of phosphorene as P biofertilizer (T_4).
5. The application of 6 g active dry yeast/vine to the soil (T_5).
6. Spraying 3 g active dry yeast/vine (T_6).
7. The application of 50 g of potassium sulphate (48% K_2O) + spraying 10 cm^3 potassein/vine (T_7).
8. The application of 0.5 kg of elemental sulphur/vine plus the recommended NPK as control (T_8).

Ammonium sulphate (20.6% N) was applied at four times : growth start, first bloom, after berry set and at one month late.

The biofertilizer, potassein and yeast were applied two times when growth starts and after berry set, whereas, the elemental sulphur was applied in the first week of February. Fertilizers were mixed with 30 cm surface layer of the soil under the vines foliage and about 0.5 m around the vine trunk, whereas, potassein and yeast at 3 g were sprayed on vines foliage. All vines received the regular horticultural practices carried out in vineyard except those dealing with the present treatments.

The following measurements were performed.

Vegetative growth parameters

Ten current season's shoot per vine were labelled for growth measurements at growth cessation of each season. The average length of shoots (cm) and leaf area were carried out annually at the end of June. Leaf area (cm^2) was calculated by picking and weighing ten leaves opposite to the basal clusters on the labelled shoots and weighing 40 sections of 1 cm^2 (4 sec. of 1 cm^2/leaf), then the leaf area (cm^2) = weight of leaves (g) x 4/weight of sections (g). The pruning wood was weight immediately after pruning (Jan. 15) and was expressed as g/vine. Total carbohydrates in canes was determined (Smith *et al.*, 1956) and total nitrogen by the semi-microkjeldahl technique (Bremmer and Mulvaney, 1982).

Leaf nutritional status

To determine leaf nutrient status, a sample of 30 leaves for each replicate was collected from the first full mature leaves from the top of growing shoots in mid of July. Leaf petioles were separated from the blades and washed with tap water, distilled water, air-dried, oven-dried at 70°C to a constant weight, then ground and kept for chemical analysis (Nijjar, 1990).

Total nitrogen was determined according to Bremmer and Mulvaney (1982). Part of each ground sample was wet-digested using 2:1 nitric to perchloric acid mixture. Phosphorus and potassium in the digests were determined by colormetry and flame photometry methods, respectively (Jackson, 1967). Iron, Mn and Zn were estimated using a GBG Model 300 atomic Absorption Spectrophotometer.

Yield and berry quality

The berry set percentage was estimated by caging five flower clusters on previous labelled shoots per vine in perforated white paper bags before bloom start. At the end of berry set stage, bags were removed and berry set % was calculated as follows: Berry set % = No. of berries per cluster / total no. of flowers per cluster x 100.

At harvesting, the yield was expressed in weight (kg) and number of cluster per vine was recorded. A sample of five clusters was randomly taken from each vine to determine cluster weight and berries characteristics. The berry quality in terms of 25 berry weight, total soluble solids, total acidity (expressed as gm tartaric acid per 100 ml juice) and the reducing sugar percentage were determined as outlined in A.O.A.C. methods (1995).

Statistical analysis of the obtained data was carried out according to Gomez & Gomez (1984) and Snedecor & Cochran (1990) using the L.S.D. test to define the significance of the differences between various treatments means.

Results and Discussion

Vegetative growth

Data presented in Table 2 show the effect of certain biofertilizers and elemental sulphur on growth of King's Ruby and Red Roomy vines in 2000, 2001 and 2002 seasons. As a general view it can noticed that shoot length, leaf area and weight of pruning wood were significantly increased by the used biofertilizers, *i.e.,* microbien, phosphorene and yeast as well as potassien and elemental sulphur compared with untreated vines in the two cultivars. In presence of microben, no significant differences were detected in vine growth vigour between vines fertilized with 60 or 40 g N/vine. These improvement occurred on vine growth might be attributed to important role of N-biofertilizer (microbin) on facilitating the fixation of atmospheric N as well as increasing the availability, uptake and translocation of N and other nutrients. P-biofertilizer (phosphorene) is responsible for activating the availability and uptake of P, Zn and other nutrients to vines surely reflected on promoting growth traits (Nijjar, 1990). Yeast has high content of minerals particularly N, P and proteins, vitamin

TABLE 2. Effect of nutrition with N and P biofertilizers and yeast as well as potassien and sulphur application on shoot length (cm), Leaf area (cm^2) and pruning wood weight (g) of King's Ruby and Red Roomy grape cvs. during 2000, 2001 and 2002 seasons.

Character / Treatment		Shoot length (cm)			Leaf area (cm^2)			Pruning wood weight (g)		
		2000	2001	2002	2000	2001	2002	2000	2001	2002
King's Ruby										
80 & 60 and 100 g/vine, NPK (Control)	T_1	74.33	85.33	89.00	154.60	173.23	186.15	430	498	675
60 g N/vine + Microbein	T_2	90.00	101.67	115.00	166.53	192.19	201.41	598	680	1150
40 g/N/vine + Microbein	T_3	95.00	100.33	106.67	165.82	188.70	200.85	517	638	1016
30 g P_2O_5/vine + 10 g phosphorene	T_4	86.67	107.67	115.67	163.36	184.31	198.36	663	746	1095
6 g yeast/vine to soils	T_5	89.33	98.33	112.33	186.61	206.53	218.80	530	630	770
3 g yeast/vine spraying	T_6	83.00	91.33	97.67	185.16	203.42	216.27	500	652	869
50 g K_2SO_4 + 10 cm potassein/vine	T_7	83.67	102.33	104.67	188.76	210.35	225.36	638	698	738
0.5 kg elemental sulph./vine + NPK as in control	T_8	91.67	106.07	115.00	164.31	185.55	296.94	536	663	1010
LSD 0.05		8.36	5.76	5.67	10.32	9.27	10.18	64.48	81.72	74.48
0.01		11.45	7.89	7.77	14.16	12.73	13.98	88.66	112.36	102.41
Red Roomy										
80 & 60 and 100 g/vine, NPK (Control)	T_1	103.33	120.67	132.67	190.25	175.53	203.80	767	963	1030
60 g N/vine + Microbein	T_2	130.00	149.33	172.67	206.51	194.23	223.18	983	1466	1936
40 g/N/vine + Microbein	T_3	133.33	156.00	176.00	204.30	190.28	221.78	1033	1460	1836
30 g P_2O_5/vine + 10 g phosphorene	T_4	134.67	157.00	184.33	203.86	188.53	218.16	1100	1386	1863
6 g yeast/vine to soils	T_5	123.67	143.33	161.67	219.75	211.60	239.33	950	1180	1380
3 g yeast/vine spraying	T_6	110.33	124.33	141.00	222.80	206.83	235.22	920	1160	1540
50 g K_2SO_4 + 10 cm potassein/vine	T_7	114.67	126.67	152.67	233.76	218.28	256.09	1033	1496	1836
0.5 kg elemental sulph./vine + NPK as in control	T_8	127.33	154.00	171.67	204.13	189.19	216.45	966	1886	1683
LSD 0.05		6.61	8.12	9.88	8.24	8.13	8.83	108.05	139.94	128.41
0.01		9.08	11.13	13.56	11.31	12.53	12.12	148.46	192.28	176.45

B and cytokinins and improves net photosynthesis (Idso *et al.*, 1995). Potassium has a main role in a lot of physiological processes occur in the plant and activates many enzymes system such that occur in protein and carbohydrate synthesis. As well as, sulphur decreases soil pH and increases the activities of micro organisms that enhance the solubility and availability of soil nutrients that increase the uptake and translocation of them.

Leaf nutrient contents

It is clear from the data presented in Table 3 that application of biofertilizers, potassien and elemental sulphur was associated with significant increase in leaf nutrient composition compared to untreated ones in the two cultivars throughout the three experimental seasons. Furthermore, using the biofertilizers such as microbin and yeast resulted in more announced and highly significant increment in leaf content of N, P, Fe, Zn and Mn compared to the increment obtained from other treatments. However, using phosphorene and potassien produced the maximum values of P and K, respectively compared with other treatments.

These findings emphasized the role of biofertilizers, potassien and sulphur in enhancing growth and improving nutrients status due to its important role in the solubility, availability the uptake and translocation of most nutrients. In addition, accelerating carbohydrate and protein synthesis and movement which aids in encouraging cell division and the development of meristematic tissues.

The present results are in harmony with those of Ahmed *et al.* (1997), El-Mogy *et al.* (1998), Mahmoud (1999), Harhash & Abdel-Nasser (2000), Abdel-Ghany *et al.* (2001), Kassem (2002), Attia *et al.* (2002), El-Dsouky *et al.* (2002) and Abdel-Galil *et al.* (2003).

Berry set and yield

Data illustrated in Table 4 show berry set and number of clusters born on the vine as well as cluster weight and yield/vine of King's Ruby and Red Roomy cultivars as influenced by certain biofertilizers, potassien and elemental sulphur applications during 2000, 2001 and 2002 seasons. A general overlook at the results, it could be observed that the number of clusters born on the vine did not change significantly in the first season of study when biofertilizers, potassien and elemental sulphur was used. In the other two studied seasons, application of certain biofertilizers, potassien and sulphur were significantly preferable in improving number of clusters per vine compared to unapplied vines. Using biofertilizers, potassien and sulphur significantly caused a remarkable promotion on berry set, cluster weight and yield/vine compared to untreated ones (control) in 2000, 2001 and 2002 seasons.

Moreover, using phosphorene and yeast applications resulted in the highest significant increases in the berry set % and yield/vine, whereas microbin, phosphorene and yeast were more effective on weight of clusters. The positive action of treatments in enhancing growth and vine nutritional status, that previously explained, surely reflected on improving number of clusters per vine and berry set percentage as well as weight of clusters and yield/vine.

TABLE 3. Effect of nutrition with N and P biofertilizers and yeast as well as potassien and sulphur application on leaf nutrient status of King's Ruby and Red Roomy grape cvs. during 2000, 2001 and 2002 seasons.

Character	N %			P %			K %			Fe (ppm)			Zn (ppm)			Mn (ppm)		
Treatment	2000	2001	2002	2000	2001	2002	2000	2001	2002	2000	2001	2002	2000	2001	2002	2000	2001	2002
King's Ruby																		
T_1	1.49	1.63	2.50	0.21	0.25	0.27	0.82	0.91	1.07	115.3	121.7	126.7	32.83	39.83	42.83	17.83	26.53	34.47
T_2	1.80	2.50	3.13	0.31	0.35	0.41	1.06	1.17	1.53	127.2	147.5	151.7	41.33	46.83	50.50	25.27	34.60	39.23
T_3	1.72	1.89	3.07	0.32	0.36	0.47	1.14	1.26	1.43	139.2	157.3	147.7	43.23	49.33	51.50	23.13	32.80	37.52
T_4	1.62	1.80	2.37	0.28	0.34	0.55	0.83	0.91	1.36	122.8	136.5	131.0	42.33	47.00	49.67	24.43	29.50	39.33
T_5	1.80	2.11	2.71	0.23	0.26	0.28	1.32	1.73	2.00	126.3	152.5	114.7	45.83	48.50	54.83	24.17	30.13	42.33
T_6	1.77	1.96	2.54	0.31	0.35	0.43	1.26	1.61	1.75	152.8	179.2	162.7	43.83	49.33	49.00	24.87	31.80	44.67
T_7	1.61	1.79	2.28	0.28	0.32	0.37	1.00	1.10	1.47	135.5	165.0	156.7	40.00	41.33	47.83	21.80	29.93	40.40
T_8	1.73	2.13	2.47	0.21	0.30	0.35	0.94	1.08	1.27	131.0	140.8	140.0	38.33	44.00	47.17	21.17	31.80	41.67
LSD 0.05	0.19	0.18	0.26	0.04	0.04	0.09	0.10	0.19	0.26	10.80	21.30	8.8	7.58	5.57	6.79	2.59	2.81	3.82
0.01	0.26	0.25	0.36	0.05	0.05	0.12	0.14	0.16	0.35	14.81	29.24	12.08	10.40	7.64	9.32	3.55	3.86	5.54
Red Roomy																		
T_1	1.57	1.73	2.22	0.18	0.23	0.27	0.81	0.94	1.05	102.3	114.2	111.7	26.83	30.67	33.33	20.80	26.40	42.00
T_2	2.39	2.86	3.46	0.30	0.33	0.42	0.81	0.89	1.82	116.8	134.0	134.5	34.50	54.33	55.50	30.07	35.27	56.67
T_3	2.28	2.82	3.24	0.31	0.35	0.46	0.97	1.07	1.77	117.5	135.0	143.3	37.00	49.17	41.17	28.47	34.73	53.13
T_4	1.92	2.06	3.17	0.30	0.34	0.60	0.80	0.89	1.57	115.7	132.7	125.8	34.33	42.17	40.17	23.40	29.67	53.60
T_5	2.01	2.22	2.53	0.19	0.25	0.29	1.61	1.83	2.03	124.8	137.5	131.7	36.83	43.50	43.67	25.57	29.40	53.47
T_6	1.98	2.19	3.22	0.30	0.34	0.45	1.53	1.72	1.88	177.8	201.7	179.3	32.83	40.00	40.50	27.17	32.00	53.87
T_7	1.69	1.74	1.86	0.22	0.27	0.32	0.73	1.05	1.20	151.7	176.7	144.2	30.00	36.50	39.83	24.50	29.93	49.00
T_8	1.78	1.94	2.01	0.20	0.27	0.32	1.20	1.32	1.82	117.7	130.0	127.5	29.50	35.70	43.17	23.40	31.00	51.33
LSD 0.05	0.18	0.17	0.18	0.02	0.03	0.05	0.11	0.14	0.15	13.1	18.8	14.4	4.18	7.51	5.40	1.96	2.83	5.31
0.01	0.25	0.23	0.25	0.03	0.04	0.07	0.15	0.19	0.21	17.95	25.81	19.76	5.74	10.30	7.41	2.69	3.89	7.29

TABLE 4. Effect of nutrition with N and P biofertilizers and yeast as well as potassien and sulphur application on yield components of King's Ruby and Red Roomy grape cvs. during 2000, 2001 and 2002 seasons.

Character	Berry set %			Cluster/vine (No.)			Yield/vine (kg)			Cluster weight (g)			25 Berry weight (g)		
Treatment	2000	2001	2002	2000	2001	2002	2000	2001	2002	2000	2001	2002	2000	2001	2002
King's Ruby															
T_1	11.29	12.58	14.28	17.67	20.13	21.33	4.70	6.25	7.76	259.7	334.7	364.0	38.18	47.51	50.23
T_2	13.05	16.75	16.87	19.00	26.00	29.00	6.00	8.00	9.31	401.3	502.0	528.0	45.71	56.21	60.79
T_3	13.70	16.86	17.09	19.33	24.00	25.33	5.30	8.50	9.26	344.3	455.7	484.7	41.96	50.80	55.61
T_4	13.98	17.57	19.46	19.00	26.33	29.00	5.33	7.50	9.94	318.7	399.0	480.7	48.98	56.40	65.89
T_5	14.54	16.25	17.53	19.67	24.00	25.67	5.12	7.65	9.00	310.3	425.7	466.7	46.51	57.66	59.80
T_6	13.87	16.86	19.02	19.00	24.67	27.00	6.10	7.73	9.19	341.7	486.3	525.7	44.89	52.49	55.24
T_7	13.42	17.57	17.91	19.00	23.67	24.00	5.25	7.65	8.80	306.7	408.0	460.3	44.88	51.81	55.20
T_8	14.22	16.03	18.44	19.00	23.67	25.67	5.50	7.15	8.70	309.3	411.3	467.7	41.54	50.47	55.91
LSD 0.05	0.75	1.10	1.00	N.S	1.83	1.23	0.42	0.88	0.93	29.73	32.48	33.85	2.07	2.81	3.18
0.01	1.03	1.51	1.38		2.46	1.62	0.58	1.21	1.28	40.81	51.46	46.48	2.84	3.85	4.36
Red Roomy															
T_1	7.60	9.25	9.71	18.33	19.00	20.33	6.10	7.50	7.70	337.7	337.3	397.3	109.8	125.9	134.20
T_2	8.35	10.79	11.74	20.00	24.00	25.00	7.54	8.20	9.39	427.0	453.3	495.7	127.1	146.0	159.80
T_3	9.19	11.23	11.80	19.00	22.00	23.00	7.41	8.50	9.64	390.0	398.3	419.0	118.8	142.68	157.0
T_4	9.95	11.79	12.89	19.67	23.33	23.67	8.00	8.97	10.26	460.0	470.3	518.3	136.80	157.80	163.50
T_5	8.81	10.82	11.99	18.67	22.00	23.33	7.35	8.32	9.10	447.3	444.0	475.3	132.50	147.60	156.6
T_6	9.56	11.36	11.95	19.67	24.00	24.33	7.90	9.00	10.76	436.0	442.3	483.7	129.0	145.30	153.90
T_7	8.30	10.09	10.77	18.67	21.33	22.67	7.10	8.18	9.34	383.3	383.7	420.0	122.90	141.90	148.80
T_8	9.42	10.99	11.48	18.33	22.00	23.33	7.20	8.10	9.22	417.7	426.7	450.0	122.90	141.90	148.80
LSD 0.05	0.66	0.76	0.71	N.S	1.44	1.59	0.61	0.56	1.02	23.96	28.84	27.48	3.32	5.06	7.92
0.01	0.91	1.04	0.97		1.98	2.18	0.84	0.77	1.40	32.89	39.51	37.73	4.56	6.94	10.87

Berry quality

Data presented in Tables 4 & 5 clearly indicate that all treatments caused a significant increase in berry weight, total soluble solids and reduced sugars as well as the total acidity compared with control. Furthermore, phosphorene and potassien applications gave significant improving in these traits as compared with the untreated ones.

These findings could be related to the effect of biofertilizers and elemental sulphur on activating the synthesis of total carbohydrates and protein and increasing the nutrient uptake which enhances cell division and enlargement in addition to physiological effect of potassien in increasing the asmotic potential of the berry cell (Abdel-Razek, 2002) that promote the water movement into the berries, leading to increase the berry volume and weight.

The positive effects of phosphorene, potassien and yeast applications on berry quality could be attributed to phosphorene hastened the maturation of grape berries. Whereas potassien improving translocation of photosynthesis products in vine. As well as, yeast could be due to photosynthesis enhancement and hormone promotion.

These results are nearly in the same line with these obtained by Wange & Ranawada (1997), Akl *et al.* (1997), El-Mogy *et al.* (1998), Mahmoud (1999), Harhash & Abdel-Nasser (2000), Abdel-Ghany *et al.* (2001), Kassem (2002), El-Dsouky *et al.* (2002) and Abdel-Galil *et al.* (2003).

Total carbohydrates and nitrogen percentages and C/N ratio

It is clear from data in Table 5 that all treatments significantly increased total carbohydrate and nitrogen percentages of wood resulted in increasing the C/N ratio compared with untreated ones. Moreover, when using potassien, phosphorene and yeast application higher wood carbohydrates and C/N ratio were observed than using mineral N only or combined with microbin.

Such results might be due to better supply of food material carbohydrates that are manufactured in the leaves, that early explained. Increasing the total carbohydrates and C/N ratio may positively affect the vine fruiting in the following season. The present results are in harmony with those of Tisdale *et al.* (1985) and Abdel-Galil *et al.* (2003).

Relationship between certain leaf nutrients and wood carbohydrate, nitrogen and C/N ratio as well as yield and total soluble solids

Data presented in Table 6 revealed that carbohydrate and nitrogen percentage in wood of King's Ruby and Red Roomy vines were positively and correlated with all leaf nutrients during three studied seasons. The positive correlation also were found between C/N ratio and leaf nutrients. Moreover, the correlation was significantly and highly with phosphorus, potassium and iron. These results could be attributed to positive effects of phosphorus and potassium on improving the photosynthesis and producing more carbohydrates as well as improving the carbohydrate translocation. Similarly, there were a significant positive correlation, between yield and all leaf nutrient contents.

TABLE 5. Effect of nutrition with N and P biofertilizers and yeast as well as potassien and sulphur application on juice constituents and wood, total carbohydrates (%), N (%) and C/ N ratio of King's Ruby and Red Roomy grape cvs. during 2000, 2001 and 2002 seasons.

Character	T.S.S. %			Acidity %			Reducing sugars %			Total carbohydrates (%)			N (%) wood			C/N ratio		
Treatment	2000	2001	2002	2000	2001	2002	2000	2001	2002	2000	2001	2002	2000	2001	2002	2000	2001	2002
King's Ruby																		
T_1	16.83	16.83	17.33	0.36	0.40	0.46	11.20	11.72	12.68	11.80	14.53	17.33	0.60	0.68	0.77	19.67	21.37	22.51
T_2	16.67	17.00	18.00	0.36	0.39	0.46	12.50	12.91	13.18	16.60	19.27	23.53	0.73	0.79	0.93	22.74	24.39	25.30
T_3	16.83	17.33	17.83	0.35	0.38	0.45	12.35	12.32	12.47	17.00	20.03	23.20	0.70	0.78	0.93	24.29	25.68	24.95
T_4	17.67	18.00	18.17	0.31	0.35	0.43	13.48	13.13	14.05	17.20	20.60	24.17	0.69	0.76	0.90	24.93	27.11	26.86
T_5	18.33	18.17	18.37	0.30	0.33	0.40	15.13	14.50	14.86	17.00	20.33	23.13	0.67	0.73	0.84	25.37	27.85	27.54
T_6	17.50	17.67	17.83	0.35	0.38	0.44	13.92	13.00	13.13	15.83	19.00	22.40	0.63	0.70	0.82	25.13	27.14	27.32
T_7	17.33	17.33	17.83	0.35	0.38	0.45	13.67	13.60	13.00	17.73	20.95	24.73	0.68	0.76	0.83	26.07	27.57	29.80
T_8	17.17	17.00	17.50	0.35	0.39	0.45	13.01	12.93	13.74	15.87	18.93	21.80	0.65	0.71	0.82	24.42	26.67	26.59
LSD 0.05	0.63	0.80	0.45	0.037	0.048	0.018	1.30	1.27	0.86	1.03	1.08	0.94	0.038	0.036	0.037	1.17	1.32	1.05
0.01	0.86	1.10	0.63	0.051	0.066	0.025	1.78	1.74	1.17	1.41	1.48	1.29	0.053	0.049	0.051	1.61	1.82	1.44
Red Roomy																		
T_1	15.67	15.83	16.00	0.39	0.38	0.42	11.93	12.65	12.88	11.73	14.77	18.40	0.57	0.67	0.74	20.58	22.04	24.86
T_2	16.33	16.50	16.10	0.38	0.37	0.41	12.08	13.09	13.17	16.27	19.30	23.80	0.72	0.80	0.93	22.60	24.13	25.59
T_3	16.33	16.63	15.83	0.38	0.36	0.40	12.46	12.99	13.10	16.33	19.67	24.33	0.71	0.77	0.86	23.00	25.55	28.29
T_4	16.67	17.67	16.50	0.37	0.35	0.38	12.89	13.68	14.33	16.83	21.13	25.67	0.68	0.79	0.83	24.75	26.75	30.93
T_5	16.83	17.67	16.67	0.31	0.33	0.36	13.58	14.23	14.72	15.97	20.77	25.13	0.63	0.80	0.91	25.35	25.96	27.62
T_6	16.83	17.00	16.33	0.37	0.36	0.36	12.75	13.65	14.16	15.30	18.37	23.33	0.60	0.70	0.80	25.50	26.24	29.16
T_7	16.50	16.83	16.33	0.36	0.36	0.38	13.18	13.72	14.43	17.27	21.87	26.43	0.60	0.72	0.77	28.78	30.38	34.32
T_8	16.50	16.83	16.33	0.36	0.36	0.38	12.85	13.85	14.39	16.60	18.33	22.33	0.68	0.75	0.90	24.41	24.44	24.81
LSD 0.05	0.83	0.80	0.38	0.017	0.032	0.05	0.65	0.71	0.93	0.70	0.56	0.59	0.032	0.026	0.033	0.91	0.81	0.63
0.01	1.14	1.10	0.52	0.023	0.044	0.058	0.89	0.97	1.28	0.96	0.77	0.81	0.044	0.036	0.045	1.25	1.11	0.86

TABLE 6. Correlation coefficients (r) between leaf nutrients and wood carbohydrates, nitrogen and C/N ratio as well as yield/vine (kg) and TSS of King's Ruby and Red Roomy grape cvs. during 2000, 2001 and 2002 seasons.

Character	C %			N %			C/N Ratio			Yield/vine (kg)			TSS %		
Leaf nutrient	2000	2001	2002	2000	2001	2002	2000	2001	2002	2000	2001	2002	2000	2001	2002
King's Ruby															
N	0.259	0.036	0.034	0.351	0.292	0.336	0.189	0.061	0.064	0.708**	0.539*	0.511*	-0.254	-0.367	-0.246
P	0.535*	0.270	0.572*	0.138	0.129	0.251	0.515*	0.291	0.344	0.760**	0.766*	0.611*	0.317	0.252	0.534*
K	0.663*	0.346	0.629	0.237	0.155	0.274	0.623*	0.532*	0.530*	0.407	0.531*	0.509*	0.537*	0.649*	0.775*
Fe	0.332	0.317	0.522	0.246	0.299	0.418	0.345	0.265	0.188	0.666**	0.661*	0.319	0.159	0.344	0.159
Zn	0.370	0.301	0.382	0.163	0.082	0.314	0.523*	0.444	0.346	0.473	0.757*	0.654*	0.576*	0.601*	0.587*
Red Roomy															
N	0.180	0.129	0.101	0.392	0.301	0.115	0.215	0.119	0.205	0.480	0.596*	0.547*	-0.383	-0.179	-0.119
P	0.301	0.386	0.326	0.218	0.113	0.213	0.312	0.328	0.327	0.646*	0.684*	0.753*	0.449	0.408	0.154
K	0.371	0.562*	0.305	0.211	0.244	0.174	0.383	0.516*	0.570*	0.371	0.490	0.539*	0.588*	0.518*	0.576*
Fe	0.507*	0.282	0.430	0.339	0.487	0.266	0.136	0.302	0.631*	0.541*	0.550*	0.659*	0.608*	0.288	0.199
Zn	0.088	0.196	0.480	0.160	0.128	0.123	0.337	0.317	0.179	0.582*	0.589*	0.258	0.594*	0.293	0.130

* Significant at 0.05 .

Such results might be due to better supply of food material carbohydrates that are manufactured in the leaves as effects of biofertilizers and potassien. These findings emphasized the fact that growth vigour and fruiting depended on nutritional status of vines. Also, data showed that there is a positive correlation between TSS and nutrient contents in leaves, except with nitrogen. The same correlation was also referred to by Abdel-Galil *et al.* (2003). On the light of the previous results, it could be recommended that using biofertilizers plus half of recommended dose of chemical fertilization as well as potassien and elemental sulphur were sufficient to get high yield with good quality and very useful in saving fertilization cost and reducing environment pollution which could be occurred by excess of chemical fertilizers.

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تأثير التسميد الحيوى والكبريت المعدنى على النمو و الإثمار فى العنب الكنج روبى والرومى الأحمر

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أجريت هذه الدراسة خلال ثلاثة مواسم متتالية ٢٠٠٠ و ٢٠٠١ و ٢٠٠٢ بالمزرعة البحثية بكلية الزراعة – جامعة أسيوط بالغريب على شجيرات العنب الكنج روبى والرومى الأحمر .

ويهدف هذا البحث إلى دراسة التأثيرات المفيدة للأسمدة الحيوية (ميكروبين – فوسفورين) و الخميرة والبوتاسين والكبريت المعدنى على النمو والمحصول وصفات الحبات .

ويمكن تلخيص النتائج فيما يلى :

١. أدى استخدام الأسمدة الحيوية والخميرة والبوتاسين والكبريت المعدنى إلى تحسين نمو الأفرخ ومساحة الورقة ووزن خشب التقليم والحالة الغذائية للشجيرات .
٢. أدت جميع المعاملات إلى زيادة معنوية فى عدد العناقيد ووزنها وزيادة المحصول وتحسين خصائص الحبات .
٣. أدى التسميد بالبوتاسين والفوسفورين واضافة الخميرة إلى زيادة الكربوهيدرات ونسبة الكربوهيدرات إلى النيتروجين مقارنة بالتسميد المعدنى منفرداً أو متحداً مع الميكروبين .
٤. أظهرت النتائج وجود علاقة موجبة بين المحتوى المعدنى للأوراق وكل من نسبة الكربوهيدرات والنيتروجين ونسبة الكربوهيدرات إلى النيتروجين بالخشب وكذلك محصول الشجيرة (كجم) .

من نتائج هذه الدراسة يمكن احلال نصف جرعة السماد الموصى بها بالأسمدة الحيوية والبوتاسين وكذلك اضافة الكبريت المعدنى بمعدل ٠,٥ كجم / شجيرة حيث يؤدى ذلك إلى تحسين الحالة الغذائية للشجيرات وزيادة المحصول وتحسين خصائص الحبات بالإضافة إلى تقليل تكلفة السماد وكذلك تلوث البيئة .