Zagazig J. Agric. Res., Vol. 34 No .(6) 2007 1075-1088

JUICE PROPERTIES OF SOME SUGAR BEET VARIETIES AS AFFECTED BY ORGANIC AND BIOCHEMICAL FERTILIZERS

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Accepted 3/10/2007

ABSTRACT: Two field experiments were carried out at Tymour region , El Hosania district, El Sharkia Governorate during 2003 / 2004 and 2004 / 2005 seasons to study the effect of organic (treated with compost and untreated) and biochemical fertilizers (90 kg N , 45 kg N , 500 gm cerialin , 1000 gm cerialin , 90 kg N +500gm cerialin , 90 kg N + 1000 gm cerialin and control) on quality of three sugar beet varieties (Kawemira, Montbianco and Gluria). The results indicated that, sugar beet variety Gluria surpassed the studied varieties with respect to its quality.Where it recorded the highest sucrose and purity percenteges at the mean line attained the lowest percent of sugar loss to molass and impurities (Na, K, and α-amino – N). Application of compost recorded the highest purity % values. Application of 1000 gm cerialin recorded the highest sucrose % values. However the difference between this fertilization treatment and both of 500 gm cerialin , 45 kg N + 500 cerialin and 45 kg N + 1000 gm cerialin were insignificant in this respect.

Key words: Sugar beet, varieties, organic fertilizer, biochemical Fertilizer, and juice properties.

INTRODUCTION

Nitrogen is one of the most important element for sugar beet crop, the increase in fertilizers cost especialy nitrogen prevents its use in higher levels, it was felt consider essential to find out the possibility saving of nitrogen fertilizer by optimizing use of nitrogen received much attention for optimum yield and quality.This

could be achieved by applying the recommended favorable new pronessity biological fertilizers such as nitrogen biofertilizers. Badawi and El-Morsy (1997) showed that Kawemira cultivar markedly surpassed Pleno cultivar in most of highest values of juice purity percentage. El - Yamani (1999) tested two sugar beet varieties Raspoly and Kawemira. He found that the highest values of sucrose % and purity % were obtained from Kawemira variety . Badawi , *et al* . (2002) showed that sugar beet cultivars (Top , Lola , Pleno and Kawemira) were significantly different in sucrose % .Kawemira cultivar was superior in sucrose % over other cultivars . Kopczynski *et al.,* (1999) reported that vermi compost enhanced the content of sugar in the roots when applied together with a micro element fertilizer. Baladoni , *et al* . (2000) found that the presence of N in the compost made it possible to apply less mineral N compounds to the crop . Tests with direct application in the sowing of the sugar beet showed little effectiveness even with a high dose. Maareg and Badr, (2001) investigated the effect of some biofertilizers (Rhizobacterin, cerialin and phosphorine) on sugar beet quality. they reported that cerialin caused an increase in sucrose% and purity%. Ramadan *et al.,* (2003) studied the effect of mixture of N fixes namly, *Azospirillum sp* . , *Azotobacter sp* . and phosphate dissolving bacteria (*Bacillus sp.*) on root quality.They showed that biofertilization treatments had a significant effect on sucrose % and purity % . El - Dosoky and Attia , (2004) studied the effect of nitrogenic N fertilizer and biofertilizer using inoculum of *Azotobacter chroococcum* and or *Bacillus megaterium* on the quality of sugar beet . They found that single inoculation with either bacteria significantly increased the quality traits , in most cases , in comparison with the un inoculation treatment was more primitive than the single one . Hilal, (2005) indicated that biofertilizer alone or with 90 kg N/ fad. significantly increased juice purity % and Alkalinity coefficient (Ac) but reduced all impurities(K , Na and α-amino N).

MATERIALS AND METHODS

Two field experiments were carried out at Tymour region , El-Hosania district, El Sharkia – Governorate during the two

growing successive seasons of 2003 / 2004 and 2004/2005 to find out the effect of organic and biochemical fertilizers on juice quality of three sugar beet varieties. Asplit-split plot design, with three replications was used . the main plot included three Multigerm varieties (Kawemira, Montbianco and Gluria), meanwhile two organic treatments (treated with compost 2 ton/fed and untreated) allocated in the sub plots (chemical analysis of the compost are presented in Table 1) and nine biochemical nitrogen treatments (with respect to cerialin(biofertilizer) was mixed with approporiat amount of sand added to soil once at sowing) 90 kg N , 45 kg N , 500 gm cerialin , 1000 gm cerialin, 90 kg N +500gm cerialin, 90 kg N + 1000 gm cerialin and control were distributed in the sub sub plots. The plot area was 15 m^2 contained 6 ridges , 5m in length and 0.5 m in width, sowing dates were october, 30 and November,1 in the 1^{st} and 2^{nd} seasons, respectively. Cerialin is a commercial name consists of nitrogen fixed bacteria namely *Baccillus polymixa*.N element was added in form of ammonium sulphate (20.6 % N) in two equal doses. The first dose at thinning (after 45 days from sowing) and the second one 4-weeks later.More over, phosphorus element was added at15kg P_2O_5/fed in form of calcium super phosphate (15.5% P_2O_5) during land preparation, meanwhile 24 kg k_2O in form of potassium sulphate (48 % K_2O) was applied with the 1^{st} N dose .

Soil samples were taken at random from the experimental field area at a depth of 0-30 cm from soil surface for both physical and chemical analysis which are presented in Table 2

Juice Quality and Chemical Composition

1. Sucrose % (pol, %) was polarimetrically determined according to the method of Le-Docte (1927).
2. Sodium and Potassium were determind in the extracted solution using flam photometry according to (Brown and Lilliand 1964). Alpha-amino N was determind using hydrogenation method – according to Carruthers *et al.*, (1962)
3. Sugar loss to molasses percentage was determined

Table 1. Show the different components of the compost

Components	Content
Moisture %	26%
Ph (extraction 1-5)	8.3
Ec (extraction 1-5)	4.1
Water saturation capacity	250%
Total - N	2.15%
Ammonium- N	460 ppm
Nitrate - N	125ppm
Organic matter	65%
Organic carbon	36.1 %
Ash	9 %
C / N ratio	16 :1
Sodium chlorid	1.21 %
Humic acids	13 %
Total phosphrus	1.5%
Total potassium	1.26%
Fe	1025 ppm
Mn	115 ppm
Cu	180ppm
Zn	28 ppm

Table 2. Soil physical and chemical analysis of the experimental fields in 2003/2004 and 2004/2005 seasons

Determination	Season	
	2003/ 2004	2004/ 2005
Physical analysis:		
Sand%	75.92	70.72
Silt%	22	22.00
Clay%	2.08	7.28
Texture class	Sandy loam	Sandy loam
Chemical analysis:		
PH	8.3	8.2
Ec (m.mhos/cm.	0.39	0.32
Organic matter%	1.34	1.34
Available N ppm	14.00	29 .00
Available P ppm	10.00	57.00
Available K ppm	344.00	312.00
Cations (meq/L):		
Ca	0.8	1.2
Mg	-	0.2
K	0.08	0.2
Na	1.88	1.8
Cu	1.6	0.02
Fe	8.8	5.4
Mn	0.08	2.6
Zn	0.46	0.36
Anions (meq/L):		
Hco3-	1.6	1.4
CL-	0.6	0.75
SO4-	0.56	1.25
CO3-	-	-

according (Devillers, 1988) using the following equation SLM % = 0.14 (Na + K) + 0.25 (α- amino N) + 0.50.

4.Purity % was calculated according to the following equation purity % = 99.36-14.27 (Na + K + alpha aminoN)/sucrose% (Devillers,1988).

RESULTS AND DISCUSSION

Results in Table 3 appeared that the tested sugar beet varieties significantly differed in sodium, potassium and alpha amino - N (impurities). Sugar beet variety Montbianco contained the highest amount of these impurities. These results are in agreament with those reported by Abd-Elrahim *et al.* (2005) and Abdel-Fatah (2006). Regarding the effect of organic fertilizer, the available data in Table 3 revealed that using compost fertilizer attained significantly highest value of soduim, potassium and α-amino-N. Regarding to the influence of biochemical fertilizer, the collected data in Table 3 pointed out that the sodium, potassium and alpha amino-N values of sugar beet were significantly affected by the tested biochemical fertilizer . Application of 90 kg N / fed recorded the highest sodium content. While potassium and α-amino- N were increased by adding 90 kg N / fed in addition to 1000 gm cerialin . However, the differences between this fertilization treatments and both of 90 kg N / fed + 500 gm cerialin , 45 kg N / fed + 500 gm cerialin and / or 45 kg N / fed + 1000 gm cerialin did not reach the level of significance. These results are in agreement with that obtained by Hilal, (2005).

Table 3-a show the interactions between the examined varieties and the studied fertilizer treatments, it is clearly show that there was a different response in sodium content due to the various combinations between varieties and fertilization treatments The combination between sugar beet varieties and fertilization treatment 90 kg N/fed attained the highest value of sodium content .this fact was true with the three varieties. Table 3-b reveal the interactions between the tested varieties and the studied fertilizer treatments .

It is clearly show that there was a different response in potassium content due to the various combination between varieties and fertilization treatment of 90 kg N/fed.

Table 3. Effect of fertilization treatments on Sodium (Na) , Potassium (K) and Alpha amino - N of some suger beet varieties at (2003/04 & 2004 /05 and their combined)

Treatments	Sodium (meg / 100 g beet)			Potassium (meg / 100 g beet)			Alpha amino - N (meg / 100 g beet)		
	2003/ 04	2004/05	Combined	2003 / 04	2004/05	Combined	2003/04	2004/05	Combined
Varieties (V)									
Kawemira	1.804b	2.081	1.943b	4.539b	5.314b	4.927b	1.659b	1.918b	1.788b
Montbianco	2.0876a	2.416	2.251a	4.839a	5.650a	5.245a	1.855a	2.167a	2.011a
Gluria	1.626c	2.108	1.867c	4.291c	5.007c	4.649c	1.513c	1.767c	1.640c
F- test	**	**	**	**	**	**	**	**	**
Organic ferti . (C)									
Treated	1.880a	2.274a	2.077a	4.621a	5.395a	5.008a	1.728a	2.007a	1.868a
Untreated	1.798b	2.130b	1.964b	4.492b	5.252b	4.872b	1.623b	1.894b	1.759b
F- test	**	**	**	*	**	**	**	**	**
Bio chemical ferti. (F)									
90 kg N	2.276a	2.716a	2.496a	4.867a	5.678a	5.273a	1.556b	1.816b	1.686b
45kg N	2.026b	2.441b	2.233b	4.627b	5.378b	5.003b	1.459b	1.705c	1.582c
500g cerialin	1.703c	2.034d	1.869d	4.512c	5.288b	4.900b	1.363b	1.589d	1.476d
1000g cerialin	1.706c	2.007d	1.8586d	4.516c	5.297b	4.907b	1.366b	1.592d	1.479d
90 N + 500 cerialin	2.036b	2.468b	2.252b	4.926a	5.749a	5.337a	2.147a	2.451a	2.299a
90 N + 1000 cerialin	2.056b	2.503b	2.279b	4.931a	5.753a	5.342a	2.102a	2.454a	2.278a
45 N + 500 cerialin	2.022b	2.466b	2.244b	4.913a	5.729a	5.321a	2.080a	2.426a	2.253a
45 N + 1000 cerialin	1.989b	2.269c	2.129c	4.931a	5.590a	5.252a	2.080a	2.438a	2.259a
control	0.737d	0.915e	0.826e	2.804d	3.450c	3.127c	0.928c	1.084e	1.006e
F- test	**	**	**	**	**	**	**	**	**
The interactions									
V x C	N. S	N.S	N.S	N . S	N . S	N.S	N.S	N.S	N.S
V x F	**	**	**	**	N.S	**	**	**	**
CxF	N. S	N.S	N.S	**	**	**	N.S	N.S	N.S
V x C x F	N. S	N.S	N.S	N.S	N.S	*	N.S	N.S	N.S

However the differences between this fertilization treatment and both of 90 kg N / fed + 500 gm cerialin and 90 kg N/fed +1000gm cerialin were insignificant in this respect this fact was true with the three varieties. Table 3-c show the interactions effect between the examined varities and the studied fertilizer treatments, it is clearly show that there was a different response in alpha amino - N due to the various combinations between sugar beet varieties and treatment of 90 kg N / fed + 1000 gm cerialin recorded the highest value of α-amino-N. However the differences between this treatment and both of 90 kg N / fed + 500 gm cerialin, 45kg N / fed + 500 gm cerialin and 45 kg N + 1000gm cerialin were insignificant in this respect. The results in Table 4 clear the influence of fertilization treatments on sucrose %, sugar loss to molasses and purity % of some sugar beet varieties at harvest. It is well known that juice quality is negatively affected by the increase in the values of sugar loss to molass on the other hand high sucrose and purity means high quality. Based upon the above mention fact . Results distinctly cleared that sugar beet variety Gluria surpassed the studied varieties with respect to its quality, where it recorded the highest sucrose and purity percentege and attained the lowest percent of sugar loss to molass. These results are in accordance with those obtained by Osman, *et al.* (2003) and Abdel-Fattah (2006). Regarding the effect of organic fertilizer, it was found that sucrose and purity percentages were not significantly affected between organic fertilization treatment in the second season and the combined analysis for sucrose % in the first. Compost application significantly decreased sugar loss to molasses in both seasons and their combined. These results are in line with that found by Cigl *et al.* (1994). Belonging the influcnce of biochemical fertilizer, the collected data in Table 4 pointed out that sucrose and purity percentages as well as sugar loss to molass values of sugar beet significantly affected by the tested biochemical fertilizer. Application of 1000 gm cerialin recorded the highest sucrose % values. However the difference between this fertilization treatment and both of 500 gm cerialin , 45 kg N + 500 cerialin and 45 kg N + 1000 gm cerialin were insignificant in this respect. Adding 500 or 1000 gm

Table 3-a. Sodium content (mg/100 gm beet) as affected by the interaction between sugar beet varieties and biochemical fertilizer (in combined analysis over two growing seasons , 2003 / 2004 and 2004 / 2005)

Biochemical fertilization / Varieties	90 kg N/ fed	45 kg N / fed	500 gm cerialin	1000 gm cerialin	90 kg N + 500 gm cerialin	90 kg N + 1000 gm cerialin	45 kg N + 500 gm cerialin	45kg N + 1000 gm cerialin	control
Kawemira	A 2.511b	B 2.077b	C 1.844b	C 1.803b	B 2.179 b	B 2.157 b	B 2.168b	C 1.823c	D 0.920a
Montbianco	A 2.826a	B 2.570a	C 1.976a	C 1.979a	B 2.500 a	B 2.552 a	B 2.495a	B 2.495a	D 0.969ab
Gluria	A 2.152c	A 2.052c	B 1.786c	B 1.787c	A 2.077 c	A 2.128 c	A 2.086a	A 2.068b	C 0.689b

Table 3-b. Potassium content (mg/100 gm beet) as affected by the interaction between sugar beet varieties and biochemical fertilizer (in combined analysis over two growing seasons , 2003 / 2004 and 2004 / 2005)

Biochemical fertilization / Varieties	90 kg N / fed	45 kg N / fed	500 gm cerialin	1000 gm cerialin	90 kg N + 500 gm cerialin	90 kg N + 1000 gm cerialin	45 kg N + 500 gm cerialin	45kg N + 1000 gm cerialin	control
Kawemira	A 5.275b	B 4.983b	B 4.964a	B 4.968a	A 5..269b	A 5.272b	A 5.258b	A 5.258b	C 3.092b
Montbianco	A 5.521a	C 5.228a	C 5.080a	C 5.087a	A 5.744a	A 5.744a	AB 5.719a	B 5.512a	D 3.568a
Gluria	A 5.022c	BC 4.798b	C 4.657b	C 4.666b	AB 4.999c	AB 5.009c	AB 4.985c	AB 4.985c	D 2.721c

Table 3-c. Alpha amino - N(mg/100 gm beet) as affected by interaction between sugar beet varieties and biochemical fertilizer (in combined analysis over two growing seasons , 2003 / 2004 and 2004 / 2005)

Biochemical fertilization / varieties	90 kg N / fed	45 kg N / fed	500 gm cerialin	1000 gm cerialin	90 kg N + 500 gm cerialin	90 kg N + 1000 gm cerialin	45 kg N + 500 gm cerialin	45kg N + 1000 gm cerialin	control
Kawemira	B 1.688b	BC 1.570b	C 1.473b	C 1.475b	A 2.291b	A 2.209b	A 2.189b	A 2.208b	D 0.992b
Montbianco	B 1.796a	BC 1.693a	C 1.612a	C 1.616a	A 2.565a	A 2.582a	A 2.558a	A 2.558a	D 1.118a
Gluria	B 1.574c	BC 1.483c	C 1.343c	C 1.346c	A 2.040c	A 2.043c	A 2.012c	A 2.012c	D 0.907c

Table 4. Effect of fertilization treatments on Sucrose % , Sugar loss to molasses % and Purity % of some suger beet varieties at (2003/04 & 2004 /05 and their combined)

Treatments	Sucrose %			Sugar loss to molasses%			Purity %		
	2003/ 04	2004/05	Combined	2003 / 04	2004/05	Combined	2003/04	2004/05	Combined
Varieties (V)									
Kawemira	18.02b	15.67b	16.85b	1.803b	2.015b	1.909b	92.964b	90.927b	91.846b
Montbianco	18.02b	13.52c	15.16c	1.933a	2.171a	2.052a	91.844c	88.384c	90.114c
Gluria	19.45a	17.35a	18.40a	1.707c	1.938c	1.822c	93.870a	91.931a	92.900a
F. test	**	**	**	**	**	**	**	**	**
Organic ferti . (C)									
Treated	17.83b	15.50	16.66	1.842a	2.075a	1.959a	92.664b	90.184	91.424b
Untreated	18.36a	15.53	16.94	1.786b	2.007b	1.897b	93.121a	90.512	91.817a
F- test	**	N.S	N.S	**	**	**	**	NS	**
Bio chemical ferti. (F)									
90 kg N	16.61d	13.98c	15.29c	1.889b	2.129c	2.009c	91.798e	88.788e	90.293e
45kg N	17.94b	16.10ab	17.02b	1.796c	2.021d	1.909d	92.846c	90.767c	91.807c
500g cerialin	19.07a	16.39a	17.73a	1.711d	1.923e	1.817e	93.644b	91.341b	92.492b
1000g cerialin	19.21a	16.81a	18.01a	1.713d	1.921e	1.817e	93.665b	91.594b	92.624b
90 N + 500 cerialin	16.95cd	13.67c	15.31c	2.011a	2.263a	2.137a	91.621e	87.489f	89.805f
90 N + 1000 cerialin	17.12c	13.69c	15.40c	2.004a	2.269a	2.136a	91.712e	87.906f	89.809f
45 N + 500 cerialin	18.92a	16.67a	17.79a	1.991a	2.254a	2.122ab	92.473d	90.101d	91.287d
45 N + 1000 cerialin	18.93a	16.72a	17.83a	1.986a	2.210b	2.098b	92.478d	90.388cd	91.433d
control	18.09b	15.59b	16.84b	1.228e	1.382f	1.305f	95.797a	94.256a	95.026a
F- test	**	**	**	**	**	**	**	**	**
The interactions									
V x C	N. S	N.S	N.S	**	N.S	N.S	N.S	N.S	N.S
V x F	*	N.S	N. S	**	**	**	**	N.S	**
CxF	N. S	N.S	N.s	N.S	**	**	N.S	N.S	N.S
V x C x F	N. S	N.S	N.S	N.S	N.S	N.S	N.S	N.S	N.S

Table 4-a. Sugar loss to molasses% as affected by the interaction between sugar beet varieties and biochemical fertilizers (in combined analysis over two growing seasons , 2003 / 2004 and 2004 / 2005)

Biochemical fertilization / Varieties	90 kg N / fed	45 kg N / fed	500 gm cerialin	1000 gm cerialin	90 kg N + 500 gm cerialin	90 kg N + 1000 gm cerialin	45 kg N + 500 gm cerialin	45kg N + 1000 gm cerialin	control
Kawemira	AB 2.012b	AB 1.881b	AB 1.821ab	AB 1.817ab	A 2.115b	A 2.092b	A 2.087b	A 2.043b	B 1.310b
Montbianco	AB 2.117a	AB 2.015a	AB 1.891a	AB 1.893a	A 2.295a	A 2.307a	A 2.290a	A 2.261a	B 1.401a
Gluria	AB 1.898c	AB 1.830b	AB 1.738b	AB 1.740b	A 2.001c	A 2.010b	A 1.990b	A 1.990b	B 1.204c

Table 4-b. Sugar loss to molasses% as affected by the interaction between organic and biochemical fertilization (in combined analysis over two growing seasons , 2003 / 2004 and 2004 / 2005)

Biochemical fertilization / Organic fertilization	90 kg N / fed	45 kg N / fed	500 gm cerialin	1000 gm cerialin	90 kg N + 500 gm cerialin	90 kg N + 1000 gm cerialin	45 kg N + 500 gm cerialin	45kg N + 1000 gm cerialin	control
Treated compost	AB 2.038a	AB 1.937a	AB 1.844a	AB 1.848a	A 2.165a	A 2.160a	A 2.145a	A 2.115a	B 1.377a
Untreated compost	A 1.980b	AB 1.880a	AB 1.789b	AB 1.785b	A 1.109b	A 2.113a	A 2.100a	A 2.082a	B 1.233b

cerialin recorded the lowest values of sugar loss to molass while the control treatment recorded the highest values of purity percentage. these results are in harmony with that found by Abo-El Fotoh *et al.*.(2000), El-Dosouky and Attia (2004) and Maareg and Badr (2001) .As for the interaction effect of the studied factors, Table 4-a show the interactions between varieties and the studied fertilizer treatments , it clearly show that there was a different response in sugar loss to molasses due to the various combinations between varieties and fertilization treatments. The combination between Montbianco variety and fertilization treatment of 90 kg N + 1000gm cerialin recorded the highest value of sugar loss to molass. However the differences between this fertilization treatment and all treatments were insignificant over check treatment which recorded the lowest value of this trait with the three sugar beet varieties . Table 4-b show the interaction between compost and the studied fertilizer treatments, it is clearly show that the combination between any of the two mineral nitrogen (45 kg or 90 kg N / fed) with compost treat. recorded the highest sugar loss to molass, whereas the lowest percentage of sugar loss to molasses resulted from control treatment with treated or untreated compost compound.

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صفات جودة العصير لبعض اصناف بنجر السكر وتاثرها بالاسمدة العضوية والبيوكيميائية

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أقيمت تجربتان حقليتان بقرية تيمور مركز الحسينية محافظة الشرقية خلال موسمى ٢٠٠٣ / ٢٠٠٤ و ٢٠٠٤ / ٢٠٠٥ لدراسة تأثير السماد العضوي و البيوكيميانى على صفات جودة بعض أصناف بنجر السكر (كواميرا ، مونتبيانكو و جلوريا) .

وكانت أهم النتائج المتحصل عليها كما يلى :

١- تفوق الصنف جلوريا عن الصنفين الاخرين فى النسبة المئوية لكل من السكروز والنقاوة فى حين ان هذا الصنف كان اقلهم فى النسبه المئوية للسكر المفقود فى المولاس ومحتوى العصير من الشوائب (الصوديوم ، البوتاسيوم والفا امينو نيتروجين)

٢- ادت المعاملة بالسماد العضوى الى زيادة نسبة النقاوة ونقص نسبة السكر المفقود فى المولاس

٣- كانت اعلى القيم فى نسبة السكروز باضافة ٥٠٠ جرام سيريالين وكذلك ١٠٠٠ جرام سيريالين، ٤٥ كيلو جرام نيتروجين + ٥٠٠ جرام سيريالين و٤٥ كجم نيتروجين + ١٠٠٠ جم سيريالين.