Effect of injection ammonia gas under different levels and depths on yield and quality of sugar beet (Beta vulgaris L)

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ABSTRACT

Rising fertilizers costs and their environmental pollution have heightened the need to improve nitrogen management to decrease these injury factors . Ammonia gas as a source of N fertilize was used to avoid this injury and increased sugar beet yield and quality by this investigation .Tow field experiments were carried out during two successive seasons 2007/2008 and 2008/2009 at Sakha Agric Res. Station, Kafr El-Sheikh Governorate, North Nile Delta Region, Agric. Res. Center, Egypt. This investigate was conducted to evaluate the effect of injection ammonia gas with three doses (60+30kg urea, 90 and 120 kg / fad.) under three injection depth (10,20 and30cm.) on yield and quality of sugar beet . A split plot design used under three replications ammonia gas were applied in main plot and injection depths were allocated in Sub- plot. Data obtained indicated that rising ammonia gas levels from 60kg ammonio+30kg urea, 90 and 120 kg / fad. and injection depth from 10 to30cm.Caused asignificant increase in mean values of root , sugar and top yields as well as top / root ratio in both seasons and extractability percentage in the first season only .On the other hand increasing ammonia gas levels from 60 to 120 kg/ fad. and injection depth from 10 to30cm.Cased asignificant decrease in values of sucrose , purity and alkaline coefficient percentage in both seasons. While, the differences between mean values of extractable sugar in both seasons were not significant .

Also sugar losses in molasses in the second season not reached to the level of significance compared with the first season. Impurities contents α - amino N increased significantly with increasing N levels in both seasons, bot was true for Na and K content .While , all impurities values of (Na , K and α - a. N) were decreased with increasing N . Generally , we com considered that ammonia gas is good and cheaper course for nitrogen fertilizer compared with any other N source and gave the maximum economic return in both seasons .

INTRODUCTION

World sugar production comes from two main crops, sugar cane represented 70 % whereas sugar beet 30%.While in Egypt sugar cane represented 46.45% , sugar beet 45.90% and other natural sweeteners 7.65 % in the year 2010 (Egyptian Society Sugar Technologists annual conference 2010). Sugar beet (Beta vulgaris L.) grows in moderate and cold zones between latitudes 30 and 60 North these conditions gave a good chance to accumulate sucrose in root. Nitrogen fertilization play an important role in crop production. Investigations targets to minimize the gap between sugar production

and consumption. Dubich et al.,(1973)concluded that injection ammonia gas at levels 50kg or 50kg urea at depth 12-15 cm. gave the highest root and sugar yields . Kampfe et al., (1973) showed that injection ammonia gas at depth of 15 cm gave maximum root and sugar yields . Similar results were obtained by Korany and Khalifa (1998) and Mullen et al .,(2000). Mostafa and Darwish (2001) concluded that injected ammonia gas at level (102kg/fad.) gave the highest root ,sugar and top yields compared with other levels under study (0, 45 and 75 kg / fad.)as well as N,P,K and Na content than urea fertilizer, on the other hand increasing levels of ammonia gas injection decreasing sucrose and purity percentage. Atia et al., (2007) compared ammonia gas with urea, they found that the first ammonia gas progressed than urea for root yield and gave maximum root yield (30.803 t / fad.) Stevens et al., (2007) investigated the effect of point injection on sugar beet using three different placement strategies .broadcast and in corporate (Bi) Knife-banded (KB)18cm from the seed row, or point injected (pi) 8 cm from the seed row. They found that advantage of (pi) than with other (Bi) or (KB) on root yield, on the other hand root sucrose content was generally unaffected by depth of injection while, sugar yield was the highest with(pi) than other. Alaa and Helal (2009) concluded that injected ammonia gas or urea at level 90 kg /fad. gave the highest root and sugar yields in addition high quality for sugar beet juice with applied on foliar spray from compost tea . So, we carried out this investigation to study effect of injection ammonia gas under different levels and depths on yield and quality of sugar beet under our invironmental conditions.

MATRIALS AND METHODS

During two cultivation seasons (2007/2008&2008/2009),field experiments were carried out at Farm of Sakha Agric Res. Station in Kafr EL -Sheikh Governorate to find out the effect of injection ammonia gas (82 %) with three levels ,(60Kg ammonia +30Kg urea/ fad.) , 90 and 120Kg ammonia only / fad . under three different depths (10,20and30cm.).Treatments were arranged in split- plot design with three replications, the main plot included the three ammonia gas levels meanwhile ,the injection depth were allocated in sub-plots. Sugar beet cultivar (Pleno)was sown in ridges 50cm .apart and 20cm. between hills , plot area was (45 m)^2 The recommendation of phosphorus and potassium fertilizers were applied as used in sugar beet fields. Sowing date was during the 2nd week of October in both seasons. Other cultural practices were carried out as recommended. At harvest , two guarded rows were harvest , yield and yield attributes were recorded .A sample of ten sugar beet roots was taken at random for quality analysis . Each sub-plot has six ridges o.55cm apart and 10m long the preceding crop was maize in the two seasons.

Juice quality characteristics were determined in the fresh roots using an automatic French system (HYCEL) in Delta sugar company :

1. Sucrose percentage (Pol. %) was determined using polarimeter on a lead acetate extract of fresh macerate root according to the method of Le-Doct (1927).
2. Potassium and sodium percentages were determined using flame photometer and α-amino nitrogen was determined using ninhydrin and hydrindantin method according to Carruthers *et al.* (1962).
3. Purity % was calculated according to the following formulas:

Purity % = 99.36 - [14.27(V_1+ V_2+ V_3) / V_4] (Devillers, 1988).

Where: V_1= Sodium % V_2= Potassium %

V_3= α-amino N % V_4= Sucrose % (Pol %).

4. Sugar loss to molasses (SM), sugar extractable and extractability % were calculated according to the following formulas:

Sugar loss to molasses = (V_1+V_2) 0.14 + V_3 x 0.25 + 0.5, Devillers (1988).

5 - Extractable sugar % = V_4 - SM - 0.6, Dexter *et al.* (1967).

6 - Extractability % = extractable sugar / sucrose %.

7- Root, sugar and top yields were determined as follows:

Root and top yield (tons/fad) was determined on the whole plot basis.

Sugar yield (tons/fad) was calculated according to the following equation:

Sugar yield = root yield(tons/fad). x sucrose % x purity %.

8 -Alkaline coefficient =v1+v2/v3 (Wieninger and Cubadinow 1971, Pollach 1984a, 1989)

Table (1) Chemical analysis of soil experimental site (0-30 cm depth) at Farm of Sakha Agric Res.Station, Kafr El-Sheikh Governorate in seasons 2007/2008 and 2008 /2009 .

Season	PH (1:2.5)	ECM Mos/ cm	Organic Matter %	Available			Anions Meq / L			
				N ppm	P ppm	K ppm	HCO_3^-	Cl^-	SO_4^{2-}	CO_3^{2-}
2006/2007	8.3	3.34	1.82	15.2	6.31	281.35	6.5	6.1	0.21	0.00
2007/2008	8.4	3.40	1.91	16.3	6.25	290.10	6.1	5.9	0.61	0.00

Statistical analysis:

Data obtained were subjected to procedures of split plot design out lined by Gomez and Gomez (1984) by using analysis of variance technique by means of "MSTAT" computer software package. To compare between means of significance Duncan,s multiple test was used (Duncan, 1955).

RESULTS AND DISCUSSIONS

1-Root and sugar yields in (tons/fad)

Data collected in table (2)Show influence of injection ammonia gas at different doses and depths on root and sugar yields. It is obviously clear that increasing both ammonia levels from 60 to 120kg / fad and injection depth from 10 to 30 cm . caused asignificant differences among mean values of root yield in both seasons.

Maximum root yields were obtained when ammonia gas was injected at 120 kg /fad (32.307 and 31.080 ton /fad)and at depth 30 cm. (31.299 and 30.987 ton /fad in both seasons resp. These results are naturally due to the increase in weight of the single root of sugar beet which accompanying to the increase in ammonia levels .

These findings are in agreement with those obtained by Dubich et al , Kampfe et al.,(1973) Benjamin et al ., (1994) and Korany and Khalifa (1998) . Significant interaction effect was found in the second season between N level and injection depth on root yield

Data in Table (2) exhibited significant increase in sugar yield in both season associated with the increase in ammonia levels to 120kg / fad . which applied to sugar beet , the same trend was found with increasing injection depth of ammonia gas from 10 to30 cm .in both seasons . the highest N levels gave (4.684 and 4.817 ton sugar /fad .resp .) and deeper depth 30cm gave (4.583 and 4.791 ton sugar /fad resp .).

Significant interaction between N levels and injection depths on sugar yield in the second season was found which gave maximum sugar yield (4.936 ton /fad .) when sugar beet fertilized by 120kg / fad .at depth 30cm .by ammonia gas . Similar results were found by Stevens et al ., (2007) , Mostafa and Darwish (2001) and Alaa and Helal (2009) .

2- Sucrose and sugar loss percentages:

Data in Table (3) showed significant reduction in sucrose % due to increasing the injection ammonia levels from 60 +30Kg urea – 120 kg ammonia in the first season by (3.53 and 2.78 % resp .) Increasing injection depth to 30 cm caused adecreasing sucrose percentage in both seasons .

Table (2): Effect of Different levels and depth of injection ammonia gas on root and sugar yields (ton /fad) during 2007/2008 and 2008/ 2009 seasons.

Levels ammonia Of Injection	Root yield (t / fad.)				Sugar yield (t / fad.)			
	Injection depth							
	10cm	20cm	30cm	Means	10cm	20cm	30cm	Means
First season								
60kg Am.+30kg urea	28.171	29.496	30.920	29.529	4.312	4.469	4.601	4.460
90kg Amm.gas	27.440	28.131	29.330	28.300	4.128	4.218	4.282	4.209
120kg Amm.gas	31.171	32.103	33.646	32.307	4.564	4.601	4.866	4.684
Means	28.927	29.910	31.299		4.335	4.429	4.583	
LSD N level	2.62				0.17			
Injection depth	1.21				0.06			
Interaction	n.s				n.s			
Second season								
60kg Am.+30kg urea	25.330	28.624	30.330	28.095	3.990	4.489	4.692	4.390
90kg Amm.gas	28.560	30.010	30.512	29.694	4.130	4.695	4.745	4.523
120kg Amm.gas	30.440	30.672	32.120	31.080	4.747	4.768	4.936	4.817
Means	28.113	29.769	30.987		4.289	4.651	4.791	
LSD N level	0.56				0.13			
Injection depth	0.70				0.16			
Interaction	0.70				0.15			

These result coincide with those reported by Mostafa and Darwish (2001) and Alaa and Helal (2009). No significant interaction was found between ammonia levels and injection depth in both seasons on Sucrose percentage. The lowest values of sugar loss (6.95and 5.45%) were found on both seasons with application 120kg / fad. ammonia gas to sugar beet compared with the highest sugar loss with low levels of ammonia gas (7.22and 5.58%resp .) in table 3 . This results are in agreement with the finding of Mostafa and Darwish (2001)and Aboshady et al ., (2008).They found that high levels of N caused adecrease sugar losses in molasses . The same trend was found with injection depth , with increasing injection depth to 30cm. sugar loss significant by decrease in both seasons .No significant interaction was found between ammonia gas levels and injection depth in both seasons on sugar loss.

Table (3) : Sucrose and Sugar loss percentages as effected by injection ammonia gas levels and injection depth in season 2007/2008 and 2008/ 2009 .

Levels ammonia Of Injection	Sucrose %				Sugar loss %			
	Injection depth							
	10cm	20cm	30cm	Means	10cm	20cm	30cm	Means
First season								
60kg Am.+30kg urea	17.16	16.75	16.29	16.73	7.80	6.99	6.87	7.22
90kg Amm.gas	16.94	16.72	16.17	16.61	8.22	7.65	7.20	7.69
120kg Amm.gas	16.49	16.00	16.00	16.16	7.59	6.81	6.45	6.95
Means	16.86	16.49	16.15		7.87	7.15	6.84	
LSD N level	0.37				0.15			
Injection depth	0.36				0.18			
Interaction	n.s				n.s			
Second season								
60kg Am.+30kg urea	17.09	16.89	16.55	16.84	5.82	5.76	5.04	5.54
90kg Amm.gas	16.95	16.85	16.75	16.85	6.03	5.46	5.25	5.58
120kg Amm.gas	16.90	16.82	16.56	16.76	5.61	5.49	5.25	5.45
Means	16.98	16.85	16.62		5.82	5.57	5.18	
LSD N level	N.S				N.S			
Injection depth	0.27				0.12			
Interaction	n.s				n.s			

3- Top yield (ton /fad .) and top /root ratio :

Top yield was appreciably affected by applicated ammonia gas levels in both seasons (Table 4).Significant increases were found in both seasons due to increase N levels from 60kg to 120kg ammonia / fad . Hic st top yields were found (12.96 and 13.19 ton/fad)in both season res. These results duee to effect of nitrogen on increase of growth rate of leaves by increase cell divisions. Mostafa and Darwish (2001) and Alaa and Helal (2009) also come up with the same finding. Injected ammonia at 30 cm progress than tow other depth (10and 20cm.) and gave the highest top yield / fad . in both seasons (12.22

and 11.83 ton /fad .resp.) . This progress related to good available N at deeper depth for long time without losses.

Significant interaction effect was found in the second season only on top yield .Significant difference were observed between values of top / root ratio in both seasons due to nitrogen levels .Injected ammonia at levels120kg gave the highest ratio (40.04 and 42. 40 % resp) .This trait is indicator to maturity stage , these result mean that increasing N levels led to increased vegetative growth than root growth and led to late maturity. EL- Shafai (1991) and El –Geddawy et al ., (2008)they found that increasing N levels increased top/ root ratio.

Table(4) : Effect of different levels and depths of injection ammonia gas on top yield and top / root ratio in 2007/2008 and 2008/ 2009 seasons .

Levels ammonia Of Injection	Top yield (t / fad.)				Top / root ratio.			
	Injection depth							
	10cm	20cm	30cm	Means	10cm	20cm	30cm	Means
First season								
60kg Am.+30kg urea	9.09	10.15	11.00	10.08	32.27	34.41	35.58	34.09
90kg Amm.gas	9.12	10.21	11.51	10.28	33.24	36.29	40.16	36.56
120kg Amm.gas	11.55	13.16	14.16	12.96	37.05	40.99	42.08	40.04
Means	9.92	11.17	12.22		34.19	37.23	39.27	
LSD N level	0.63				0.56			
Injection depth	0.27				0.41			
Interaction	n.s				0.50			
Second season								
60kg Am.+30kg urea	9.00	10.15	12.00	10.38	35.53	38.95	39.56	38.01
90kg Amm.gas	10.28	11.56	12.40	11.41	35.99	38.52	40.64	38.38
120kg Amm.gas	12.33	13.15	14.08	13.19	40.50	42.87	43.84	42.40
Means	10.54	11.62	11.83		37.34	40.11	41.35	
LSD N level	0.39				0.50			
Injection depth	0.32				0.40			
Interaction	0.40				0.50			

\ The highest values of top/ root ratio were recorded in both seasons (39.27 and 41.35 %) resulted from injected ammonia at depth 30cm.These result may be due to available ammonia at this

depth for more time than other depth which help volatilization to decrease N available to adsorbed by roots.

Asignificant interaction between ammonia gas levels and injection depth on top/ root ratio in both seasons. Maximum values were obtained (42.08%and 41.35%) in both seasons resp. by application of 120 Kg ammonia gas at depth 30 cm.

4- Extractable sugar and Extractability percentage :

Data presented in table (5)shawed no significant difference were observed amang values of extractable sugar in both seasons due to levels of ammonia gas. Similar result was found by Aboshady et el., (2008) .

Table(5) :Extractable sugar and extractability percentages as affected by levels and depths of injection ammonia gas fertilizer in growing seasons 2007/2008 and 2008/ 2009.

Levels ammonia Of Injection	Extractable sugar%				Extractability percentages%			
	Injection depth							
	10cm	20cm	30cm	Means	10cm	20cm	30cm	Means
First season								
60kg Am.+30kg urea	13.96	13.82	13.40	13.73	81.35	82.51	82.66	82.17
90kg Amm.gas	13.60	13.57	13.17	13.45	80.28	81.16	81.45	80.96
120kg Amm.gas	13.36	13.13	13.25	13.25	81.02	82.06	82.81	81.96
Means	13.64	13.51	13.27		80.88	81.91	82.31	
LSD N level	n.s.				0.82			
Injection depth	0.23				0.45			
Interaction	n.s				n.s			
Second season								
60kg Am.+30kg urea	14.55	14.34	14.27	14.40	85.04	85.08	86.22	85.45
90kg Amm.gas	14.44	14.43	14.40	14.42	85.90	85.64	85.97	85.60
120kg Amm.gas	14.43	14.39	14.20	14.34	85.38	85.55	85.80	85.58
Means	14.47	14.40	14.29		85.20	85.42	86.00	
LSD N level	ns				n.s			
Injection depth	0.13				0.24			
Interaction	n.s				n.s			

On the other hand injection ammonia gas at depth 30cm, reduce this character from (13.64 to 13.27%) in the first season and from (14.47 to 14.29%) in the second season.This reduction in this trait due to increase in α-amino nitrogen which related to high Nlevel due to prevent crystallization of sucrose and loss to molasses. There were no significant interaction between ammonia levels and injection depth on extractable sugar in both seasons.

Extractability percentage recorded asignificant decreased in the first season with high level of ammonia gas (120kg /fad) (81.96%) compared to low level (60 and 90kg /fad.) which gave the highest extractability in first season (82.17%).

This decrease in extractability due to decrease in sugar extractable significantly than sucrose % by increasing in N levels. These results reveal that increasing N level increased impurities in root juice . These results are harmony with those abtained by Aboshady et al ., (2008) .

Injected ammonia in soil under 10,20and 30cm.for sugar beet plants exhibited significant differences among mean values of extractability percentage in both seasons . Increasing injection depth to 30cm . significantly increased this trait from (80.88 to 82.31%)and (85.20 to 86.00%) in both seasons respectively . There was asignificant interaction between N levels and injection depths on extractability % in the second season only

5- Purity and Alkaline coefficient percentages:

The results in Table (6) showed a significant decrease in purity percentage in both season due to applied nitrogen fertilizer in form of ammonia gas to sugar beet plants and gave maximum purity % with low levels in both seasons (90.33 and 92.82 resp.) In comparison with the other two levels. This decrease due to increase in Na, K and α-amino nitrogen content tham sucrose % which related with high N levels. Mostafa and Darwish (2001) and Alaa and Helal (2009) mentioned that high purity % was found with low level of N application. The results in Table (6) showed a significant increase in purity % amounted to 1.72 and 0.76 in the first season and 0.91 and 0.34 in the second season with increasing injection depth of ammonia gas from 10 cm. to 30 cm . in both seasons because root content from Na, K and α-amino nitrogen decreased with increasing injection depth from 10 – 30 cm .

Alkaline coefficient in both seasons in Table (6) appeared that values of this trait decreased significantly with increasing nitrogen levels from 60 to 120 kg. All mean values of alkaline coefficient significantly increase more than 1.8, this mean that nitrogen application doses were suitable to sugar beet and optimum for sugar beet yield and its quality .(Weininger and Kubadinow 1971, Pollach1984,1989).

Table(6) :Purity percentage and Alkaline coefficient percentages as affected by ammonia gas levels and injection depths in seasons 2007/2008 and 2008/ 2009

Levels ammonia Of Injection	Purity percentage				Alkaline coefficient percentages			
	Injection depth							
	10cm	20cm	30cm	Means	10cm	20cm	30cm	Means
First season								
60kg Am.+30kg urea	89.21	90.45	91.34	90.33	3.20	4.48	4.64	4.11
90kg Amm.gas	88.81	89.66	90.28	89.58	3.77	3.90	3.97	3.88
120kg Amm.gas	88.80	89.59	90.37	89.58	3.18	3.37	3.82	3.46
Means	88.94	89.90	90.66		3.38	3.92	4.14	
LSD N level	0.64				0.15			
Injection depth	0.49				0.16			
Interaction	n.s				0.02			
Second season								
60kg Am.+30kg urea	92.16	92.85	93.46	92.82	4.07	4.11	4.90	4.36
90kg Amm.gas	92.02	92.85	92.83	92.57	3.45	3.55	3.57	3.52
120kg Amm.gas	92.24	92.43	92.85	92.51	3.01	3.21	3.90	3.37
Means	92.14	92.71	93.05		3.51	3.62	4.12	
LSD N level	0.17				0.27			
Injection depth	0.35				0.19			
Interaction	n.s				0.30			

Application nitrogen fertilizer in form of ammonia gas at different depth (10,20 and 30 cm.)gave values more than 1.8, this indicated that all of these depths gave optimum growth and quality for sugar beet in both seasons. Depth (30 cm.) progress than other depths and gave maximum values in both season .
(4.14 and 4.12 resp.)

Significant interaction was observed between nitrogen levels and injection depths on alkaline coefficient in both seasons.

6 – Na , K and α-amino nitrogen content:

Table (7) revealed that significant differences were observed among mean values of Na , K and α-amino nitrogen content in both

seasons due to effect of levels of ammonia gas which injected under different depth .Increasing ammonia levels from 60kg to 120kg / fad led to decreasing values of K content in both season while this trend was found with Na content in the first season only . On the other direction increasing ammonia levels caused to increasing values of α-amino nitrogen in both season becous N is available at this depth thom 10 – 20 cm which volatilization coused to decrease N at this depths .

Table (7): Na , K and α – amino nitrogen as affected by ammonia gas levels and injection depths in seasons 2006 /2007 and 2007/2008.

Levels ammonia Of Injection	Na- content				K-content				α – amino nitrogen content			
	Injection depth											
	10cm	20cm	30cm	Means	10cm	20cm	30cm	Means	10cm	20cm	30cm	Means
First season												
60kg Am.+30kg urea	3.18	2.51	2.46	2.72	6.12	6.04	5.90	6.02	2.91	1.91	1.80	2.21
90kg Amm.gas	3.39	3.10	2.76	3.08	6.51	5.95	5.86	6.11	2.62	2.32	2.17	2.37
120kg Amm.gas	2.91	2.35	2.18	2.48	6.35	6.10	5.46	5.97	2.91	2.51	2.00	2.47
Means	3.16	2.65	2.47		6.33	6.03	5.74		2.81	2.25	1.99	
LSD N level	0.06				0.06				0.10			
Injection depth	0.07				0.08				0.05			
Interaction	0.07				0.08				0.08			
Second season												
60kg Am.+30kg urea	1.88	1.79	1.52	1.73	5.04	4.41	4.16	4.54	1.70	1.51	1.16	1 46
90kg Amm.gas	2.18	1.78	1.64	1.87	4.75	4.46	4.35	4.52	2.00	1.76	1.68	1.81
120kg Amm.gas	1.91	1.82	1.62	1.78	4.42	4.41	4.39	4.41	2.10	1.94	1.54	1.86
Means	1.94	1.80	1.59		4.74	4.43	4.30		1.93	1.74	1.46	
LSD N level	0.10				0.07				0.10			
Injection depth	0.04				0.11				0.10			
Interaction	.07				0.10				0.10			

Concerning to injection depth , showed that injection ammonia at 30cm depth gave minimum values of all impurities (Na , K and α-amino N) in both seasons .

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الملخص العربى

تأثير حقن الأمونيا الغازية بمعدلات وأعماق حقن مختلفة على محصول وجودة بنجر السكر

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أقيمت تجربتان حقليتان في المزرعة البحثية لمحطة بحوث سخا – محافظة كفر الشيخ خلال الموسمين الزراعيين ٢٠٠٧/٢٠٠٨، ٢٠٠٨/٢٠٠٩ وذلك بغرض دراسة تأثير حقن الامونيا الغازية كسماد أزوتى

(٨٢ %) بمعدلات (٦٠كجم أمونيا غازية +٣٠كجم يوريا ،٩٠كجم أمونيا غازية ،١٢٠كجم أمونيا غازية /ف) تحت أعماق حقن مختلفة (١٠-٢٠-٣٠سم) على محصول وجودة بنجر السكر وقد استخدم تصميم القطع المنشقة مرة واحدة فى هذا البحث حيث وضع السماد الازوتى بمعدلاته المختلفة (٦٠كجم أمونيا غازية +٣٠كجم يوريا،٩٠كجم أمونيا غازية ،١٢٠كجم أمونيا غازية /فدان) فى القطع الرينسيه بينما أعماق الحقن وضعت فى القطع الشقية الأولى (١٠-٢٠-٣٠سم) وقد تم تنفيذ جميع العمليات الزراعية ا للازمه للمحصول حسب التوصيات الموصى بها وذلك من الزراعة حتى الحصاد.

وقد أظهرت النتائج المتحصل عليها انه بزيادة معدلات السماد الازوتى المتمثلة فى الامونيا الغازية من ٦٠-١٢٠ كجم أمونيا /ف وذلك بزيادة أعما ق حقن الامونيا ٣٠سم الى وجود زيادة معنوية فى متوسطات المحصول لكلا من الجذور – السكر – العرش بالطن/فدان بالاضافه إلى زيادة نسبه العرش / الجذر فى كلا الموسمين ونسبة استخلاص السكروز المنوية زيادة معنوية فى الموسم الأول وغير معنوية فى الموسم الثاني وعلى العكس من ذلك فقد أدت زيادة معدلات حقن الامونيا حتى ١٢٠كجم / ف وكذلك زيادة عمق الحقن حتى ٣٠سم إلى حدوث نقص معنوي فى قيمة كلا من نسبة السكروز فى الجذور والنقاوة للعصير ومعامل القلوية فى كلا الموسمين . بينما لم تكن هناك فروقا معنوية بين متوسطات قيم السكر المستخلص فى كلا الموسمين وأيضا لم تصل الفروق بين متوسطات صفه السكر المفقود فى المولاس فى الموسم الثانى إلى مستوى المعنوية ٥%إذ ما قورن بالموسم الأول . وبالنسبة للشوائب الموجودة فى عصير البنجر (الصوديوم – البوتاسيوم – ألالفا امينو نيتروجين) فقد وجد انه بزيادة معدلات حقن الامونيا من ٦٠ – ١٢٠ كجم / ف قد أدى ذلك إلى نقص معنوي فى قيم كلا من البوتاسيوم فى كلا الموسمين أما الصوديوم فقد زاد فى الموسم الثاني فقط وأما محتوى الجذر من الالفا امينوتيتروجين فقد زاد معنويا بزيادة الامونيا فى كلا الموسمين

ومن هذه النتائج يمكن اعتبار الامونيا الغازية ارخص وأفضل مصدر للسماد الازوتى أذا ماقورن بمصادر النيتروجين الأخرى المختلفة حيث أنها أعطت أقصى عائد اقتصادي في كلا الموسمين .