Journal of Sugar Beet
http://jsb.sbsi.ir/
Journal of Sugar Beet 2014, 29(2)

Introduction of a new formula for determination of autumn sugar beet purchase price

M. Abdollahian-Noghabi[(1)]*, H. Sharifi[(2)], B. Babaei[(3)] and G.A. Bahmani[(4)]

[(1)] *Associate Professor of Sugar Beet Seed Institute (SBSI), Karaj, Iran.*
[(2)] *Instructor of Dezfool Agricultural Research Center, Dezfool, Iran.*
[(3)] *Instructor of Sugar Beet Seed Institute, Karaj, Iran.*
[(4)] *Former manager of Ahvaz Sugar Factory, Ahvaz, Iran.*

Abdollahian-Noghabi M, Sharifi H, Babaei B, Bahmani GA. Introduction of a new formula for determination of autumn sugar beet purchase price. J. Sugar Beet. 2014; 29(2): 115-121.

Received May 2, 2011; Accepted December 18, 2013

ABSTRACT

This study was carried to modify current sugar beet purchase formula into linear base with respect to sugar percentage of autumn sugar beet. Ahvaz sugar factory was selected as an autumn sowing factory in Iran and 163 samples were randomly taken by four-hours intervals from delivery vehicles in 2007 (28th April to 27th June). From each truck, one sample was taken and sugar content, water content, marc, brix, reducing sugar, sodium, potassium, amino nitrogen, molasses sugar, and extraction coefficient of sugar were determined. Also, results of all 4084 delivery vehicles belonging to five contractors were statistically analyzed for sugar content (SC), sugar beet price drop per ton, and paid price per vehicle. Results showed that average sugar content for all delivery vehicles was 12.84% (in the range of 10 to 15.20%) with standard deviation (SD) of 0.847. Average sugar content of Ahvaz factory was 3 times lower than base price (16%) and 5.5 times lower than total SC average in 2007 (18.29%). Average crop loss (estimated visually) was 11.92% (in the range of 2 to 50%) with SD of 0.847. The average crop loss of Ahvaz factory was nine times greater than total average in 2007 (about 3% for 4,282,805 tons of sugar beet). Technical quality results showed that average moisture content of autumn sowing samples collected from Khozestan province was 79% which was 4% higher than normal beet (75% moisture content or 25% dray matter). Based on autumn sugar beet quality in Khozestan, new purchase price formula with three different coefficients was introduced for SC in the range of 10 to 24%. In this formula, the purchase price per ton can be calculated by following equations: a) SC of 10 to 15% {base price × (((SC×12) – 80))/100}, b) 15 to 20% {base price × ((SC×0.065) + 0.025)} and c) SC equal or grater than 20% {base price × 1.325}. Application of the new formula for estimation of sugar beet purchase price for autumn sowing samples in Khozestan may improve the quality of sugar beet. Consequently, both sugar factory and growers will benefit from this win-win formula.

Keywords: autumn sowing, crop loss, extractable sugar, price, sugar beet, sugar content

INTRODUCTION

Since 1975, sugar beet purchase in Iran is performed using content assayer in 32 sugar factories and also a linear relationship (1) for both spring and autumn sugar beet in the range of 10 to 24%.

$$\text{sugar beet purchase price} = \frac{\text{base price} \times (\text{sugar content} - 3)}{13} \quad (1)$$

In this equation, it is assumed that the amount of allowed sugar loss for sugar factories is 3% and commercial efficiency of sugar extraction is 13%. Studies showed that average sugar loss during 1998-2002 was 3.86% (in the range of 2.44-4.81%) with standard deviation of 0.66 (Abdollahian Noghabi and Sheikholislami 2004). However, the amount of sugar loss reported by sugar factories is different from what assumed in purchase equation which requires more studies. Average commercial sugar extraction efficiency during same period was 11.99% with standard deviation of 1.38 and a minimum of 8.16% and a maximum of

*Corresponding author's email: noghabi@sbsi.ir

13.96%.

Furthermore, there was a significant difference among sugar factories using spring and autumn sugar beet samples (Abdollahian-Noghabi and Sheikholislami 2004). Studies on sugar beet purchase system in different countries showed that in Netherland, shoot and vegetative loss is measured separately from soil loss and is considered as a loss penalty threshold (Huijbregts 2006). In U.K. sugar beet is purchased through a three years agreement between farmers and sugar factory. Payment is based on non-linear and decreasing relationship and no extra penalty is considered for sugar beet loss (Culloden 2006). In Sweden, Denmark, and some other countries, sugar beet purchase is on the basis of a five years agreement between farmer and sugar factory with respect to sugar content, and reward is paid in a non-linear and decreasing relationship. In this method, payment is based on extraction coefficient (sugar content replacement) and involves consideration of total potassium and sodium amount in formula (Erikson 2006). In Austria, loss penalty threshold is so high (20-25%) and rarely is reached in normal harvest and transport (average 8-10% loss). Sugar beet quality evaluation is performed in two stages; during transport to silo which is beside field and also on arrival to factory. In this way, sugar loss which is measured during storage is differed from transport time (Eigner 2006). In Morocco, sugar beet payment is only based on sugar content. Extra analysis is carried out on potassium, sodium, amino nitrogen, and reducing sugar. Molasses sugar is estimated based on Devillers equation (Fares 2006). Due to different climatic conditions and sugar beet quality, different formulas were introduced by different countries for sugar beet purchase price and most of them only consider sugar content for price determination. Various organic and inorganic compounds in sugar beet root (so called impurities) cause a decrease in technological quality via increasing molasses sugar content (Harvey and Dutton 1993; Huijbregts *et al*. 1996; Smed *et al*. 1996). The primary basis for relationship among sugar molasses and potassium and sodium impurities is based on the fact that a mole of potassium and sodium in sugar beet root causes a movement of one mole sugar into molasses during sugar extraction process and finally leaves white sugar cycle (Dedek 1927). In the last century, different empirical formulas were introduced for molasses sugar content estimation based on impurity type and content (Sheikholeslami 1997; Abdollahian-Noghabi 2001). Based on climatic conditions, cultivar type, and also sowing and harvest techniques, some differences exist in these formulas in relation to the variable number and degree of their influence. Average sugar content of autumn sugar beet in Khozestan was about 13% and due to the dramatic reduction of sugar extraction coefficient to less than 13%, some efforts should be made in Khozestan province to increase average sugar content and as a consequence increase in commercial efficiency of sugar factories. The aims of this study were to introduce a new formula for autumn sugar beet purchase, to determine difference between 2 price formulas of all samples delivered to sugar factory, to calculate their frequency in each group, and finally, to predict the impact of two formulas on technological quality of autumn sugar beet.

MATERIALS AND METHODS

This study aims to modify the autumn sugar beet purchase formula from linear relationship with fixed current coefficient (sugar content in the range of 10-24) into a non-linear relationship in accordance to qualitative parameters affecting sugar extraction coefficient in samples collected in 2007 (from autumn sugar beet sowing areas). Ahvaz sugar factory was selected as a model for autumn sowing. During the period of 60 working days in this factory (28th April to 27th June 2007) 4084 cargoes with average weight of 17 tons and a total of 68801 tons sugar beet from three agro-industries, two contractors, and Safiabad Agricultural Research Center were delivered to Ahvaz sugar factory. From the beginning until the end of delivery period, two working shifts were performed and in each shift, with an interval of three hours, sampling was done from sugar beet trucks inside sugar content determination section. From each cargo, one sample containing 40 roots was randomly selected and was washed and weighed. Then, 300 g of completely mixed and uniform brei was prepared using sawing machine. In addition, one extra sugar beet sample was taken from some cargoes. The scalp of the roots was cut horizontally from petiole junction to storage root (Jaggard *et al*. 1999). The scalps were weighed and brei was prepared. The scalped beets were also weighed and brei was prepared (Akeson *et al*. 1979). For qualitative analysis, brix level was measured (from 50 gram brei) using refractometer and marc level was measured after four steps extraction from about 20 g brei through placing in water bath and drying at 105 ^{o}C. After extraction of 26 g brei and

Table 1. The status of sugar beet delivery, average content and delivery loss in 2007

Row	Contractors	Sugar beet (ton)	Sugar beet cargo	Sugar content		Loss	
				Average (%)	Standard deviation	Average (%)	Standard deviation
1	Shahid Beheshti Agro-Industry	19048.363	1148	12.91	0.766	12.07	7.968
2	Shahid Rajaei Agro-Industry	20410.599	1208	12.78	0.919	13.63	8.063
3	Mainab Agro-Industry	22070.910	1286	12.95	0.770	10.68	3.589
4	Rezaei field	2837.950	169	12.69	0.728	9.59	1.730
5	Zarei field	4373.171	265	12.35	1.037	11.00	3.069
6	Safiabad Agricultural Research Centre	59.980	8	13.90	0.210	2.0	0.0
	Total/average	68800.970	4084	12.84	0.847	11.92	6.613

clarifying the extract by acetate (II) lead, different parameters such as sugar content (using polarimetric method), sodium and potassium concentration (using flame photometry), and amino nitrogen (using Betalyzer) were measured. The crude syrup purity was measured by dividing sugar content by brix. The dry matter in each sample was determined via drying a part of brei at 85 ^{o}C for 48 h (Abdollahian-Noghabi *et al*. 2005). Data analysis was carried out using SAS software.

Meanwhile, results of 4084 sugar beet cargo traits such as gross weight, theoretical loss percentage, loss rate, net weight, sugar content, the amount of sugar in each cargo, the price per ton of sugar beet according to its content, and total cash paid to each cargo was examined and statistical analysis were also performed. Finally, effects of two formulas on technological quality of autumn sugar beet with consideration of quality as a raw material for sugar factory and also the revenue from sales and production per unit area for farmer were reviewed.

Results and Discussion

Ahvaz sugar factory's operation

Table 1 shows the total operation of Ahvaz sugar factory in 2007. The total sugar content was 12.84% (minimum of 10% and maximum of 15.20%) with standard deviation of 0.847. Average sugar beet loss was 11.92% (minimum of 2% and maximum of 50%) with standard deviation of 6.613. The total sugar beet was 68801 tons which belonged to three agro-industry companies, two contractors, and Safiabad Agricultural Research Centere and with loss consideration it decreased to 60548 tons (Anonymous 2007). Based on the approved price determined by government, the purchase price for each ton (16% content) was 460000 Rials. Therefore, in Ahvaz sugar factory, the purchase price per ton was 348190 Rials (minimum of 247692 and maximum of 431692 Rials) with standard deviation of 29975. These results showed that autumn sugar beet content was 3 and 5.5 units lower than average content purchase price (16%) and average sugar beet content (18.29%), respectively in 2007. Therefore, average payment per ton of sugar beet delivered to factory was 112000 Rials less than average approved purchase price.

Correlation between sugar extraction and sugar content

Fig. 1 indicates relationship between sugar extraction coefficient and sugar content. With increase in sugar content (6-12%), sugar extraction coefficient increased simultaneously but the trend decreased afterwards (12-22%). The highest sugar extraction coefficient was achieved for approximately 15% sugar content (Fig. 1) and it was considered as a base for 100% payment.

Introudcing a new formula for autumn sugar beet purchase price in Khozestan

Present results collected from 4084 sugar beet cargoes, delivered to Ahvaz sugar factory, showed that the new formula not only supprots farmers who producing primary materials with higher quality but also increases sugar extraction coefficient efficiency which justifies the investment on

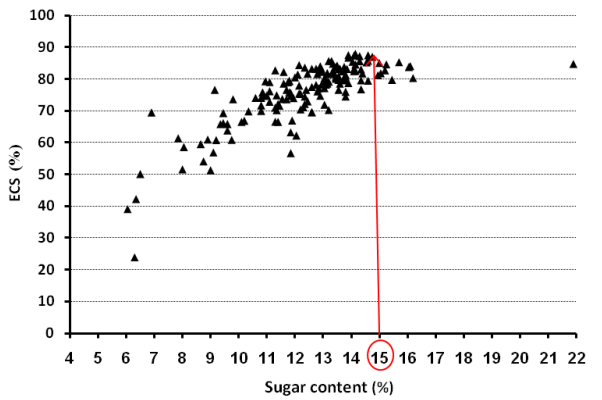

Fig. 1. sugar extraction coeffiecient relation with autumn sugar beet content for 162 samples

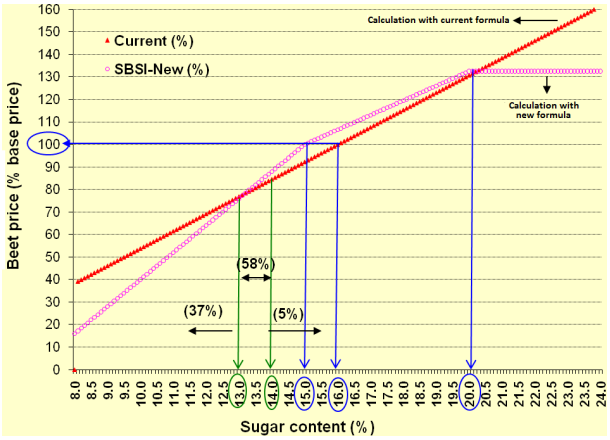

Fig. 2. Comparsion of the current purchase formula (linear with fixed coefficient) with new formula (with different coefficients) with respect to technological quality of sugar beet in the range of 8 to 24%.

Khozastan sugar industry. The current formula has a fixed coefficient for sugar content in the range of 10 to 24%, however the new formula has three fixed coefficients. The 1.325 fixed coefficient was derived according to the current sugar beet purchase formula in Europe (for more than 20% content or equivalent) (Sheikholeslami 2003), production cost, sugar processing, and sugar extraction efficiency (relation C). To estimate sugar beet purchase with 15 to 20% content, the fixed coefficient in realation B was used. Under Khozestan climatic condition and considering breeding principles such as proper water management (low irrigation at the end of the growing season), optimum nitrogen frtilizer application, and proper cutting, autumn sugar beet with 14% content was produced (Table 1). Therfeore, since average total sugar content was 13% (Table 1), it was considered as the conicidence point of the current formula with new formula (Fig. 2) and continued until the lowest level (8%). As a result, the fixed coefficient in relation A was considered for sugar beet purchase price in the range of 10% to 15% (Table 2). Using different coefficents for sugar beet purchase with more than 16% or equivalent content is conventional in different countries. For example, in the Europe common market, for 16-18%, 18-19%, and 19-20% content, the minimum of 0.9, 0.7, and 0.5% increase is considered, respectively. In contrast, for 15.5-16% and 14.5-15.5% content, the minimum of 0.9 and 1% decrease is considered (Sheikholeslami 2003).

A distinguishing feature of the new formula is its simplicity and application for farmers and sugar factory so that with using two simple linear relations (relation A and B) in the range of 10-20% (0.05 distance) the calculation and payment of autumn sugar beet purchase price become plausible (Table 2). New formulas for calculating the cost per ton of autumn sugar beet in Khozestan are as follows:

A) 10-15 % content

$$\text{Cost per ton of sugar beet} = ((\text{sugar content} \times 12) - 80) / 100 \times \text{base price}$$

B) 15-20 % content

$$\text{Cost per ton of sugar beet} = ((\text{sugar content} \times 0.065) + 0.025) \times \text{base price}$$

C) $\geq$ 20% content

$$\text{Cost per ton of sugar beet} = 1.325 \times \text{base price}$$

Table 2. Autumn sugar beet purchase price based on approved price per ton and 15% content in each year

Sugar beet content											
Decimal	10	11	12	13	14	15	16	17	18	19	20<
0.00	40.00	52.00	64.00	76.00	88.00	100.00	106.50	113.00	119.50	126.00	132.50
0.05	40.60	52.60	64.60	76.60	88.60	100.33	106.83	113.33	119.83	126.33	132.50
0.10	41.20	53.20	65.20	77.20	89.20	100.65	107.15	113.65	120.15	126.65	132.50
0.15	41.80	5..80	65.80	77.80	89.80	100.98	107.48	113.98	120.48	126.98	132.50
0.20	42.40	54.40	66.40	78.40	90.40	101.30	107.80	114.30	120.80	127.30	132.50
0.25	43.00	55.00	67.00	79.00	91.00	101.63	108.13	114.63	121.13	127.63	132.50
0.30	43.60	55.60	67.60	79.60	91.60	101.95	108.45	114.95	121.45	127.95	132.50
0.35	44.20	56.20	68.20	80.20	92.20	102.28	108.78	115.28	121.78	128.28	132.50
0.40	44.80	56.80	68.80	80.80	92.80	102.60	109.10	115.60	122.10	128.60	132.50
0.45	45.40	57.40	69.40	81.40	93.40	102.93	109.43	115.93	122.43	128.93	132.50
0.50	46.00	58.00	70.00	82.00	94.00	103.25	109.75	116.25	122.75	129.25	132.50
0.55	46.60	58.60	70.60	82.60	94.60	103.58	110.08	116.58	123.08	129.58	132.50
0.60	47.20	59.20	71.20	83.20	95.20	103.90	110.40	116.90	123.40	129.90	132.50
0.65	47.80	59.80	71.80	83.80	95.80	104.23	110.73	117.23	123.73	130.23	132.50
0.70	48.40	60.40	72.40	84.40	96.40	104.55	111.05	117.55	124.05	130.55	132.50
0.75	49.00	61.00	73.00	85.00	97.00	104.88	111.38	117.88	124.38	130.88	132.50
0.80	49.60	61.60	73.60	85.60	97.60	105.20	111.70	118.20	124.70	131.20	132.50
0.85	50.20	62.20	74.20	86.20	98.20	105.53	112.03	118.53	125.03	131.53	132.50
0.90	50.80	62.80	74.80	86.80	98.80	105.85	112.35	118.85	125.35	131.85	132.50
0.95	51.40	63.40	75.40	87.40	99.40	106.18	112.68	119.18	125.68	132.18	132.50

*The sugar content values are brought in the second row and their decimals in the first column (for axample, 14.25%)

Table 3. Sugar beet purchase price based on 1950000 Rials price per ton and 15% content in 2013

Sugar beet content											
Decimal	10	11	12	13	14	15	16	17	18	19	20<
0.00	780.000	1.014.000	1.248.000	1.482.000	1.716.000	1.950.00	2.076.750	2.203.500	2.330.250	2.457.000	2.583.750
0.05	791.700	1.025.700	1.259.700	1.493.700	1.727.700	1.956.338	2.083.088	2.209.838	2.336.558	2.463.338	2.583.750
0.10	803.400	1.037.400	1.271.400	1.505.400	1.729.400	1.962.675	2.089.425	2.216.175	2.342.925	2.469.675	2.583.750
0.15	815.100	1.049.100	1.283.100	1.517.100	1.751.100	1.969.013	2.095.763	2.222.513	2.349.263	2.476.013	2.583.750
0.20	826.800	1.060.800	1.294.800	1.528.800	1.762.800	1.975.350	2.102.100	2.228.850	2.355.600	2.482.350	2.583.750
0.25	838.500	1.072.500	1.306.500	1.540.500	1.774.500	1.981.688	2.108.438	2.235.188	2.361.938	2.488.688	2.583.750
0.30	850.200	1.084.200	1.318.200	1.552.200	1.786.200	1.988.025	2.114.775	2.241.525	2.368.275	2.495.025	2.583.750
0.35	861.900	1.095.900	1.329.900	1.563.900	1.797.900	1.994.363	2.121.113	2.247.863	2.374.613	2.501.363	2.583.750
0.40	873.600	1.107.600	1.341.600	1.575.600	1.809.600	2.000.700	2.127.450	2.254.200	2.380.950	2.507.700	2.583.750
0.45	885.300	1.119.300	1.353.300	1.587.300	1.821.300	2.007.038	2.133.788	2.260.538	2.387.288	2.514.038	2.583.750
0.50	897.000	1.131.000	1.365.000	1.599.000	1.833.000	2.013.375	2.140.125	2.266.875	2.393.625	2.520.375	2.583.750
0.55	908.700	1.142.700	1.376.700	1.610.700	1.844.700	2.019.713	2.146.463	2.273.213	2.399.963	2.526.713	2.583.750
0.60	920.400	1.154.400	1.388.400	1.622.400	1.856.400	2.026.050	2.152.800	2.279.550	2.406.300	2.533.050	2.583.750
0.65	932.100	1.166.100	1.400.100	1.634.100	1.868.100	2.032.388	2.159.138	2.285.888	2.412.638	2.539.388	2.583.750
0.70	943.800	1.177.800	1.411.800	1.645.800	1.879.800	2.038.725	2.165.475	2.292.225	2.418.975	2.545.725	2.583.750
0.75	955.500	1.189.500	1.423.500	1.657.500	1.891.500	2.045.063	2.171.813	2.298.563	2.425.313	2.552.063	2.583.750
0.80	967.200	1.201.200	1.435.200	1.669.200	1.903.200	2.051.400	2.178.150	2.304.900	2.431.650	2.558.400	2.583.750
0.85	978.900	1.212.900	1.446.900	1.680.900	1.914.900	2.057.738	2.184.488	2.311.238	2.437.988	2.564.738	2.583.750
0.90	990.600	1.224.600	1.458.600	1.692.600	1.926.600	2.064.075	2.190.825	2.317.575	2.44.325	2.571.075	2.583.750
0.95	1.002.300	1.236.300	1.470.300	1.704.300	1.938.300	2.070.413	2.197.163	2.323.913	2.450.663	2.577.413	2.583.750

*The sugar content values are brought in the second row and their decimals in the first column (for axample, the price per ton with 14.25% equals 1540500 Rial)

For example, based on the new formula and the sugar beet paurchase price in 2014, Table 3 is presented with consideration of 15% content and 1950000 Rials purchase price per ton.

Comparison of the sugar beet price using current and new formulas

The coincidence point of the current purchase formula with new formula is 13% sugar content (Fig. 2) which is equal to average total sugar beet production in Khozestan province (Table 1). It indicates that based on new formula, less money will be paid per ton of sugar beet with less than 13% sugar content (equal to 37% of total poulation) compared with current formula. In contrast, more money will be paid per ton of sugar beet with more than 13% (63% of total population) and up to 20% sugar content compared with before. For exapmle, for 4084 sugar beet cargos delivered to Ahvaz sugar factory in 2007 (last year of Ahvaz sugar factory operation), if the sugar beet was purchased based on new formula and approved price of 46000 tomans with 16% sugar content, in general, less than 42 million Tomans could be paid to sugar beet cargo with less than 13% sugar content and more than 12 million Tomans to more than 13% or equal sugar content. Based on the current formula in 2007 and approved price of 46000 Tomans with 16% sugar content, 827 million Tomans, equal to 39%, of the total payment was belonged to sugar beet cargo with less than 13% sugar content. However on the basis of the new formula, only 37% of the total payment belongs to sugar beet cargo with less than 13% sugar content (equal to 773 million Toman). In other words, the nature of the new formula is such that to motivate farmers for producing sugar beet with more than 13% sugar content in order to earn more profit. In addition, owing to the higher sugar extraction efficiency per ton of sugar beet samples with more than 13% sugar content, the factory profit can rise. Thus, the new formula can be expressed as a win-win purchase formula.

In the case of one unit increase in total 4084 delivered cargo and using the current formula, the total cost of sugar beet can be increased to 10% (from 2 billion and 113 million Tomns into 2 billion and 327 million Tomans) whilst using new formula, it can be increasd to 16% (from 2 billion and 71 million Tomans into 2 billion and 404 million Tomans). Based on the Netherland's purchase price formula, with increase in sugar content from 16 to 18%, sugar beet purchase price per ton increases by 18% and with the decrease in sugar content from 16 to 14%, the purchase price per ton decreases to 24% (Middelburg 2008). In other words, the new purchase formula is designed in a way that motivates farmers who produce sugar beet with more than 16% sugar content and has a penalty for less than 16% sugar content production. This issue was considered in the new formula for sugar beet with less or more than 15% sugar content (Fig. 2).

Effects of the new formula on technological quality and income per hectare

Quantitative analysis of the roots showed that the average moisture content of autumn sugar beet (79%) was 4 times higher than normal sugar beet (75% moisture content or 25% dry matter) (Asadi 2007). Sugar beet crown contribution to total weight was 7%. From technological point, cutting off the sugar beet crown which has the highest rate of impurities (sodium, potassim, and amino nitrigoen with 4.13, 6.12, and 4.27 mmol/100 g sugar beet brei, respectively and 59.12% sugar extraction coefficient) can improve the technological quality (sodium, potassim, and amino nitrigoen content in root without crown was 2.56, 4.64, and 1.71 mmol/100 g sugar beet brei, respectively and 78.04% sugar extraction coefficient) of the remained parts and also increases the sugar extraction efficiency (Akeson *et al*. 1979; Jaggard *et al*. 1999; Abdollahian-Noghabi *et al*. 2005). Results also showed that proper crown cut resulted in increase of 1 unit sugar content (from 12.26 to 13.34%) and two and a half units sugar extraction coefficient (from 75.43 to 78.04%). Since in the current formula, a similar and fixed coefficent was given to 10-24% sugar content, farmers not only have any motivation for cutting off the crown but also in the case of crown cut off, the root yield will decrease. The removed crown can be used as a fodder. If the root yield is considered to be 45 t ha^{-1}, with crown cut, the root yield will decrease to 41.85 t ha^{-1} but sugar content will increase one unit. From economical point, with considering 135000 Tomans per ton purchase price and 16% sugar content, proper crown cut off can increase the sale income to 4 and 19% per hectare based on current and new formulas, respectively. For example, if by overuse of nitrogen fertilizer, a farmer produced 80 ton roots with 13% sugar content in 2013, based on the current and new formuls he wwould earn 8307680 and 8208000 Tomans, respectively and with producing higher quality sugar beet (15% sugar content and 60 t ha^{-1} root yield), he would earn 7476900 and 8100000 Toman, respectively. In other words, the equal product sale (for example 8 million Tomans) will be achieved by 80 tons root yield and 13% sugar content based on the current formula and 60 tons root yield and 15% sugar content using new formula. Therefore, as the greater importance has been given to the technological quality of sugar beet in the new formula, farmers are willing to apply optimum nitrogen fertilizer and water as well as perfoming proper crown cut off which will reduce crop loss and will increase sugar factory's efficiency. It is clear that it also promotess autumn sugar beet planting which has superiority to spring planting in terms of water use efficiency (Taleghani *et al*. 2010).

Effects of new formula on factory income through buying autumn sugar beet

In 2007, Ahvaz sugar factory received 60548 tons sugar beet with 12.86% sugar content (after excluding 8253 tons as a crop loss). Average sugar extraction coefficnt was 71.48% (Anonymous 2007). Therefore, with considering 1500 Tomans purchase price per Kg, the total sugar production value will be 8340 million Tomans. In accordance to new formula, it is predicted that the sugar content will increase in region, thus with consideration of one unit sugar content increase, the influence was evaluated on sugar production. Results showed that with one unit increase in average sugar content, sugar extraction coefficient increased at least two units (from 71.48 to 73.48%), and as a consequence it resulted in 20000 Tomans more economic value. These conditions seems to justify the investment on autumn sugar beet sowing and provides more confidence for planning the primary sugar factory supply.

ACKNOWLEDGMENT

The authors are grateful to the Sugar Beet Seed Institute and Ahvaz sugar factory for funding on this study and express their gratitude to them for research facilities.

REFERENCES

Abdollahian-Noghabi M. Study of using the formulas to estimate molasses sugar under Iran climate conditions. Proceedings of the 23th Seminar of Iran Sugar Industries; 2001 Apr 27-28; Mashad, Iran. 2001. P. 192-199. (in Persian)

Abdollahian-Noghabi M, Sheikholislami R. Technical quality of sugar beet and payment based on beet quality-current problems and future solutions. Proceedings of the 26th Seminar of Iran Sugar Industries; 2004 May 5-7; Mashad, Iran. 2004. P. 22-31. (in Persian)

Abdollahian-Noghabi M, Sheikholeslami R, Babaei B. Technical terms of sugar beet quantity and quality. Sugar Beet J. 2005; 21 (1):101-104. (in Persian, abstract in English)

Akeson WR, Wesfall DG, Henson MA, Stout EL. Influence of nitrogen fertility and topping method on yield, quality and storage losses in sugar beet. Agron J. 1979; 71 (2): 292-297.

Anonymous. Iran sugar statistic. Iranian Sugar Factories Syndicate website (www.isfs.ir); 2007.

Asadi M. Beet-Sugar Handbook. John Wiley & Sons, New

Jersey, 2007; pp. 866.

Culloden M. Survey of beet quality assessment after 2006 in different countries. Report of Beet Quality Group of the IIRB; 2006 Nov 11 and 12; Cambridge, UK; 2006. P. 3.

Dedek J. Der Ursprung und das Wesen der Melasse. Zeitschrift des Vereins der deutschen Zuckerindustrie. 1927; 77: 495-561.

Eigner H. Survey of beet quality assessment after 2006 in different countries. Report of Beet Quality Group of the IIRB; 2006 Nov 11 and 12; Cambridge, UK; 2006. P. 3.

Erikson PO. Survey of beet quality assessment after 2006 in different countries. Report of Beet Quality Group of the IIRB; 2006 Nov 11 and 12; Cambridge, UK; 2006. P. 3.

Fares K. Survey of beet quality assessment after 2006 in different countries. Report of Beet Quality Group of the IIRB; 2006 Nov 11 and 12; Cambridge, UK; 2006. P. 3.

Harvey CW, Dutton JV. Root quality and processing. In: The sugar beet crop; Science into practice, Chapman & Hall, London: (eds. DA Cooke and RK Scott), 1993; P. 571-617.

Huijbregts AWM, Glattkowsk H, Hovghton BJ, Hadjiantoniov D. Effect of agronomic factors on parameters used in formulas to estimate extractable sugar in sugar beets. Proceedings of the 59th Winter Congress of the International Institute for Sugar Beet Research, Brussels; 1996 Feb; P. 353-368.

Huijbregts A. Survey of beet quality assessment after 2006 in different countries. Report of Beet Quality Group of the IIRB; 2006 Nov 11 and 12; Cambridge, UK; 2006. P. 3.

Jaggard KW, Clark CJA, Draycott AP. The weight and processing quality of components of the storage roots of sugar beet (*Beta vulgaris* L). J Sci Food Agric. 1999; 79: 1389-1398.

Middelburg MCG. Quality. In: IRS website. (Translated from Dutch to English). 2008.

Sheikholeslami R. Laboratory methods and quality control in food processing. Mersa Press, 1997; pp. 342. (in Persian).

Sheikholeslami R. Sugar Technology. Editor Press, 2003; pp350. (in Persian).

Smed E, Huijbregts AWM, Hadjiantoniou D, Vallini G. Influence of agronomic factors on non conventional parameters of the internal quality of sugar beet. Proceedings of the 59th Winter Congress of the International Institute for Sugar Beet Research, Brussels; 1996 Feb; P. 385-389.

Taleghani DF, Sharifi H, Ahmadi M, Ashrafmansori GR, Moharamzadeh M, Javaheri MA, Basati J, Ebrahimian H, Sadeghzadeh S, Aghaei M, Abdollahian-Noghabi M. 2010. Development of autumn sowing sugar beet in Iran. Proceedings of the key papers of 11th Iranian Crop Science Congress, Tehran; 24-26 July. (in Persian)